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**Mobilisation du portail de médiation des connaissances
ePLANETe Blue pour définir les nouveaux défis de
développement soutenable au niveau des établissements
d'enseignement supérieur et de recherche (HERE) dans
l'optique d'une économie des connaissances**

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Mobilizing ePLANETe.Blue knowledge mediation portal to deal with new challenges of sustainable development in Higher Education and Research Establishments (HERE) from a perspective of Knowledge Economy

Thèse de doctorat de l'Université Paris-Saclay
préparée à l'Université de Versailles-Saint-Quentin-en-Yvelines

École doctorale n°578 Sciences de l'homme et de la société
Spécialité de doctorat : Sciences Économiques

Thèse présentée et soutenue à Guyancourt, le 17 septembre 2019, par

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Titre : Mobilisation du portail de médiation des connaissances ePLANETe Blue pour définir les nouveaux défis de développement soutenable au niveau des établissements d'enseignement supérieur et de recherche (HERE) dans l'optique d'une économie des connaissances

Mots clés : Portail des connaissances ; Eco-Innovation et Développement durable ; Défis des établissements d'enseignement supérieur et de recherche (ICI); Évaluation de la qualité; Outils de soutien à la délibération; Economie de la connaissance

Résumé :

Au cours de la dernière décennie, les établissements d'enseignement supérieur et de recherche (HERE) du monde entier ont été confrontés à un certain nombre de défis relatifs à l'articulation de trois dimensions à savoir le développement de l'Enseignement Supérieur, l'Innovation et le Développement soutenable. Les questions qui se posent sont relatives à l'adoption de nouvelles technologies innovantes par l'enseignement supérieur, l'évaluation de la qualité des stratégies des ESR dans un perspectif multicritère et multi-acteurs, le développement de programmes prenant en compte des défis du développement soutenable, etc. En prenant l'exemple de la stratégie de développement de l'Université de Versailles Saint-Quentin-en-Yvelines et de la création de l'Université de Paris Saclay, nous examinerons la manière dont des initiatives significatives pour relever ce triple défi ont été développées.

Un rappel historique sera réalisé pour retracer l'évolution de la stratégie de l'Université de Versailles Saint-Quentin-en-Yvelines (2004-2015) et de l'Université de Paris Saclay (2015-2020) en matière de développement de programmes de formation et de partenariats pour le développement soutenable. Nous nous appuierons notamment sur l'utilisation du portail de médiation des connaissances ePLANETe.blue qui fournit (a) un outil innovant de documentation des programmes et des supports pédagogiques (TALIESIN DOORWAY), (b) un outils d'évaluation de la qualité des stratégies d'ESR dans une perspective délibérative et (c) une démarche innovante et originale dans le cadre du développement d'approches pédagogiques. Une approche réflexive est proposée afin d'évaluer la contribution d'ePLANETe.blue à l'économie de la connaissance.

Title : Mobilizing the (ePLANETe Blue) knowledge mediation portal to define new challenges of sustainable development at the higher education and research establishments (HERE) with a view of knowledge economy

Keywords : Knowledge Portal ; Eco-Innovation and Sustainability; Challenges of Higher Education and Research Establishments (HERE); Quality Evaluation; Deliberation Support tools; Knowledge Economy

Abstract :

Over the past decade, higher education and research establishments (HERE) around the world have faced a number of challenges related to the articulation of three dimensions, namely the development of Education, Innovation and Sustainable Development. The questions are related to the adoption of new innovative technologies through higher education, the evaluation of the quality of ESR strategies from a multi-criteria and multi-actor perspective, the development of programmes taking into account the challenges of sustainable development, etc. Taking the example of the development strategy of the University of Versailles Saint-Quentin-en-Yvelines and the creation of the University of Paris Saclay, we will examine how significant initiatives to address this triple challenge have been Developed.

A historical reminder will be carried out to retrace the evolution of the strategy of the University of Versailles Saint-Quentin-en-Yvelines (2004-2015) and the University of Paris Saclay (2015-2020) in the development of training programmes and partnerships for sustainable development. In particular, we will rely on the use of the ePLANETe blue knowledge mediation portal, which provides (a) an innovative tool for documenting educational programmes and materials (TALIESIN DOORWAY), (b) a quality assessment tool ESR's strategic objectives from a deliberative perspective and (c) an innovative and original approach in the development of pedagogical approaches. A reflexive approach is proposed to evaluate the contribution of ePLANETe blue to the knowledge economy.

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GENERAL INTRODUCTION

Higher education institutions are large, complex, adaptive social systems like all other human Organizations (Sarker, Davis, & Tiropanis, 2010). Over the last decade, higher education around the world is facing a number of challenges¹, such as teaching level sustainability to the improving the quality of learning and teaching via Multi-criteria evaluation methods, Fostering an effective interdisciplinary curriculum design, Designing Effective and Innovative Courses linking towards inclusive and equitable quality education and long-life learning for all, linking students to work experience and Job opportunities that is relating to the knowledge economy, Globalization, funding etc; Campus level sustainability to the establish Sustainable campus(Green Campus, Green building, green transportation, campus preservation), Effective learning environments, Technology facilitation mechanism for building effective partnerships for education; and the implementing innovating ways to the adopting new technologies, transformation of education to the Portal based on knowledge, Building capacities and Empowerment, Learning styles inventory etc . There are lots of changes and challenges in the Higher Education (HE), students are changing, and their learning styles are changing as well as their demands are changing. At the same time, much more has been expected of institutions in terms of their wider engagement locally, regionally, nationally and globally (Sarker et all, 2010). Universities need to prepare students for a more global knowledge Economy in near future (ibid,2010). Higher Education (HE) institutions around the world face the growing problem of relevance as they enter the twenty-first century².

Recently we identified twenty higher education challenges facing 21st century's higher education based on different literature³. We identified curriculum design/alignment, student retention, student employability, widening participation, funding, emerging technology, new generation of staff, quality of learning and teaching, quality of research, assessment, accreditation of higher education institutions and programmes, compete and collaborating globally in research and talent, tenure, group formation for learning and teaching, critical thinking and argumentation, construction of personal and group knowledge, contribution to economy, integration of knowledge capital and cross-curricular initiatives, and higher education governance and management as the burning challenges in today's higher education(Sarker et all, 2010). The details of those challenges can be found in a literature review of Higher Education Challenges and Data Infrastructure Responses (Sarker, Davis, & Tiropanis, 2010).

From the view point of twenty-first century challenges, The Higher Education institution facing a number of challenges and most contributions mention curriculum design, student retention, new technologies, quality of learning and teaching, widening participation, quality of research, funding and the necessity to improve governance and management as the most burning challenges(Sarker et all, 2010). To provide the best service to the new students higher education institutions need to change and hence, they need to response to the challenges (ibid, 2010) . In recent years considerable interest has focused on identifying those challenges(ibid, 2010). To efficiently operate and to survive in this globalization era, higher education institutions need to respond those challenges (Sarker, Farhana, Davis, Hugh and Tiropanis, Thanassis ,2010)

¹ Sarker, Farhana, Davis, Hugh and Tiropanis, Thanassis (2010) : The role of institutional repositories in addressing higher education challenges. *SemHE '10: The Second International Workshop on Semantic Web Applications in Higher Education*, Southampton, United Kingdom.

² Werner Z. Hirsch and Luc E. Weber (1999) "Challenges Facing Higher Education at the Millennium," American Council On Education and Oryx Press Series on Higher Education, <http://hdl.handle.net/2027.42/58009>.

³ Sarker, F., Davis, H., Tiropanis, T.: A Review of Higher Education Challenges and Institutions' Data Infrastructures Response to those Challenges, International Conference of Education, Research and Innovation (ICERI2010, Madrid, Spain (accepted, 2010).

in competent and innovative way that would be knowledge portal based. So, in the present age, academic institutions including universities have increasingly recognized that an institutional knowledge portal is an essential infrastructure of higher level education. Our proposed ePLANETe blue is that type of knowledge portal which is capable to face the best practices of all higher education institutional challenges by the operative ways. The proposed ePLANETe blue can mostly be utilized to address most of the higher education (HE) challenges. It is a digital archive of the intellectual product created by REEDS Research group for the purpose of best practices of education, sustainability, and innovation for the faculty, research staff, students, communities and stakeholder of an institution and accessible to end-users both within and outside of the institution with few if any barriers to access. It is also a digital knowledge platform that can be decertifying the online deliberation, experimental assessment and observational data captured by members of the institution that support their scholarly activities to education, sustainability and innovation. It argued that the ePLANETe blue is a very powerful idea that can serve as an engine of change for institutions of higher education. If properly developed by the locally, regionally, nationally and globally governance, it advances a surprising number of knowledge Society/Economy's goals, and addresses an impressive range of education, sustainability and innovation challenges.

In the context of literatures and own verdict, we will assemble those challenges as group like **Group1:** Education, **Group 2:** Innovation and **Group 3:** Sustainability that currently facing our higher education (HE) institutions based on their interrelationship and influence of those challenges. Mostly, We have found nine (9) key issues on the burning challenges of education, sustainability and innovation such as sustainable development goal4: Towards inclusive and equitable quality education and long-life learning for all; Sustainability strategies of Higher Education; Globalization; Promoting education for sustainable development; Sustainable Development at higher education; Sustainable campus: Green Campus; Transformation of education : Supporting equitable access to higher education; Building capacities and Empowerment; and the Technology facilitation mechanism for building effective partnerships for education that I will discuss in chapter wise in my work. We have grouped those challenges in a hierarchy way that will correspondent by a knowledge transformer/ knowledge portal i.e ePLANETe blue. The ePLANETe blue is intended to assist the identification of best practices at specific levels of action, and to encourage knowledge exchanges in "virtual community", and thus it is to improve education, sustainability, and innovation performance through the engagement of collaborative activities of different sorts. If the corresponding ways of ePLANETe blue, the lower group challenges improve their quality or efficiency then the challenges it influences in the upper group will automatically improve. Precisely, challenges in group3 influence the challenges in group2 and challenges in group2 influence the challenges in group1 and also if any of the challenges in group3 improve its quality or efficiency then the challenges influence or interrelated with/by this challenge will automatically improve their quality or efficiency. Moreover, we will demonstrate all of those challenges, and identify the feature of proposed ePLANETe blue that can address these challenges with the help of technological way. Besides, in order to find out of revolution of knowledge economy , we will investigate the contextual integration of knowledge economy with the sustainability higher education, innovation, digital and cross knowledge Technique (ICT and innovative knowledge portal i.e. ePLANETe blue) that related to Sustainable Development challenges of Higher Education, Attraction and Excellency of teaching programs(more rigorous curriculum , job oriented programs, research facilities, ICT for Multi stakeholder quality assessment of academic knowledge communities). It also examined "the mechanisms and strategies" used by territorial university's authority to accommodate changes and challenges in the Higher Education (HE) on offering pattern of teaching programs from territory to international for connecting the behaviors of knowledge economics.

Objectives:

The main objectives of this work is to-

- Establish a technological and institutions data infrastructural innovative knowledge portal named ePLANETe Blue that can address, define and response to the new challenges of education, sustainability and innovation at higher education for creating knowledge Society/Economy.
- Launch a tool (upcoming days) for the performance assessment of the university teaching program and campus level with regards to sustainable development by integrating the various doorways, representation racks for different Worksites, Multi-criteria & Multi-Actors Integrated Evaluations, five Ps approach, INTEGRAAL framework of ePLANETe Blue
- demonstrate and evaluate the uses of ePLANETe Blue in order to create the opportunity of knowledge economy and development of social processes mobilizing stakeholders towards new challenges of education, sustainability and innovation at campus and teaching level of higher education; More particularly, identifying the ways on the perspective of ePLANETe Blue, which online tools can be useful for collaborative learning and collective action processes in response and support of sustainable development at campus and teaching level of higher education.

Additionally, this work answers the following questions:

- How technology, methodology, and data infrastructures could provide responses to address those challenges in a world where students are changing, their learning styles are changing, and the technologies to accommodate their needs are changing?
- How triangle issues (i) innovation and sustainability; (ii) evaluation of the quality of higher education and research establishments (HERE), and (iii) the specific roles of information technology for green innovation case of 'ePLANETe Blue' work together to response those challenges?
- How do higher education higher education and research establishments (HERE) organize themselves to respond to the above challenges? Are there any barriers that prevent institutions to open their information to be accessible to deliberative respond these challenges by the multi-criteria assessment method? If yes then how can they solve these problems?

Finally, the research will seek to answer this central scientific research question: "In what ways, the Mobilizing (ePLANETe.Blue) knowledge mediation portal to deals with new challenges of sustainable development to support the identification and the implementation of best practices in Higher Education and Research Establishments (HERE) from a perspective of Knowledge; Is it a effective knowledge mediation portal to deals with new challenges of sustainable development for HERE?"

Methodological Framing:

In this work, I will use a strong Action-research component, exploiting the collective action and collaborative learning functionalities of the ePLANETe blue (Knowledge Portal) for the addressing, articulation and documentation of solving way of education, sustainability, and innovation challenges by the INTEGRAAL methodology in order to create knowledge economy which is correspondent the social choice and needs by six steps:

Step 1. Identifying the problem: We will describe the field of study selected and the case study. Data collection and analysis, and interviews with the stakeholders will be employed to investigate the case study.

Step 2. Structuring the problem: We will determine the key actors and stakeholder's groups within our case study. A literature review will be conducted in the sustainability, cities, building as universities subjects. After determining a preliminary list of the sustainable performance issues of a renovation process of a

university building, we will analyze the pertinence of the performance issues. We will categorize the actors and the performance issues through an interactive process of documenting and evaluating the problems studied, based on the consultation of the actors concerned.

Step 3. Representing the system: The literature review will be used here to make an inventory of tools and data available for representing the system of analysis of the performance renovation process of the university buildings. Indicators and tools will be inserted in an online platform called ePLANETe, that was also developed at the Centre International REEDS. This modeling system will assist us in the representation of our tool in a digital platform.

Step 4. Evaluating and deliberating: In this step, we will use an expert system and an evaluation section with the project's actors to assess the case study. The ePLANETe platform will be used to insert values and generate a final spider diagram.

Step 5. Analyzing and communicating: An extensive analysis of the results will be performed to provide interpretation of the results. We will analyze results from a global view of each category, and we will use the indicator's values to provide an explanation, in addition to the actor's statement.

Step 6. Reflecting on outcomes: We will consider the results of the evaluation process and the case study results. This Step represents a data analysis for clarification and verification

Plan and Structure:

My thesis divided in to 7(seven) chapters:

Chapter 1: Integrated Approach of Education, Innovation and Sustainability in Perspective of Knowledge Economy: It will describe the key challenges issues of education, innovation and sustainability through OECD and UNESCO's taxonomy. It will also describe the triangle issues of education, innovation and sustainability in the perceptions of knowledge Economy

Chapter 2: Ground Analysis, Next Initiatives for Future Challenges/ Issues of Education, Innovation, and Sustainability in University Versailles Saint-Quentin-En-Yvelines (UVSQ) and University of Paris Saclay(UPSaclay): This chapter will investigate the ground analysis of UVSQ and UPSaclay's present and future Initiatives for facing the upcoming challenges of education, innovation and sustainability in order to create knowledge economy as a case study; It will mainly focuses on the teaching and campus level sustainability of UVSQ and UPSaclay's that will making sense a co-relation to the new challenges of education, innovation and sustainability in regards to knowledge society/economy. To gain the reality of existing and potential courses of UPSaclay, the practical case studies have to be assigned in this chapter

Chapter 3: The Presentation of Innovative ePLANETe platform: This chapter will describe the new Ground of Knowledge Economy for Facing New Challenges of Education, Innovation and Sustainability. Besids, this chapter will present the emerging 'ePLANETe' concept and functionalities as an innovation programme contributing to sustainability goals in higher education that developed by the KerBabel team at the UVSQ during the years 2000-2015, the suite of Internet-based knowledge mediation and deliberation support functionalities can be seen as an experimentation of the challenges of "ICT for Green

Chapter 4: This chapter will present the application of **Innovative doorway of ePLANETe** (The Taliesin Doorway) for building Knowledge Partnerships for Sustainability. It is noted that the ePLANETe is an on-line "Collaborative Platform" that seeks to support a broad variety of forms of learning, and of sharing of resources for learning, always with the accent on community and conviviality. In a local/global perspective, it seeks, to incite new experiments in collaborative learning, social networking and knowledge sharing

concerning the biosphere and sustainability, and to offer tools supporting debate and deliberation addressing social, political, technological, economic and environmental dimensions of sustainability

Chapter 5: Quality Evaluation via Innovative Methods: A Case Study of University Paris Saclay: This chapter will examine the quality evaluation via existing and potential innovative methods and tools for general assessing way, quality assurance criteria, models of teaching Program, evaluation strategy VIA innovative knowledge Portal i.e ePLANETe blue Platform. Practical quality evaluation on the GTDL teaching programme of University Paris Saclay (UPSaclay) as case studies

Chapter 6: Mobilizing Communities of Knowledge in an Evaluation Process of Sustainable Campus: In this chapter, we seek to show how current developments in ICT for “social networking” can be made the basis for large-scale collaborative learning, reputation and accountability, supporting the co-construction of social solidarities around the purposes and practices of “sustainable campuses” in respect to engagement communities, CSR Methodology, Campus Strategies and Social Networking for Deliberation support.

Chapter 7: Evaluation of ePLANETe platform in higher Education and Research Institutions: In this chapter, we demonstrate and evaluate of ePLANETe platform in terms pédagogie, learning and project support of higher Education and Research Institutions for best practices scenarios. It will find out the answer of the question “In what ways the ePLANETe works as an integrated intermediary for the best practices of higher Education and Research Institutions in terms of pédagogie, learning and project support that follow the collective action process for helping community/ stakeholders/users to achieve their goals?”

CHAPTER 1: INTEGRATED APPROACH OF EDUCATION, INNOVATION AND SUSTAINABILITY IN PERSPECTIVE OF KNOWLEDGE ECONOMY/ SOCIETY

1.1. Education issues

Economic aspects of education have acquired great significance in education research during the new millennium earmarked as Knowledge Economy (Vibhuti Patel, 2012). Economists have long viewed education as an important determinant of economic development and growth⁴. Most analyses have focused on sustainability development; knowledge based economy; broad education quantities: years of schooling, enrollment rates, school construction (Cantoni, Davide and Yuchtman, Noam, 2013). Much less attention has been paid to the importance of different types of educational content to a country's economic development⁵. For the past quarter century, economists have shown renewed interest in long-run economic growth (Hanushek, 2016) i.e the territory level. So, it is widely seen as one of the main factors that determine economic growth and the distribution of income (Meier, 1999). That's way, around the world, countries have been pushing to expand education (Hanushek, 2016).

The Education plays mainly three roles in economics⁶. First, education is an investment good (Meier, 1999). Individuals accumulate human capital in order to receive a higher income afterwards (Mincer, 1958; Schultz, 1961; Becker, 1993). The demand for education is determined by equaling the marginal cost of education, consisting of direct cost, i.e. tuition fees, and opportunity cost arising from foregone income, to the marginal benefits due to a higher present value of lifetime income (Meier, 1999). As expected, the demand for education depends negatively on the interest rate and both direct and indirect cost (Ben Porath, 1967; Bishop, 1977).

The focus on human capital as a driver of economic growth for developing countries has led to undue attention on school attainment (Hanushek, 2013). Differences in growth rates have a huge impact on the economic wellbeing of the nation—indeed much larger impacts than those of even the deepest recessions (Hanushek, 2016). Human capital investment levels decrease over the life-cycle (BenYorath, 1967; van Imhoff, 1989). If the return on human capital is uncertain, the expected return can turn out to be higher or lower than the interest rate in the optimum (Meier, 1999). While initial wealth has no impact on the decision to receive education under perfect information, the corresponding demand elasticity is positive under uncertainty about future wage rates (Kodde, 1988). A positive impact of wealth on the demand for education also occurs if individuals are liquidity constrained (Kodde and Hiven, 1935). While all unemployment rate contingent on education is associated with a positive income elasticity of demand for education (Kodde, 1988), unemployment benefits reduce human capital investment (Dellas, 1997). Higher education is seen as the source of innovation that will drive productivity improvements and thus economic growth (Hanushek, 2016). And, expansion of higher education is frequently put forth as an attractive government policy because of its potential impact on economic growth (e.g. Browne Report, 2010). Empirical investigations show that both a higher volatility of the unemployment rate and a

⁴ See Easterlin (1981), Mankiw et al. (1992), Benhabib and Spiegel (1994), and Psacharopoulos and Patrinos (2004). Review articles by Krueger and Lindahl (2001) and Hanushek and Woessmann (2008) summarize the existing evidence on the effects of education on growth rates.

⁵ Some examples of papers that widen the scope of analysis are Aghion et al. (2009), Jones (2011), Algan et al. (2011), and Huang (2012).

⁶ Meier, V. (1999). Economic theories of education. Inst. für Volkswirtschaftslehre und Bevölkerungsökonomie. Retrieved from https://www.researchgate.net/profile/Volker_Meier/publication/27457707_Economic_theories_of_education/links/00b4951cc30d8db2ec000000.pdf

higher volatility of GDP have a negative effect on human capital accumulation (Flug et al., 1998). In order to address the role of higher education along with a series of other possible issues, we consider a series of alternative specifications that elaborate on the prior estimates (Hanushek, 2016). To begin with, simply because of the different technologies that are being employed, the overall relationship between skills and growth may be more important to OECD (Organization for Economic Cooperation and Development) countries than in developing countries (ibid, 2016).

Second, education can be seen as a consumption good (Schultz, 1961; Nerlove, 1972; Bos, 1980; Kodde and Ritzen, 1984). In comparison to the predictions of the human capital approach, incorporating the consumption aspect leads to longer study terms (Meier, 1999). Further, this view yields another explanation for the observable positive income effect with respect to the demand for education (Kodde and Ritzen, 1984).

Third, a high demand for education can also signal a high productivity to potential employers (Arrow, 1973; Spence, 1973; Stiglitz, 1974, 1975). The main idea starts from the Premise that firms cannot observe the productivity of their workers directly (Meier, 1999). However, learning at school is less costly for talented individuals. Individuals with a high productivity naturally increase their demand for education up to the point at which individuals with low productivity will refrain from imitating their behavior (Meier, 1999). This mechanism generally leads to over-investment in unproductive education. However, if different types of labor are complements in production, this screening mechanism can also have positive effects on productivity since a misallocation of the different types of individuals can be avoided (Arrow, 1973; Stiglitz, 1975; Wolpin, 1977). If the supplementary education is associated with an increased productivity, then voters who cannot assess the talent of their children will opt for a level of resources for this screening process below the social optimum (Stiglitz, 1975). Several other functions of education are discussed in the literature (Meier, 1999). Rosenzweig (1995) posits that educated individuals are more likely to choose input combinations close to the cost minimizing level. An overview on further functions of education, for example a rising productivity in household production, is provided by Haveman and Wolfe (1984) and Hanushek (1986).

It is well established that improvements in education are associated with long-term improvements in economic performance David Earle (2010). There are three broad theories about how education influences economic performance (ibid, 2010):

- The basic **human capital** approach is that education improves the overall skills and abilities of the workforce, leading to greater productivity and improved ability to use existing technology, and thus contributing to economic growth (ibid, 2010):
- The **innovation approach** links education to improving the capacity of the economy to develop of new ideas and technologies (ibid, 2010):
- An extension of this is the **knowledge transfer** approach, which sees education as a means of spreading the knowledge needed to apply new ideas and make use of new technologies (OECD, 2010a).

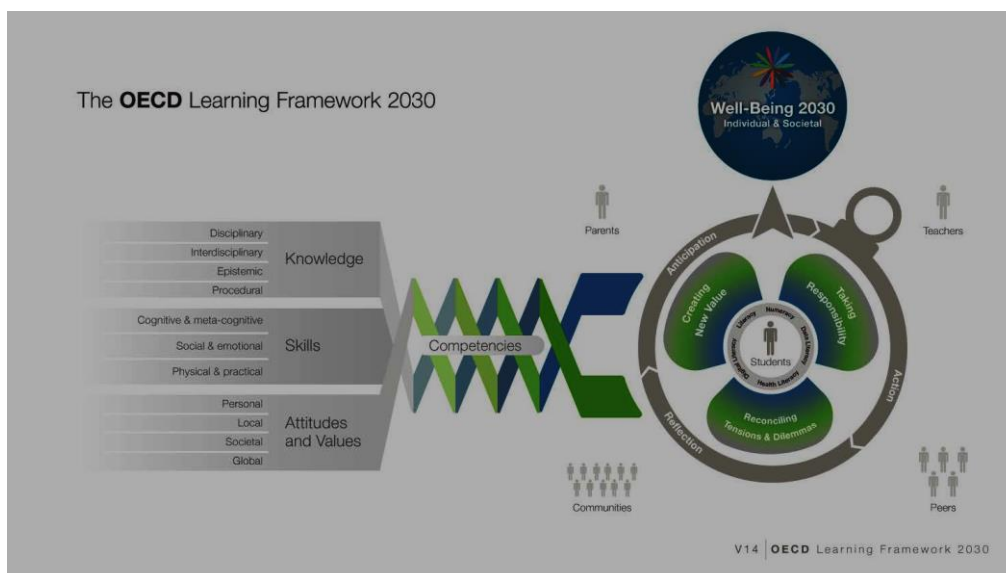
Though, there is a vital question as whether there is a contributing link between education and economic performance, and if so, in what direction. Here the quality of education is very important (OECD, 2010a). Razzak and Timmins (2010) showed that increases in the percentage of employees with bachelors degrees and above are highly correlated to increases in the average GDP per person. From the view point, the general education and higher education in certain, is strength for personal growth, socio-economic progress, and territory and cultural development. The education and economic performance are likely to be interlinked and having a more educated workforce enables firms to take advantage of new economic opportunities that leading to improved performance (David Earle, 2010). In the broader world, globalisation,

technological advancement and innovation are defining economic development, people are much more mobile internationally as they seek out career opportunities, and competition for foreign direct investment remains intense (Hunt, 2011). In the strongly viable inclusive situation, the economic fortunes of each country are increasingly determined by the quality of its national territory education policy, strategies and system. For the upcoming days, the higher education and research establishment will need to be more positive in commercialization, production & distribution of knowledge, use of knowledge and knowledge transfer for pursuing the collaboration with others in enterprise and the wider knowledge economy and society.

1.1.1. OECD’s Education 2030-framework (E2030)

Recent changes in civilization, including speedy technological changes, economic and cultural globalisation, global inequalities, migration, and new forms of communication and interaction, changing household structures, and increasing social security issues, have all served as a background for the need of defining and selecting key competencies within OECD’s Education 2030-framework⁷. It has three main types of competencies: 1) knowledge, 2) skills and 3) attitudes & values. The arrangement of the three domains and the documentation and selection of key constructs in individually domain (e.g. theoretical understanding in disciplines, life-threatening thinking, self-reflection, respect for others, resilience, empathy) are resulting from different disciplines including social science, psychology, philosophy, economics, history and culture, and anthropology and the ensuing inter multi-disciplinary and multi-stakeholder exchanges by a “learning compass”, including specialists, universities, educators, guardian, managers and students themselves. Together, these competencies will be part of international proportional curriculum investigation that goals to stimulate and sustenance countries in making restructuring happen.

Figure 1. 1: The OECD Learning Framework 2030: Work-in-progress



Source: E2030 Position Paper (05.04.2018)

⁷ Miho Taguma, senior policy analyst at The Early Childhood and Schools Division of Directorate for Education and Skills, Organisation for Economic Co-operation and Development, OECD.

Moreover, Education can equip learners with agency and a sense of purpose, and the competencies they need, to shape their own lives and contribute to the lives of others (OECD, 2018). To sort out how best to do so, the Organisation for Economic Co-operation and Development (OECD) has launched “The Future of Education and Skills 2030” project (Andreas Schleicher⁸, 2018). The aim of the project is to help countries find answers to two far-reaching questions⁹:

- **What** knowledge, skills, attitudes and values will today's students need to thrive and shape their world (E2030 Position Paper, 05.04.2018)?
- **How** can instructional systems develop these knowledge, skills, attitudes and values effectively (E2030 Position Paper, 05.04.2018)?

Besides, the goal is to explore the bigger picture and longer-term challenges facing education through the development of a conceptual **Learning Framework for 2030**; and make the process of curriculum design more evidence-based and systematic through an **International Curriculum Analysis**¹⁰.

- **Life Long Learning(LLL)**

The learning framework of OECD’s 2030, eventually, intentions to serve as a life-long and life-wide learning framework for 2030. It is at this initial stage developed primarily for the secondary school level after that the higher education. But the variations and trials that have started the development of the E2030 framework move everybody and are as such appropriate for all parts of the education and social system. Over time, E2030 would be advanced to contain more parts of the education system. The Forum of ASEM LLL (2016) serves as a appropriate platform for deliberations on “how lifelong learning aspects can be incorporated into the E2030 framework in the future and vice versa”.

In the prespectives of knowlodge economy, new innovative technologies, the increase of technological changes and prespectives of globalization those are all influences the needs to improve the population’s skills and competences (Laal & Salamati, 2012). The Lifelong learning (LLL) covers the whole range of learning that includes: formal, informal and non-formal knowledge of education. It also includes the skills, knowledge, attitudes and behaviours that people acquire in their day-to-day experiences (Dunn, E., 2003). LLL is the continuous building of skills and knowledge throughout the lifestyle of an individual. It not only increases the social system inclusion, active social responsibility and personal skill development, but also competitiveness and employability (Wikipedia, LLL, 2011). The term lifelong, as applied to education or learning, has been in circulation for more than a quarter of a century (Friesen, N. & Anderson, T., 2004). LLL declared and comprises that learning consequences from different conceps, settings and contexts that can be interconnected together.

The Cedefop glossary (Tissot, P., 2004) defines core concepts of various forms of learning as follows:

- Formal learning involves the learning that happens exclusive an organized and structured context (formal education, in-industrial training), and that is designed as learning. It may lead to formal recognition (diploma, certificate), (p. 70);
- Non-formal learning contains the learning that can be embedded in planned actions that are not obviously chosen as learning, but which contain an important learning element such as vocational skills acquired at the workplace, (p. 112);

⁸ Director for Education and Skills , the Organisation for Economic Co-operation and Development (OECD)

⁹ E2030 Position Paper (05.04.2018)

¹⁰ Flyer-The-Future-of-Education-and-Skills-Education-2030

- Informal learning is defined as learning outcome from daily life activities related to family, work or relaxation. It is often referred to as experiential learning and can, to a degree, be understood as accidental learning (p. 76).

From these view point, we can say, Lifelong learning can cover everything that deals with education from early childhood through adulthood like higher education and it should be refered to perpetual learning, periodic learning, continuing education and grownup education. Longworth and Davies (1996) describe lifelong learning as, "the development of human potential through a continuously supportive process which stimulates and empowers individuals to acquire all the knowledge, values, skills, and understanding they will require throughout their lifetimes and to apply them with confidence, creativity and enjoyment in all roles, circumstances, and environments" (Longworth & Davies, p. 22).

Nowadays, lifelong learning (LLL) is at the center of universal consideration, since it is part of the 2030 agenda on Sustainable Development Goal 4, which desires to countries for "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." This procedure of learning has been named as a priority at the territory level. In the Buenos Aires Declaration (2017), emanating from the Regional Meeting of Education Ministers of Latin America and the Caribbean, the ministers recognized the importance of the educational targets of SDG 4. It accordingly course of aware constant education that would be dynamism throughout life style and focused towards as long as both the individual needs and that of the applicable community, that will not only progress individuals to become responsible to themselves and their communities, but understand and involve actively at all levels of their societies (Abukari, 2004). Perhaps, We are in a challenging in global issues where people must have to advance the capibility and skills to understand, interpret and process different information and knowldge those are essential to identify and assessment all forms of learning. Continuing education benefits individuals, communities and the country's economy, as (Laal & Salamati, 2012):

- It delivers to the personalization with the information, knowledge, capabilities, values, attitudes and understanding they'll need in future life as persons, inhabitants and workforces(Laal & Salamati, 2012).
- It prepare the more productive, innovative and creative communities, as memberscreate and discover new knowledge and information for abilities and ideas. In our knowledge-based economy has changed the contents of society and workplace. But people who hold LLL, who frequently learn new skills and train for new challenges, can better cope with the demands of workplace changes(ibid, 2012).
- It strengthens the economy(ibid,2012). The more skills, attitude, information, knowledge and ability that individuals develop, the greater the level of capacity in the economy. A stronger economy means citizens benefit from the chance to earn more, live better and contribute to the economic system (Canlearn, 2009).

Jarl Bengtsson¹¹ wrote shortly before his death that 'on the one hand lifelong learning is accepted, in policy terms, by all OECD countries and many other countries, but on the other hand there is an uneven and slow pace of implementation of lifelong learning' (Bengtsson, 2013, p. 1). The EUCEN¹², a European membership

¹¹ Jarl Bengtsson, Professor of Education, was for many years Head of the Centre for Educational Research and Innovation at OECD. He was also President of the PASCAL Observatory

¹² EUCEN (European University Continuing Education Network) is an international non-governmental non-profit-making organization, and is the largest and oldest European network focusing actively on ULLL. EUCEN aims to contribute to the economic and cultural life of Europe through the promotion and advancement of lifelong learning within higher education institutions, and to foster universities' influence on the development of lifelong learning knowledge and policies throughout Europe.

organization comprising 191 members (mainly universities) from 36 countries, comes to a similar conclusion concerning University Lifelong Learning (ULLL) based on its mobilizing mediation of knowledge of platform, network and project results. Higher education ministers in Europe have definitively adopted a voluntary discourse inviting higher education and research establishment (HERE), including universities, to develop lifelong learning in their central actions. Their successive statements on Prague in 2001, Berlin in 2003, Bergen in 2005, London in 2007 and finally Leuven-Louvain-la-Neuve in 2009 have recognized lifelong learning as one of the ten priorities for 2010–2020¹³ (see for instance the Bologna Process website: <http://www.ehea.info/>). They anxiety the standing of going beyond initial education, continuing education and adult education towards a more critical and comprehensive implementation of LLL within the higher education and research establishment i.e. universities by 2020. That's why, a number of universities and research establishedment have established an opportunity for lifelong learners, such as young and adults for education without a university degree, individuals seeking professional development for skills development, unemployed adults, migrants etc . They have share and created creative, innovative collaborative sustainable projects and accumulated a great deal for best practice. However, notwithstanding the quality and quantity of these initiatives, the results so far seem to be inadequate to external and internal stakeholders, since they are extremely dependent on the management of each and every higher education and research establishment. The Higher education and research establishment involves with territory level, national and international level, such as productions and distribution, industries, and school districts to assure their employees receive the education they need. i.e. many Higher education and research establishment work with a multideceplinary school area to provide required teacher certification classes in the summertime that address the region's particular needs. These classes can be obtainable in a variety of ways to meet instructor's plans with a rigorous 2/3 days courses that length a week and meet a few hours a day or even courses that meet once a week for 1/2 hours over the summertime. Higher education and research establishment can offer short-term, long term or ongoing training to corporations depending on their needs i.e. a college may be called upon to come to a business for a limited hour and train staffs on a promoted effective arrangement on program. Robust training can occur if a company or industry acquisitions a brand new program with which the employees have no ideas, or if the company is introducing new practices that must be learned from the very beginning.

Another thing, the Employment-related programs can be called internship programs, work-related courses, and certificate programs etc. Many community of higher education, universities and research establishment that offer skill development technical programs for partner institutional with businesses and industries in their key service areas to place their students and graduates in internship programs with those entities so that students can be acquired some or more real-life experience working in their preferred field, which better prepares them for the challenging world of work and the possibility of full-time employment from their internship employers. So, Nowadays, higher education and research establishment (HERE) is a wider place for acquire knowledge. It has linked to the society and economy where there are recognized opportunities for learning for every person wherever they are and however old they should be (Green, 2002). The increasing pace of innovation and technological change in the knowledge economy and society, which means we need a flexible and adaptable workforce that is ready to reskill and retrain to keep pace with the economy's skills needs (Laal & Salamati, 2012). LLL enables people to take an active part in society (Dunn, E., 2003). Mascle, D. (2007), enumerates five great benefits for LLL that come to mind as the following¹⁴:

¹³ <http://www.ehea.info>.

¹⁴ Dunn, E., (2003). Mascle, D. (2007), enumerates five great benefits for LLL

- First is the prospect of a fatter paycheck. Job promotions go to smart people who keep up with the latest information and technology. It's just good sense to refresh and retrain for the workplace (Mascle, 2007).
- Second is the enhanced self-esteem when reaching for new horizons, accepting tough challenges and arriving at a whole new level. New learning is not a picnic but the joys of accomplishment are real (ibid,2007).
- Third is the freedom given to adult learners (ibid, 2007). Mature classmates segment their ideas, knowledge and teach each other. Term papers, Assignments and specific course works may culminate in a group work, project or program rather than a graded exam. Learning facts is at a least; answers are not absolute. To say the honestly, there are some lessons where accuracy counts and assessments are required.
- Fourth is the shift of schooling to a 24/7 model and long-distance or online methods (ibid, 2007). Exchange the classroom for the computer permits to stay home and study in the bathrobe. Get a degree without ever moving on university campus. With monetary issues, time and space constraints detached anyone who really desires to go on learning knowledge can do so. Additional, some class matriculations are open with start dates at accessibility.
- Number five is making scholarship a habit (ibid, 2007). Earned Education becomes second landscape; it's who we are as much as what we do (ibid, 2007).

From the prespective views of LLL, The demand for more flexible educational environments increases according to continuous learning which comes to be seen more and more as a necessity for almost everyone in our rapidly changing and increasingly global society (Chen, T., 2003). In the 21st century, we all need to be lifelong learners (Laal & Salamati, 2012). Our world is changing around us in such a frantic pace that if we do not continue to grow and develop; we will soon be left behind. We need to continually keep our skills sharp and up to date so that we have an edge in all we do (Eggelmeyer, S. 2010).

○ **Sustainability in higher education**

The concepts of sustainability and sustainable development(SD)¹⁵ were presented a few years ago out of the deliberation between supporters of classical economic theory in the tradition of Adam Smith that on the one hand and environmentalists on the other. The period 2005 – 2014 has been declared as the United Nation Decade of Education for Sustainable Development (UNDESD, Johannesburg Summit, 2002). Nowadays, there are many definitions of sustainability and sustainable development (Pearce & Barbier, 2000); the concept of sustainable development was originally introduced at the first Earth Summit in 1972 in Stockholm. During this meeting of public administration, representatives and nongovernmental organisations where education was recognized as essential to the effective accomplishment of sustainable development, and a fact that has been repeated by frequent public administrations and practitioners in the foremost years. Since then, advancement has been adjustable and generally substandard. However, a badly needed injection of resolution was administered in 2005, when the UN adopted a Decade of Education for Sustainable Development (DESD) (UNESCO, 2005). The challenge faced by universities is reflected in international efforts such as the DESD((Garland, Hadfield, Howarth, & Middleton, 2009) . The

¹⁵ The most quoted definition of sustainable development comes from the Brundtland Report which defines it as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

international implementation scheme"s overall goal for DESD is¹⁶: "...to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. This educational effort will encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations (DESD, 2005-2014)." Also the idea being that, such an input will "encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations(ibid, 2005-2014) ."

Education has a vital role to play in developing the knowledge, skills, attitudes and values that enable people to contribute and advantage from an inclusive and sustainable future (E2030 Position Paper, 2018). Learning to form perfect and determined objectives, work with others with different viewpoints, find unexploited openings and recognize numerous explanations to immense difficulties will be essential in the upcoming years. The OECD Education 2030 contributes to the UN 2030 Global Goals for Sustainable Development (SDGs), aiming to ensure the sustainability of people, profit, planet and peace, through partnership (OECD, 2018). According the paper on Measuring Sustainable Development: Achievements and Challenges by Enrico Giovannini ¹⁷and Myriam Linster¹⁸, The OECD has a specific programme on sustainable development since 1998 following a recommendation by the High-Level Advisory Group on the Environment to the OECD Secretary General and subsequent mandates from OECD Ministers in 1998 and 2001. Ministers recognised sustainable development as an overarching goal of OECD governments and the Organisation and emphasised OECD countries' special responsibility for leadership on sustainable development worldwide; and the work has been designed to help Member countries address fundamental sustainable development issues by making the concept of sustainable development operational for public policies and moving beyond a sectoral approach to a more integrated approach(Giovannini & Linster, 2007). It also includes the advancement of suitable tools to display evolution to sustainable development. Between 1998 and 2001, OECD work concentrated on better understanding the significance of sustainable development for public policies and on examining the main policy challenges of relevance to sustainable development that OECD countries face as a group (OECD, 2001a). It additionally reviewed the challenges for the measurement of progress and made proposals on how to identify and develop appropriate indicators and measurement frameworks (OECD, 2001b). Between 2001 and 2004, the links between the three pillars of sustainable development were further examined with emphasis on policy reform and implementation and on the analytical and scientific understanding in the area of sustainable development (Giovannini & Linster, 2007). It was complemented with further exchange of experience on measurement frameworks (OECD, 2004a), and on key indicators for measuring national progress (OECD, 2004d).

In 2005 and 2006, the OECD has provided a forum for substantive policy dialogue on sustainable development and related cross-cutting issues, among which sustainable resource use, including the development of related measurement tools including material flow accounting, and decoupling and resource productivity indicators (OECD 2004b).

The OECD Programme on Institutional Management in Higher Education (IMHE), in collaboration with the Directorate for Public Governance and Territorial Development, conducted in 2004-2007 a comparative

¹⁶ United Nations Decade of Education for Sustainable Development (2005-2014): International Implementation Scheme; UNESCO: Paris, France, 2005.

¹⁷ Chief Statistician, (enrico.giovannini@oecd.org), Organisation for Economic Co-operation and Development, Paris

¹⁸ Environment Directorate (myriam.linster@oecd.org), Organisation for Economic Co-operation and Development, Paris

study of how issues relating to higher education institutions and their regional engagement were addressed in the OECD area (OECD, 2007b). In 2013, the OECD Higher Education Programme (IMHE) launched the first annual State of Higher Education publication (SOHE).

The underlying rationale of the OECD study was based on recognition that regional engagement must be integrated with teaching and research functions if higher education's contribution to learning outcomes, and to knowledge exploitation by business and to civil society is to be maximized (OECD, 2007b). Besides, higher education and research establishment can play a key role in sustainable development of their regions through their research, education and services. It has extended involvements to the key strategic policy issues regarding higher education and research establishment. Work on education at the OECD seeks to develop and review policies of strategic development of sustainability to increase the competence and effectiveness of higher education requirements and the evenhandedness with which their welfares are collective. It emphasizes on how to evaluate and progress strategic outcomes of sustainable education at HERE, to endorse excellence teaching and to build social consistency over higher education. If we are in challenges of education in this century, we have to must deepen sustainability alertness across the world. The most effective way for promoting sustainable development is by developing the capacity of all stakeholders through education (Abdallah, 2008.). Under these requirements, universities, HERE and colleges seem to be in a exclusive situation to take a control role on sustainable development. This sustainability quest challenges universities around the world to rethink their missions and to re-structure their courses, research programs, and life on campus¹⁹. As leaders and contolers , they can predict and strategize towards a global issues and successful resolution; as centers for learning, they can educate and empower students to address issues related to climate change, energy efficiency, as well as sustainability in its broader definition (ibid 2008).

Concrete lessons from the OECD study on "Supporting the Contribution of Higher Education Institutions to Regional Development" this paper looks into sustainable development of and by universities and other higher education institutions. It highlights what the "Triple Bottom Line"²⁰ approach means in higher education that is to help instructors and institutions identify and implement sustainable practices that work within their educational socio-cultural micro/macro environment(s). Based on the underlying rationale that sustainable development of higher education institutions can be mobilised best in the context of regions, it highlights the experiences of individual universities in the OECD countries (Puukka²¹, 2008). Finally, it allurements light on the constrictions in contradiction of this action and recommends how to move forward.

The sustainable strategies of Higher education institutions to contribute the sustainable environmental development in their regions in many ways, for example by²²:

- Generating human capital in the region through their learning and further education programmes in areas of sustainable development (PUUKKA et all, 2008).
- Acting as a source of expertise through research, consultancy and demonstration.

¹⁹ Nizar Abdallah, Presidio School of Management, San Francisco, CA, USA- The Case For Advancing Sustainable Development In Higher Education: An Economic Perspective

²⁰ See the figure of Triple bottom line of sustainability in a higher education institution (PUUKKA, 2005)

²¹ Jaana Puukka- Analyst Organisation for Economic Co-operation and Development (OECD)France

²² PUUKKA, Jaana, (2008), "Mobilising higher education for sustainable development – lessons learnt from the OECD study". Proceedings of the 4th International Barcelona Conference on Higher Education, Vol. 7. Higher education for sustainable development. GUNI Available at <http://www.guni-rmies.net>.

- Playing a brokerage role in bringing together diverse regional actors and elements of capacity to the sustainability process (ibid, 2008).
- Demonstrating good practice through on-campus management and development activities, strategic planning, building design, waste minimization and water and energy efficiency practice, responsible purchasing programmes and pursuing good citizen type initiatives like a “green campus”(ibid, 2008).
- Offering recognition and reward incentives for staff to be involved in sustainable development leadership groups in the regional community (ibid, 2008).

UNESCO (2004) identifies two unique opportunities for HEIs to engage in sustainable development. First, “Universities form a link between knowledge generation and transfer of knowledge to society for their entry into the labour market(UNESCO, 2004). Such preparation includes education of teachers, who play the most important role in providing education at both primary and secondary levels (ibid, 2004). Second, they actively contribute to the societal development through outreach and service to society (ibid, 2004).” Cortese (2003) seconds this notion, stating “Higher education institutions bear a profound, moral responsibility to increase the awareness, knowledge, skills, and values needed to create a just and sustainable future. Higher education often plays a critical but often overlooked role in making this vision a reality (Cortese, 2003). It trainup most of the professionals and expert who develop, manage, control, teach, work in, and inspiration society“s HERE.” Thus, HERE have a critical and tangible role in emerging the values, potentials and awareness not only desirable to perpetuate the sustainable development (SD) philosophy, but to advance upon its distribution. In Crospondent to this responsibility there have been numerous attempts at fortifying commitment from institutional management. Probably best known is the Talloires Declaration, an international agreement signed by over 350 university presidents in over 40 countries to take actions to implement sustainable practices into their respective institutions, reverse environmental damage, reorient research activities and enhance outreach in colleges and universities (ULSF, 1990). In addition, the American College & University Presidents Climate Commitment asks individual presidents to take steps toward institutional plans to reduce carbon emissions and adopt energy efficiency policies, as well as report their progress (ACUPCC, 2007). Other programmes include the International Sustainable Campus Network and the Global Higher Education Sustainability Partnership (GHESP), which provide forums for institutions to exchange good practices and improve current practices (ISCN, 2007; GHESP, 2004). The Baltic 21 has also highlighted the role of education as a means to achieve broader objectives on sustainable development (Baltic 21, 2004). While these are positive steps to creating green campuses, sustainable campus, teaching program, curriculums and communities, what is inattentive is a systematic attitude to embedding sustainability. The OECD member countries agreement on developing a green and sustanable growth strategy, yet the discoveries are relevant to it. The green and sustanable growth strategy recognizes the need to regulate student teaching, training and skills to meet challenging world and changing labour demands and policies, as well as the need to re-orient teaching, research and development for new technologies and innovations.

○ **Value Creation Strategies in higher education : Globalization**

It is inevitable that higher education and rearerach establishment’s education systems and policies, are being transformed to globalization by the value creation strategies i.e. Cross-border higher education. The term ‘globalisation’ as used here is considered to be unbiased as far as possible and free of ideological gear or particularly state links. By ‘globalisation’ is meant ‘the widening, deepening and speeding up of world wide interconnectedness’ (Held et al. 1999, p. 2). Globalisation is a geo-spatial process of growing interdependence and convergence, in which worldwide or pan-regional (for example European) spheres of action are enhanced. Globalisation can take many different forms, and embody various projects (Davies & Nyland 2004, p. 9). In the era of globalization and knowledge economy, the education, innovation,

sustainability, economic and cultural changes are combined to growth the competitive advantage of regions that generate the best circumstances for progress and development. On the other hand, it rests on the first world-wide systems of communications, information, knowledge and culture, tending towards a single world community as Marshall McLuhan (1964) predicted²³; It is the processes of communications and information, where the economic and cultural aspects are drawn together, that above all constitute what is new about globalisation; and inclusion/exclusion in relation to ICT networks and knowledge have become key dividing line in shaping relations of power and inequality (Castells, 2000; Giddens, 2001).

Higher education and research establishment are foundational to the sophisticated use of innovative technologies and to culturally multifaceted communities, and like ICTs are formative of the emerging global environment²⁴. 'Although many universities and research establishment still seem to perceive themselves rather as objects of processes of globalisation, they are at the same time also key agents' (Enders & de Weert 2004c, p. 27). Research universities are intensively linked within and between the major 'global cities' that together constitute the nodes of a globally networked world (McCarney 2005). Castells (2001, p. 225) remarks that 'the Internet is in fact the technological medium that allows metropolitan concentration and global networking to proceed simultaneously. There is a strong positive correlation between the higher education enrolment ratio of a nation or a region, and its global competitive performance (Bloom 2005, pp. 23-24). The Internet facilitates world wide databases and collaboration between academic faculty, stimulating more face-to-face and electronic meetings. Cross-border e-learning, combining ICTs and teaching, has not displaced existing educational institutions as some expected but continues to grow, with open potential for new kinds of pedagogy and access (OECD; 2005b).

Today's education system should prepare students for their future and provide them with the necessary competencies to engage in a world that is increasingly becoming more complex, uncertain, volatile and ambiguous (*Taguma, 2016*). There is an increasingly important basic skill in ever-changing technological universe: ability to learn and adapt to the needed new skills and training (OECD, 2007). The OECD indicated to the globalization for the purpose of trains the highly skilled workers and contributes to the research base and capacity for innovation that determine competitiveness in the knowledge-based global economy and society. It benefits international collaboration and cross-cultural exchange. Cross-border flows of ideas, students, faculty and financing, coupled with developments in information and communication technology, are changing the environment where higher education institutions function (OECD, 2009). Establishing a multidimensional learning framework with a common language could also enable countries, both individually and collectively, to explore recognising student outcomes that are not yet measured but are critical in navigating in time and social space and shaping their own future²⁵. An Organization for Economic Co-operation and Development (OECD) survey notes that "English is the premier language of business and professions and the only global language of science, research and academic publication" (OECD, 2008; p.20). It is said that English has become the 'Latin of the 21st century; its knowledge empowers one in the globalized world and a lack of Knowledge of it "seriously disenfranchises" (Mathews, 2013). All the desirable changes to shift universities and research establishment and to bring into line with the requirements of the global market suggest the globalization of higher education. Universities and research establishment are evaluating and revising their curricula, instruction methods, and language of instructions

²³ Guy Neave's description of globalisation as "quickenning exchange" is suggestive of both its economic and cultural aspects (Neave, 2002, p. 332)

²⁴ Marginson, S. and M. van der Wende (2007), "Globalisation and Higher Education", OECD Education Working Papers, No. 8, OECD Publishing, Paris. <http://dx.doi.org/10.1787/173831738240>

²⁵ *ibid*

to reflect globalized higher education and promote cross-border Education; as a perspective of Globalization, the higher Education to 2030 addresses some issues both from a quantitative and a qualitative standpoint. Increased global competition in higher education, simultaneous to cross-border collaboration is illustrated not only on a global scale, but also at a regional level through developments in Europe (OECD, 2009). The European model (Paris model) served as a common global academic model attracting international students, following Latin as the common language of academic discourse (Altbach, 1998). The OECD has identified many of the benefits that accrue to higher education and research establishment from increased of globalization, including the attraction of new talent, broadening of staff experience, facilitation of research cooperation, and the diversification of funding streams (OECD, 2008).

The reviewed trends point towards the possible following key developments in the future²⁶:

- **Cross-border higher education, implying mobility of students, faculty and institutions, will grow(OECD,2009):**

Cross-border education has become the means to globalize higher education(*ibid*, 2009). CBHE implies the mobility of students, *faculty, institutions*, and programs crossing national boundaries; it has become a market-driven activity and has become a tradable commodity under GATS through multiple providers and attracting thousands of students who are willing to buy these services at an international price(*ibid*, 2009).. Higher education has become a major global industry (Varghese, 2014). It recognizes that the “international knowledge order” has become a powerful determinant in the globalized competition for talented students, resources, and reputation (Weiler, 2001). The reasons that promote and hasten the process of globalization of higher education are:²⁷ i) the need to deepen and widen the knowledge base of the economy(Varghese, 2014); ii) well-educated persons should be exposed to ideas, not confined to any national boundary(*ibid*, 2014); iii) increasing student demand for foreign degrees; iv) financial attraction of many universities to enroll foreign students(*ibid*,2014); v) prestige that is sought by institutions to show that they play a global role(*ibid*,2014); vi) better communication and cheaper travel costs make people reach different places easily (Wildavsky, 2010). Increasing demand for the higher educated for the global market and an insatiated demand for higher-education degrees to enter the global market both put pressure on the cross-border institutions to offer courses and student places (Varghese, 2014). Further, it has become an attractive area of investment at times producing more profit than in other sectors.

Trade in education under the GATS framework takes place in four modes (Knight, 2002). They are:

- Cross-border supply of the service where consumers remain within the country (*ibid*,2014). E-learning-based distance teaching programs are decent examples of this type of cross-border education. Innovative Technological development has given opportunity for creating online universities and massive open online courses (MOOCs).
- Consumption abroad where the consumers (students) cross the border includes full-time study for a degree—part of the study at home, and the remaining part in a foreign country—and exchange and joint degree programs(*ibid*,2014).
- the commercial presence of the provider in another country in the form of branch campuses or twinning and franchising arrangements between universities from the developed and developing world, but also among universities of the developed world as a whole(*ibid*,2014).

²⁶ OECD (2009) Higher Education to 2030, Volume 2: Globalisation

²⁷ Varghese, N. V. (2014). Globalization and higher education: Changing trends in cross border education, 15.

- The presence of persons in another country to provide the service. The most visible form of this mode is the mobility of professors from one country to another as an employee of a foreign university, as part of an academic partnership, or to teach in a branch campus (ibid,2014).

Today globalization of higher education is represented through any one of these modes corresponding to the specific division of responsibilities in each country, the UNESCO and OECD Guidelines on “Quality Provision in CrossBorder Higher Education” recommend actions to six stakeholders²⁸: governments; higher education institutions/providers including academic staff; student bodies; quality assurance and accreditation bodies; academic recognition bodies²⁹; and professional bodies³⁰. The purposes of the *Guidelines* are to protect students and other stakeholders from low-quality provision and disreputable providers (that is, degree and accreditation mills) as well as to encourage the development of quality cross-border higher education that meets human, social, economic and cultural needs³¹. The most common form of cross-border education is over student mobility, teaching and research staff and institutional mobility.

Since the 1980s, cross-border higher education concluded the mobility of students, academic staff, Programmes/institutions and professionals has grown up remarkable. In corresponding, new delivery modes and cross-border providers have appeared, such as campuses abroad, electronic delivery of higher education and for-profit providers (OECD, 2004a, 2009, 2010a). These new forms of cross-border higher education offer increased opportunities for improving the skills and competencies of individual students, the quality of national higher education systems, and also an engine for innovation and capacity development, provided they aim at benefiting the human, social, economic and cultural development of the receiving country (OECD/World Bank, 2007; OECD, 2010b). particularly, The market for cross-border students is increasing quickly over the past era. According to UNESCO statistics (UIS, 2012), between 2000 and 2010 the number of students crossing borders have almost doubled from 1.9 million to 3.6 million. According the article of university world news on “Global postgraduate student mobility trends to 2024” by Karen MacGregor(10 October 2014, Issue No:338), India will have the highest number of tertiary enrolments in 2024, at 48 million, followed by China (37 million), the United States (22 million) and Indonesia (11 million). India and China will fuel growth in outbound postgraduates: “In aggregate, total outbound postgraduates are forecast to rise by 335,000 to 2024 within the 23 origin markets, with India and China accounting for 36% and 33% of the total growth respectively.”

- **Academic research will become increasingly international and will continue to be affected by both collaborative and competitive forces(OECD,2009):**

Cross-border collaboration in academic education and research has developed along with the development of knowledge, innovation, information and communication technologies. For the *UNESCO Science Report*, several factors explain this movement towards greater international scientific collaboration. On the one hand, there has been phenomenal growth in scientific publications (+23%) since 2008, which is itself a reflection of the 21% growth in the global pool of researchers between 2007 and 2013, who now number 7.8 million (*UNESCO, 2017*). On the other hand, ‘the competition to publish in a limited number of high-impact journals has increased dramatically’, observes the report, ‘as has the competition among scientists

²⁸ In the Guidelines, the distinctions among these stakeholders are made based on the functions and it is recognized that the different functions do not necessarily belong to separate bodies.

²⁹ Academic recognition bodies include qualification recognition bodies, credential evaluation bodies, and advisory/information centres.

³⁰ UNESCO and the Organisation for Economic Cooperation and Development (OECD): Guidelines on “Quality Provision in CrossBorder Higher Education”

³¹ Stéphan, V-L & Sebastian, P(2012). Guidelines for quality provision in cross-border higher education: where do we stand?

to secure jobs in the most reputed research institutions and universities (ibid, 2017). Moreover, these institutions are themselves increasingly competing with one another to attract the world's best talent'³². 'The Internet has brought with it "open science", observes the report, 'paving the way to online international research collaboration, as well as open access to publications and underlying data'³³. At the same time, Internet has enabled a global move in the direction of 'open education' with the widespread development and availability of online university courses (MOOCS) provided by new global university consortia'³⁴.

Besides International funding for university research has also increased, even if it still denotes a small portion of research funding. However, international rankings based profoundly on research norms are likely to added increase global opposition, particularly for research capacity, as numerous countries are attempting to build so-called world-class universities and research establishment. This advances the major issue of where academic teaching and research takes place. Future scenarios do not aim to predict the future, or to picture what a desirable future would be like, but merely aim to provide stakeholders with tools for thinking strategically about the uncertain future before them, which will be partly shaped by their actions and partly by factors beyond their control (Vincent-Lancrin ,2004)

- **Higher education systems in Asia and Europe will gradually increase their global influence, although North America will continue to hold a clear advantage especially with regard to research(OECD, 2009):**

Over the past two decades, even if from lower starting points, the growth in scientific output has been faster in Asia and Europe than in North America(OECD, 2009). China and India, the two largest academic systems in the world, will have an increasingly important role to play in the future, even though they are unlikely to rival OECD systems in terms of quality in the medium term (ibid, 2009).The European higher education system, the Bologna Process has originated action a certain degree of harmonisation and convergence of higher education systems and structures that at to realise the objectives of transparency, mobility, flexibility, comparability, compatibility and increasing global competitiveness through regional co-operation, providing a stimulating example for other counties.

In 2000, nearly 90% of students from North America and Europe cross the border to study in another country of the same region; 80% of students from Latin America travel to North America and Western Europe for their studies (Varghese, 2014). These percentages have declined to 86.4% and 75%, respectively (**Table 1.1**). East Asia and the Pacific has become a more attractive place for student mobility in 2010 than in 2000(ibid, 2014).

³² International scientific collaboration has become a must, says report | United Nations Educational, Scientific and Cultural Organization. (2017). http://www.unesco.org/new/en/natural-sciences/science-technology/single-view-sc-policy/news/international_scientific_collaboration_has_become_a_must_sa/

³³UNESCO(2017) .International scientific collaboration has become a must, says report. http://www.unesco.org/new/en/natural-sciences/science-technology/single-view-sc-policy/news/international_scientific_collaboration_has_become_a_must_sa/

³⁴ ibid

Table 1. 1: Student mobility between regions in 2010

Source: UIS 2012(Note: figures in parentheses are percentages)

Sending region	No. of students sent (000s)	First Destination – North America and Western Europe	Second destination (%)
Arab States	249.3	162.0 (65.0)	Arab states (18.0)
Central and Eastern Europe	387.2	235.4 (60.8)	Central and Eastern Europe (34.5)
Central Asia	120.8	72.5 (60.0) (Central and Eastern Europe)	Central Asia (17.6)
East Asia and Pacific	1008.7	520.5 (51.6)	44.2 (East Asia and Pacific)
Latin America and the Caribbean	196.9	147.8 (75.1)	20.8 (Latin America and the Caribbean)
North America and Western Europe	542.7	468.9 (86.4)	6.1 (East Asia and Pacific)
South and West Asia	343.4	244.2 (71.1)	19.6 (East Asia and Pacific)
Sub Saharan Africa	267.0	155.4(58.2)	24.4 (Sub Saharan Africa)
World total	3572.8	2061.5 (57.7)	21.1 (East Asia and Pacific)
Unspecified	466.8		

- **Private higher education provision and financing will increase worldwide, especially outside the OECD area(OECD, 2009):**

On average, the growth of private higher education and, especially research funding, has been faster than that of public funding in the OECD area, although in the majority of OECD countries higher education is still largely funded by the public purse(ibid, 2009). With the exception of Japan and Korea, the persistent reliance on the State is even more marked in higher education provision; private higher education provision and funding have seen significant increases over the past decades(ibid, 2009). This progress is expected to remain, particularly in developing countries where swift demographic development will remain to enhancement HE demands. Since the private sector caters to an increasing number of students in only a small number of OECD countries, namely in eastern Europe, Portugal and Mexico (ibid, 2009). International, mutually private higher education facility and financing have seen noteworthy growths over the past years.

- **Growth of market-like mechanisms will be more marked in higher education governance through the use of performance-based and competitive allocation of funds(OECD, 2009):**

The increase of competitive research funding in many OECD countries, together with an emerging range of merit-based grants and loans worldwide, reflects the global quest for accountability, efficiency and effectiveness(OECD,2009). Funds have been shifted from institutional core funding to project funding (Lepori et al., 2007), often on a competitive basis, reward success in raising third-party funds in performance-based funding schemes (OECD, 2010). At the same time, because research requires a degree of stable funding, national systems strive for a balance between competition and stability (OECD, 2012, p. 177f.). However, while demand-side financing has growth prospects, especially in higher education systems that already combine a mixture of public and private elements, traditional supply-side models of allocating government funding are still largely predominant in most OECD countries (OECD, 2010). Taking into account specific economic, social and cultural contexts, an essential challenge for higher education systems is to combine the encouragement of efficiency and excellence with the promotion of equity and access(ibid,2009).

- **Focus on quality assurance will strengthen in response to the growing importance of private and cross-border higher education, institutional rankings and the quest for accountability(OECD, 2009):**

The overall emphasis on quality assurance has started to move towards assessing educational and labour market outcomes instead of inputs, but there are still notable differences between audit and evaluation approaches across regions(OECD,2009). At the same time, one can observe the emergence of cross-border accreditation and a general strengthening of co-operation across borders: several regional networks of quality assurance agencies have been established and there is an increasing interest in establishing common regional criteria and methodologies, particularly in Europe(ibid,2009). The arrival of a mutual quality assurance context on an international steadiness does not, nevertheless, appear probable in the upcoming days. The OECD Learning Framework 2030 therefore encapsulates a complex concept: the mobilisation of knowledge, skills, attitudes and values through a process of reflection, anticipation and action, in order to develop the inter-related competencies needed to engage with the world³⁵. To ensure that the new learning framework is actionable, the OECD Education 2030 stakeholders have worked together to translate the transformative competencies and other key concepts into a set of specific constructs (e.g. creativity, critical thinking, responsibility, resilience, collaboration) so that teachers and school leaders can better incorporate them into curricula (OECD, 2018).

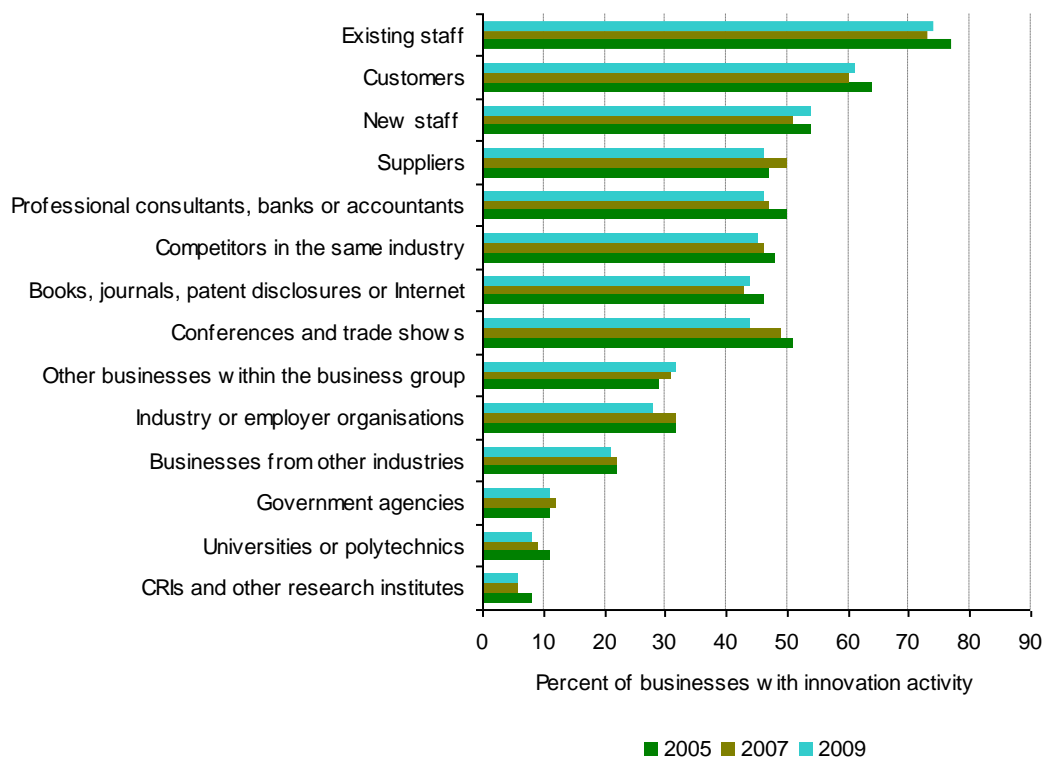
³⁵ E2030 Position Paper (05.04.2018)

1.2. Innovation issues

Innovation continues to cluster around regions with vibrant communities, skilled people and universities (Florida, 2005; ASHEIM & Gertler, 2005; Boucher *et al.*, 2003; Lord Sainsbury, 2007). Within this context, the role of higher education and research establishment (HERE) is of growing standing position. The traditional assumption that innovation results from meeting demands, nowadays is replaced by the idea that sometimes innovation generates demands never imagined before (Mota & Oliveira, 2014). Recall to the education theories about how education influences economic growth that I have discussed education in terms of its involvement of skills and abilities to the workforce. That that were the human capital theoris. Though, those theories suggested that more there is more to it than that, and that innovation and knowledge transfer play important roles in this areana.

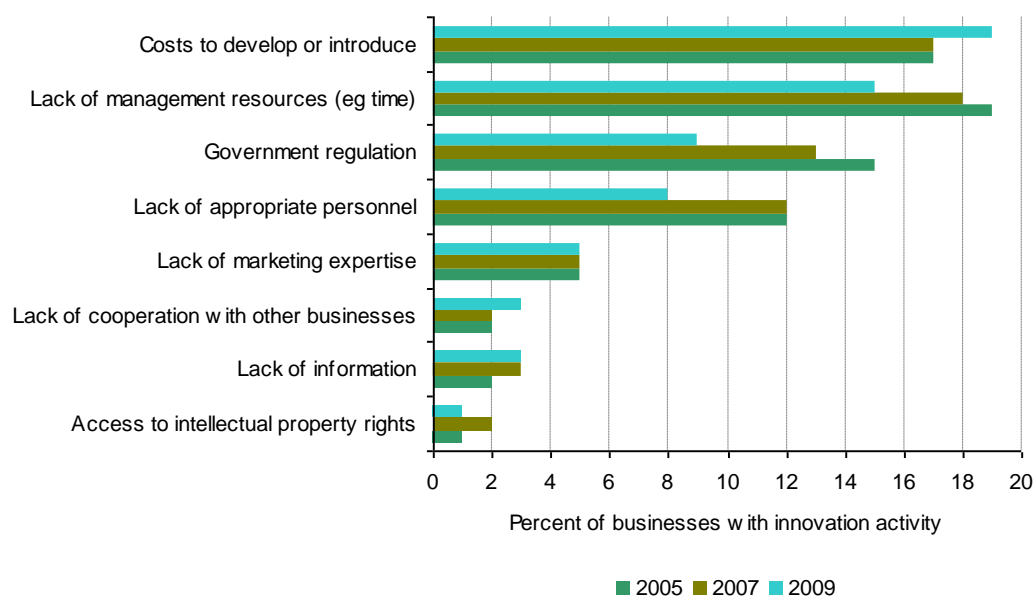
Innovation has a substantial view in economic point because it would be provided a step change in economic output. Its effect on efficiency is to decrease the amount of exertion to produce the equal volume of outputs; more significantly, growth the capacity of outputs being formed for the similar amount of effort. Besides, it can also provide output in shifts toward higher value-added products for the same or parallel amount of investment.

Figure 1. 2: Sources of information for firms with innovation activity



Source: Statistics New Zealand (2010a)

Figure 1. 3: Factors hampering innovation in business to a high degree



Source: Statistics New Zealand (2010a)

Table 1. 2 Innovation and Not Innovation Activities

			<u>Innovation</u>		<u>Not Innovation</u>
			New to the World	New to The Firm	Already in the Firm
<u>Innovation</u>	Technologically New	Product			
		Production Process			
		Delivery Process			
	Significantly Technologically Improved	Product			
		Production Process			
		Delivery Process			
		Organisation			
<u>Not Innovation</u>	No Significant Change. Change without novelty or other creative improvements	Product			
		Production Process			
		Delivery Process			
		Organisation			

Source: OECD (1981).

Table 1. 3 Type of Variables, Titles and Sources for the Measurement of Scientific and Technological Activities

<u>Type of Main</u>	<u>Titles and Sources</u>
Research and Development (R&D)	<u>Frascati Manual</u> : “Standard Practice of Research and Experimental Development” and also <u>Frascati Manual Supplement</u> : “Research and Development Statistics and Output”
Technology Balance of Payments	<u>OECD</u> : “Manual for the Measurement and Interpretation of Technology Balance of Payments”
Innovation	<u>Oslo Manual</u> : OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation
Patents	<u>OECD-Patent Manual</u> : “Using Patent Data as Science”
Scientific and High Technology	<u>OECD-Canberra Manual</u> : “The Measurement of Scientific and High Technology”
Bibliometrics	<u>OECD</u> : “Bibliometric Indicators and Analysis of Research Systems, Methods and Examples” (Working Paper)
Globalisation	<u>OECD</u> : “Manual of Economic Globalisation”
Education Statistics	<u>OECD</u> : “OECD Manual for Comparative Education”
Education	<u>OECD</u> : “Classifying Educational Programmes: Manual”
Training Statistics	<u>OECD</u> : “Manual for Better Training Statistics:”

Source: OECD/Eurostat (1997)

1.2.1. Innovation Theory, Models and application:

The main tendency of Innovation is become a central point to sustain a better performance (Dittrich & Duysters, 2007), create competitive advantage (Barney, 1991, Day, 1994), value creation (Deeds, DeCarolis, & Coombs, 2000) and economic development (Schumpeter, 1934), and most importantly to attain economic and social success in today's globalized business world (Castaño et al., 2016, Senge et al., 2006). That's why, Now a days innovation has become one of the central mechanism for strategic change, growth (Dittrich & Duysters, 2007), better performance (Barney, 1991, Day, 1994), competitive advantage (Drucker, 1985), economic development (Schumpeter, 1934), and for creating value (Deeds et al., 2000) in order to attain economic and social success in today's globalized business world (Castaño et al., 2016, Senge et al., 2006).

George M. Korres³⁶ and Stylianos Drakopoulos³⁷ have pointed out that there is a huge literature suggesting

³⁶ Corresponding Address: Associate Professor Dr. George M. Korres, University of Aegean, Department of Geography, University Hill, Mitilene

and demonstrating that research and scientific indicators make an important contribution to the growth at the firm, industry and national levels. Most of these studies have investigated the relation between productivity, employment, growth and R&D (Korres & Drakopoulos, 2009).

The Input-Output framework³⁸

The structural decomposition analysis can be defined as a method of characterizing major shifts within an economy by means of comparative static changes (Korres & Drakopoulos, 2009). The elementary approach was introduced by Leontief (1953) for the assembly of the US economy and has been lengthy in numerous ways. Joseph Schumpeter, the pioneer in recognizing innovation as essential to economic development, argues that innovation covers five areas: product innovation, process innovation, marketing innovation, input innovation, and organizational innovation (Schumpeter, 1934).

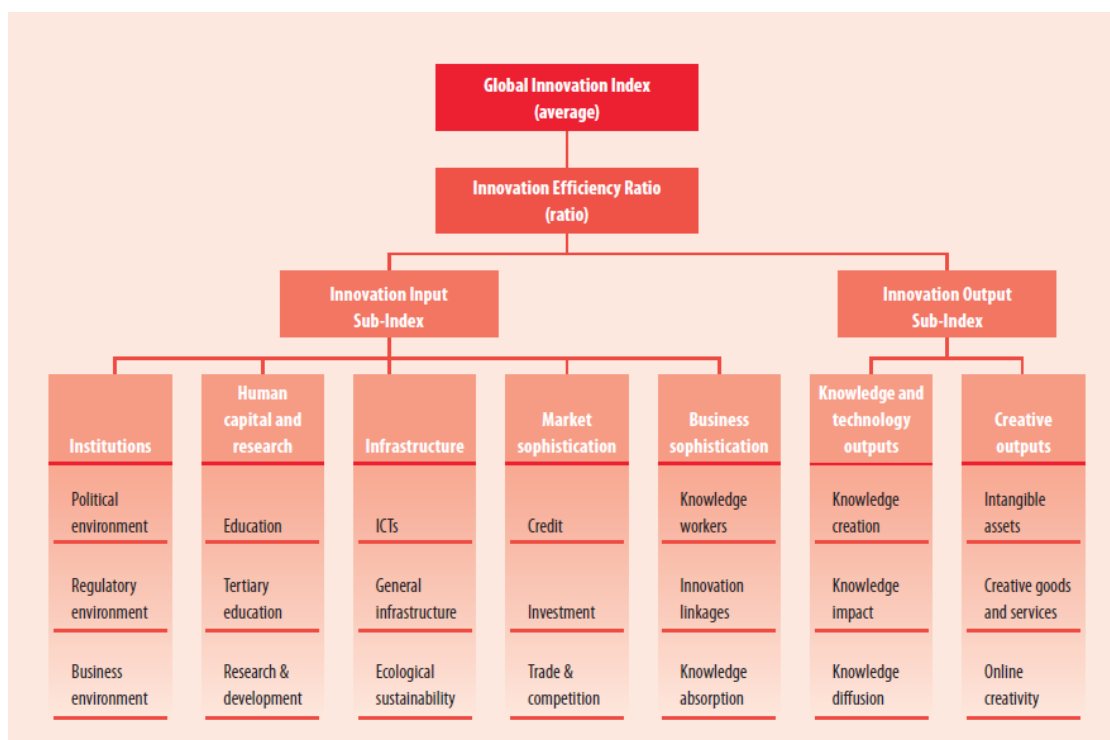
Carter (1960) has combined some dynamic fundamentals with a proper deliberation of the part of investment in embodied technical change. The outputs of innovation depend on time, money, and how companies perform their daily tasks (Cooper, 1998, Mazzarol and Reboud, 2011). Chenery, Syrquin and others (1963) added elements of trade into this framework. Growth decomposition analysis uses input-output techniques because they capture the flows of goods and services between different industries. Input-output methods exploit the inter-linkages effects and also search for the components of growth (Korres & Drakopoulos, 2009).

Besides, input-output methods permit us to estimate the influence of *technical variation* to output development. The main dispute of the technique of inter-industry investigation is to display openly interlinks of progress rates in different segments of the economy. Frequently, two different compositional indicators are used to analyze the extent of structural change, the annual growth rate of real output in each industry and the share of national real output accounted for each industry (ibid, 2009)

³⁷ Dr. Sty lianos Drakopoulos, Assistant Professor , Technological Educational Institute (TEI) Kalamatas, School of Economics and Business Administration, Department of Financial Economics

³⁸ Korres, G. M., & Drakopoulos, S. (2009). Economics of Innovation: A Review in Theory and Models. *Economics of Innovation*, 14.

Figure 1. 4 Knowledge and Technology outputs as well as creative outputs.



Source: jugaadtoinnovation.blogspot.com/2014/08

Technological change acting an important role in the enlargement and decline of sectors(Korres et all, 2009). Technological change and innovation activities contribute essentially to the regional dimension and productivity growth³⁹. The technological infrastructure and innovation capabilities affect not only the regional growth, but also the whole periphery and economy as well (Korres et all, 2009). In the last decades, OECD /introduced some measures and indexes, concerning the Research and Development Expenditures, patents etc., that measuring the innovation activities (ibid, 2009) . Technology intensity and real growth rates of output can be used to classify individual industries into different performance groups. These groups can then be used to describe the patterns of structural change and to make comparisons among various countries (ibid, 2009). The impact of technical change is investigated with the intention of realization how much the use of primary inputs has changed, because of changes in the endogenous factors of the model(ibid,2009). Furthermore, the effects of technical change on industrial output are analyzed, in order to reveal how much output in each industry has changed because input-output coefficients have altered⁴⁰.

Catching Up and the Production Models⁴¹

The Higher levels of innovation actions tend to have a higher level of value added per worker (or a higher GDP per head) and a higher level of innovation activities than others (Korres & Drakopoulos, 2009). Following the technological-gap arguments, it would be expected that the more technologically advanced countries would be the most economically advanced (in terms of a high level of innovation activities and in terms of GDP per capita). The level of technology in a country cannot be measured directly. A

³⁹ Modeling the Technological Change and Innovation Activities for Estimation of Productivity Growth | George Tsobanoglou

⁴⁰ ibid

⁴¹ Korres, G. M., & Drakopoulos, S. (2009). Economics of Innovation: A Review in Theory and Models. *Economics of Innovation*, 14.

proxy measure can be used to give an overall picture of the set of techniques invented or diffused by the country of the international economic environment. For the productivity measure, we can use the real GDP per capita as an approximate measure. The most representative measures for technological inputs and outputs are the indicators of patent activities and the research expenditures. Difference in economic growth of various countries gave rise to the emergence of the 'new innovation paradigm' (Lundvall and Borrás, 1997; Mytelka and Smith, 2002) that has widened and strengthened the notion of innovation as a complex social phenomenon (OECD, 1992). The 'social capability for growth' that determines the nation's ability for institutional change, especially towards those type of institution which facilitate a high rate of technical change, e.g., innovation system (Freeman, 2002) appears to be deceive for accelerating economic growth rates. If we consider the emphasis is on structural changes in economy and macroeconomic development with the development of ICT, we will see following key feature⁴²:

- High value added in goods and services require knowledge and education(Soukup, 2013): Alan Greenspan (former chairman of Fed – Federal Reserve System of the USA) said in 1996 that physical volume (weight) of the US product at the end of 20th century was the same as the one of the end of the 19th century(ibid, 2013). However, the real US product of the end of the 20th century was hundred times bigger than the one of the end of the 19th century (ibid, 2013). That's why, the main reason we can say –“the structure of US product has changed”. The proportion of services and intangible assets has up and the ratio of heavy and bulky goods has down.
- Informational technologies grant enterprises a tool for quick and efficient changes (Soukup, 2013): Innovativeness can change organization structure. They can create the connections with their providers and consumers in more effective method and their more products can rapidly arrive the competition market.
- ICT has significantly reduced impact of geographical distance between different places (Soukup, 2013)
- Mediators do not play as important role as they used to and can be even excluded (Soukup, 2013):

Besides, if innovation is important for HERE to assembly the sustainable development challenges, formerly partnership is important to innovation. Over the historical decade of public-private sector partnerships, they have become an inspired and sophisticated instrument for talking importance challenges and for leveraging skills and properties of the private sector and civil society to the goals of SD. Sustainable Development Goal (SDG) 9 specifically calls for countries to upgrade technological capabilities and support technology development by encouraging innovation, increasing research and development and supporting a policy environment conducive to industrial diversification and increased value addition to commodities(UNECE,2016). Besides, Sustainable Development Goal 17 highlights the importance of multi-stakeholder partnerships in support of all the Goals. On this front, the UNECE's guiding principles for good governance in Public-Private Partnerships (PPP) can accelerate access to the means of implementation for achieving the Goals(ibid,2016). The Asia-Pacific Economic Cooperation and Policy Partnership on Science, Technology and Innovation (PPSTI) care the progress of STI collaboration and active innovation policy in APEC economies. Dialogue between members addresses issues of innovation policy development and aims to strengthen cooperation between governments, businesses and academia.⁴³

⁴² Soukup, J. (2013). *Knowledge Economy and Innovation Indices: Their Concordance And Diversity*. 9.

⁴³<http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Policy-Partnership-on-Science-Technology-and-Innovation.aspx>

1.3. Sustainable issues

Sustainability involves some concern for intergenerational equity or fairness in the long-term decision making of a whole society, some recognition of the role of finite environmental resources in long-term decision making, and some recognizable (if perhaps unconventional), use of economic concepts such as instantaneous utility, cost, or intertemporal welfare (Pezzey & Toman, 2002.). However, the concern for intergenerational equity may not involve explicit use of the word “sustainability” in any form; many other formulations are possible (ibid, 2002). It also may be quite indirect, as with a strand of the literature focused on the ecological or physical feasibility of continued economic expansion with finite resources⁴⁴. Concern about sustainability is almost as old and enduring as the dismal science itself, even though the word itself has come into fashion only in the past decade or so (Pezzey & Toman, 2002.). In 1952, the President’s Materials Policy Commission (1952) was concerned about the sustainability of the American economy’s postwar growth, given its prodigious wartime increase in the consumption of nonrenewable minerals from apparently finite supplies (ibid, 2002). Lastly, Economists interested in sustainability issues returned to the scene in the late 1980s with the publication of *Our Common Future* by the World Commission on Environment and Development (WCED 1987). This publication facilitated to launch a new agenda for both expansion and environmental economics.

Now the economic aspect of sustainable development can be seen as part of HERE’s teaching and campus level, even everyday school life. The highest possible of HERE’s lies in the saving of energy consumption and other expected resources as well as educating people to become aware and thoughtful customers. Besides, Economic and ecological sustainability are often seen as conflicting targets, but in the HERE context they may well support each other. For example, decrease of material, water or energy consumption is ecologically and economically sustainable action at the same time. Other means of endorsing economic sustainability such as allocation, allowing and re-use of items, and favouring of tough, recyclable, domestic products. In procurements, the school should try to pay attention to the whole lifecycle of products. Environmental labels provide information on low environmental impacts of a product (SUSDE, 2003).

Holistic view of sustainable development

Ecological, economic and social contents of sustainable development are not totally new things in educational world⁴⁵. In education, there is a significant requirement for implementing a holistic view. In our complex and continuously changing world, all things are more and more mixed together yet they still appear us as fragmented pictures⁴⁶. Ecological and environmental problems are worldwide and they are interconnected with social and economic issues. The challenge of sustainable development is to bring out the ways in which individual behaviour and local actions can have global influence on environmental and societal issues.⁴⁷

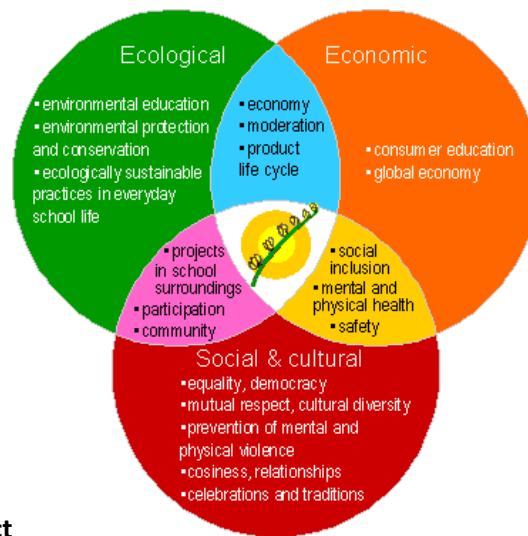
⁴⁴ The survey in Toman and others (1995).

⁴⁵ Sustainable Development - an educational package for the schools, <http://www.kolumbus.fi/~ftp-osb/projektit/susde/prod34.htm>

⁴⁶ <http://www.kolumbus.fi/~ftp-osb/projektit/susde/prod34.htm>

⁴⁷ ibid

Figure 1. 5: Holistic view of sustainable development of the school



Source : SUSDE Project

Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity (ecounesco website). As early as the 1970s "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems"⁴⁸. Ecologists have pointed to The Limits to Growth, and presented the alternative of a "steady state economy" in order to address environmental concerns⁴⁹. The field of sustainable development can be conceptually broken into three constituent parts (Csaba et al, 2008): environmental sustainability, economic sustainability and socio-political sustainability. Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations⁵⁰. The Brundtland Commission, formally the World Commission on Environment and Development (WCED), known by the name of its Chair Gro Harlem Brundtland

⁴⁸ Dr. Juhász Csaba, Szöllősi Nikolett (2008). Environmental management

⁴⁹ <http://ecounesco.ie/ue4sd/item/79-what-is-sustainable-development>

⁵⁰ Dr. Juhász Csaba, Szöllősi Nikolett (2008). Environmental management

Figure 1. 6: Early Stages of sustainability at as the 1970s



Source: www.tankonyvtar.hu/hu/tartalom/tamop425/0032_kornyezeti_ranyitas_es_minosegbiztositas/ch04.html

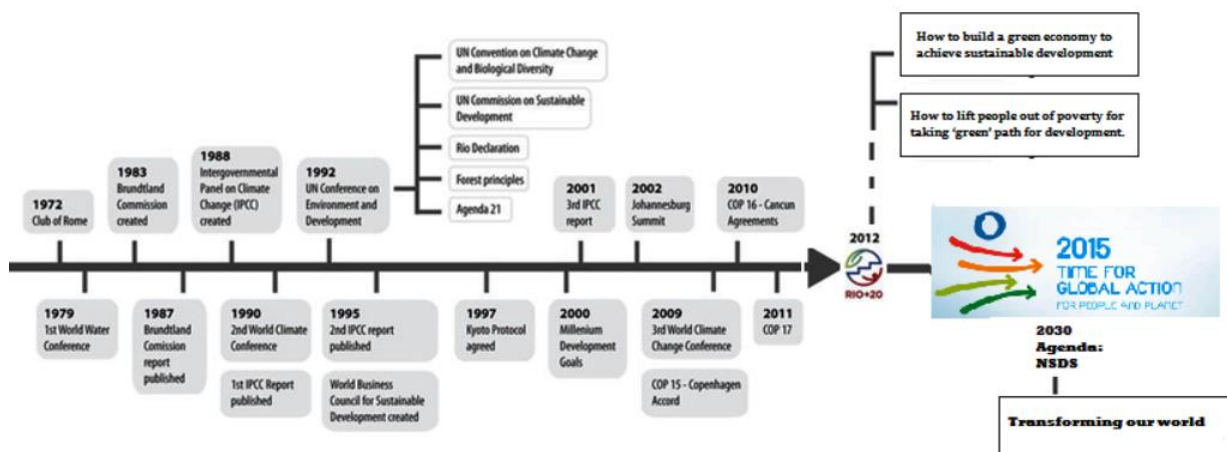
Being social workshops and major providers of higher education and research, universities can contribute to societal transformations towards sustainable development (SD). Many universities have already recognised their responsibility for SD and taken initial steps, be it on the operational level with an environmental management system or on the level of research and teaching. In order to follow this path systematically, it is necessary to transfer SD conceptions into concrete target systems and indicators. Indicators also promote comparability and mutual learning of universities (Kopfmüller et al. 2001; Müller-Christ 2013b; Renn et al. 2007). Although sustainability indicators (SI) play an important role in SD transformations, there has been no systematic discourse on this subject in Germany so far (Müller-Christ 2013a, b). The international discourse on assessing SD at universities has recently intensified (Ramos and Pires Moreno 2013; Lozano 2010; Mader 2012). Although many policy statements and declarations promoting SD in university contexts have been made since the 1990s (Shriberg 2002; Disterheft et al. 2013; Jenssen 2012), the development of cross-institutional assessment tools is a relatively new field (Shriberg 2002). Existing approaches can be roughly clustered in four categories according to their functions (Jenssen 2012; Ramos and Pires Moreno 2013): First, certified environmental management systems (e.g. Eco-Management and Audit Scheme (EMAS); EcoCampus) provide an environmentally-focused assessment framework and can be seen as the origin of more holistic approaches. Second, selfassessment tools and questionnaires (e.g. Alternative University Appraisal (AUA); University Leaders for Sustainability Questionnaire; Greening Campus Manual) have the capability to provide institutions with a quick overview of their sustainability performance (Abdul Razak et al. 2013; Shriberg 2002). The depth of these assessments varies from a purely environmental focus to more holistic approaches. Third, whole-system benchmarking tools cover a broad range of sustainability issues and provide a rating system (e.g. Sustainability Tracking, Assessment and Rating System (STARS); Sustainability Reporting Card (SRC)). Fourth, only a few certified integrative sustainability assessment tools, such as e.g. Auditing Instrument for Sustainability in Higher Education (AISHE), Assessing Responsibility in Sustainable Education (ARISE), Learning in Future Environments (LiFE) currently exist (Yarime and Tanaka 2012; Boer 2013; Abdul Razak et al. 2013; Nguyen 2011).

1.3.1. The UNESCO's SD Goals for Education: Leading Education 2030

Sustainable development is acquiring high attendance in higher education. In fact, one of the targets for

the Sustainable Development Goals announced by the United Nations in September 2015 aims to ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, thorough education on sustainable development (Crespo, Míguez-Álvarez, Arce, Cuevas, & Míguez, 2017). The most widely accepted definition of sustainable development appeared in the report of the World Commission on Environment and Development by Brundtland, which was published in 1987 and states that sustainable development is ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’⁵¹. There are different interpretations of sustainable development. The most popular one describes this term based on three pillars: economy, environment, and society (sustainability Venn diagram)⁵². Although the study of sustainable development requires evaluating these three dimensions, different authors highlight the environmental dimension⁵³ while the social dimension is often overrated. Supplementary dimensions can be also found in the literature such as the cultural, institutional, or temporary dimensions. On 25–27 September 2015, in the 2030 Agenda for the Sustainable Development of the United Nations, a total of 17 Sustainable Development Goals and 169 associated targets were announced, which determined the ambition to reach sustainable development (UN, 2015).. Action framework, over the next fifteen years will be motivated with these goals and targets.

Figure 1. 7: Sustainable development framework 1972-2015



Source: own accumulate

This new global framework to redirect humanity towards a sustainable path was developed following the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil in June 2012, in a three year process involving UN member states, national surveys engaging millions of people and thousands of actors from all over the world. At the core of the 2030 Agenda are 17 SDGs (Wordu, 2018) The universal, transformational and inclusive SDGs describe major development challenges for humanity (ibid,2018). The aim of the 17 SDGs is to secure a sustainable, peaceful, prosperous and equitable life on

⁵¹ Brundtland Commission. Our common future: Report of the World Commission on Environment and Development. In UN Documents Gathering a Body of Global Agreements; Brundtland Commission: Oslo, Norway, 1987.

⁵² Parkin, S. Sustainable development: The concept and the practical challenge. In Proceedings of Institution of Civil Engineers—Civil Engineering; Thomas Telford Ltd.: London, UK, 2000; pp. 3–8.

earth for everyone now and in the future (ibid, 2018).

The 17 Sustainable Development Goals (SDGs) as (UN,2015):

1. No Poverty – End poverty in all its forms everywhere
2. Zero Hunger – End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Good Health and Well-Being – Ensure healthy lives and promote well-being for all at all ages
4. Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Gender Equality – Achieve gender equality and empower all women and girls
6. Clean Water and Sanitation – Ensure availability and sustainable management of water and sanitation for all
7. Affordable and Clean Energy – Ensure access to affordable, reliable, sustainable and clean energy for all
8. Decent Work and Economic Growth – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduced Inequalities – Reduce inequality within and among countries
11. Sustainable Cities and Communities – Make cities and human settlements inclusive, safe, resilient and sustainable
12. Responsible Consumption and Production – Ensure sustainable consumption and production patterns
13. Climate Action – Take urgent action to combat climate change and its impacts
14. Life below Water – Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Life on Land – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development

1.3.2. UNESCO's SDG4 Strategy 2030

UNESCO together with UNICEF, the World Bank, UNFPA, UNDP, UN Women and UNHCR organized the World Education Forum 2015 in Incheon, Republic of Korea, from 19 – 22 May 2015, hosted by the Republic of Korea. Over 1,600 participants from 160 countries, including over 120 Ministers, heads and members of delegations, heads of agencies and officials of multilateral and bilateral organizations, and representatives of civil society, the teaching profession, youth and the private sector, adopted the Incheon Declaration for

Education 2030, which sets out a new vision for education for the next fifteen years⁵⁴

Through the Incheon Declaration adopted at the World Education Forum in May 2015, UNESCO, as the United Nations' specialized agency for education, was entrusted to lead and coordinate the Education 2030 agenda with its partners (Persia education foundation, 2017). The roadmap to achieve the ten targets of the education goal is the Education 2030 Framework for Action, adopted in November 2015, which provides guidance to governments and partners on how to turn commitments into action (ibid,2017).

Education 2030 goes beyond past attempts to ensure access to basic education, as set out in the Education for All goals and the education-related Millennium Development Goal 2 of 2000-2015 (Irina Bokova,2016).

Expanded agenda:

- Reaches from early childhood learning to youth and adult education and training;
- emphasizes the acquisition of skills for work;
- underlines the importance of citizenship education in a plural and interdependent world;
- focuses on inclusion, equity and gender equality; and
- aims to ensure quality learning outcomes for all, throughout their lives.

The main responsibility for implementing the agenda lies with governments, with UNESCO and partners providing support through coordinated policy advice, technical assistance, and capacity development and monitoring of progress at global, regional and national levels (Persia education foundation, 2017).

1.3.3. Partnerships and support

The balance and desire of the Global Education 2030 Agenda involves international and national coordination instruments, and strong partnerships. The Education 2030 Framework for Accomplishment delivers Member States and partners with actionable strategies to implement the agenda.

At the global level, the main mechanisms for Education 2030 direction and partnerships include:

- **SDG-Education 2030 Steering Committee**
- **Collective Consultation of NGOs on Education 2030 (CCNGO)**
- **Global Education Meetings**
- **E-9 Partnership**

UNESCO assembles the SDG-Education 2030 Steering Committee - a democratic, multi-stakeholder partnership that delivers both a forum for debate and a key structure for coordinating global education exertions. The command of the Steering Committee is to offer strategic direction to Member States and the education municipal, make references for catalytic action, supporter for satisfactory financing, and monitor improvement to Education 2030 targets over UNESCO's Institute for Statistics and the Global Educational Monitoring (GEM) Report.

Regional instruments for direction and partnerships show a key part in confirming coordination of efforts, as well as a two-way communication between international and national levels. Multi-stakeholder partnerships are a critical modality through which to balance up innovation, resources and action to provide the SDGs. They distance a extensive and various procedure of institutional arrangements for growing collaboration and cooperation between government, corporate, civil society, UN and other multidimensional agencies to discourse development challenges.

Progress of goal 4 in 2016⁵⁵:

⁵⁴ Education 2030 : Incheon Declaration

Notwithstanding the significant progress, the world unsuccessful to chance the Millennium Development Goal of attaining worldwide primary education by 2015. In 2013, 59 million children of primary-school age were out of school. Estimates show that, among those 59 million children, 1 in 5 of those children had dropped out and recent trends suggest that 2 in 5 of out-of-school children will never set foot in a classroom. These Goals obviously identify that this gap must be closed, even as the global community more clearly discourses the challenges of quality and equity.

Measuring education attainment, opening in the early scores, will help to classify where schools are weakening to meet their assurances to children and to express fitting corrective action. For example, data for 2013 from 15 Latin American countries show that in six countries, fewer than 50 per cent of third graders had a minimum level of proficiency in mathematics; in three countries, fewer than half were proficient in reading⁵⁶.

At the finish of primary school, children should be able to read and write and to understand and use basic concepts in mathematics. Though, in 2014, between 40 per cent and 90 per cent of children unsuccessful to attain even lowest levels of skill in reading, in 10 African countries, and in 9 of those countries, between 40 per cent and 90 per cent of children unsuccessful to attain lowest levels of skill in mathematics.

The end of lower secondary education often accords with the end of necessary education. By this phase, fresh or young people should be able to main subject-related knowledge and skills and possess personal and social skills. Data from 38 countries in the developed counties show that, in the majority of those countries, at least 75 per cent of fresh and young people achieved at least a minimum skill in reading and/or mathematics; the same was true for only 5 out of 22 countries, in developing regions, for which data were available⁵⁷.

Achievement rates for both primary and lower secondary education has been growing gradually since 2000. Achievement rates for primary education in both developed and developing counties exceeded 90 per cent in 2013. At the junior secondary level, the gap between developed and developing counties has pointed substantially, but quiet raised at nearly 20 percentage points in 2013 (91 per cent for developed regions and 72 per cent for developing regions)⁵⁸.

Quality primary or early education provides children with basic perceptive and language skills and fosters demonstrative development. In the majority of the 58 countries with available data for the period 2009-2015, more than half of children between the ages of 3 and 4 were developmentally on track in at least three of the following domains: literacy, numeracy, physical development, social-emotional development and learning⁵⁹.

According to Report of the Secretary-General, "Progress towards the Sustainable Development Goals", E/2016/75, Goal 4 strongly supports the reduction of determined gaps. Globally, in 2013, two thirds of the 757 million adults (aged 15 and over) who were unable to read and write were women; 1 in 10 girls were out of school, compared to 1 in 12 boys; Children from the poorest 20 per cent of households are nearly four times more

⁵⁵ See Sustainable development goal : knowkedge plateform : <https://sustainabledevelopment.un.org/sdq4>

⁵⁶ See Report of the Secretary-General, [The Sustainable Development Goals Report 2018](#)

⁵⁷ Ibid,2018

⁵⁸ Ibid,2018

⁵⁹ Ibid, 2018

likely to be out of school than their richest peers; Out-of-school rates are also higher in rural areas and among children from households headed by someone with less than a primary education⁶⁰.

To fulfil the promise of universal primary and secondary education, new primary school teachers are needed, with current estimates showing a need for nearly 26 million of them by 2030⁶¹. Africa faces the ultimate challenges in this issue by nearly 7 in 10 countries experiencing critical scarcities of accomplished primary school teachers. According to Report of the Secretary-General, "Progress towards the Sustainable Development Goals", E/2016/75, In 2013, only 71 per cent of teachers in sub-Saharan Africa and 84 per cent in Northern Africa were trained in accordance with national standards⁶². Official progress support for educational subsidies amounted to around \$1.1 billion annually from 2011 to 2013 and talled \$1.2 billion in 2014, with Australia, France and Japan being the largest contributors.⁶³

Progress of goal 4 in 2017⁶⁴

Attaining inclusive quality and equitable education for all will involve growing efforts, especially in sub-Saharan Africa and Southern Asia for helpless populations' i.e persons with disabilities, ethnic people, refugee children and poor children in rural areas.

According to Report of the Secretary-General, "Progress towards the Sustainable Development Goals", E/2016/75, Notwithstanding substantial advances in education enrolment over the past 15 years, the accustomed net enrolment rates were 91 per cent for primary or basic education, 84 per cent for under secondary education and 63 per cent for higher secondary education in 2014. About 263 million children and youth were out of school, including 61 million children of primary school age. Sub-Saharan Africa and Southern Asia account for over 70 per cent of the global out-ofschool population in primary and secondary education⁶⁵. Current education evaluation shows that in 9 of 24 sub-Saharan African countries and 6 of 15 Latin American countries with data, fewer than half of the students at the end of primary education had attained minimum skill levels in mathematics. In 6 of 24 sub-Saharan African countries with data, fewer than half of the students who finished their primary schooling had attained minimum proficiency levels in reading⁶⁶. Equity issues constitute a major and considerable challenge in education according to a recent evaluation. In all countries with data, children from the richest 20 per cent of households achieved greater proficiency in reading at the end of their primary and lower secondary education than children from the poorest 20 per cent of households. In most countries with data, urban children scored higher in reading than rural children.⁶⁷

The lack of qualified teachers and the underprivileged condition of schools in many parts of the domain are exposing prospects for quality and equitable education for all. Sub-Saharan Africa has a comparatively low ratio of qualified teachers in pre-primary, primary and secondary education (44 per cent, 74 per cent and 55 per cent, respectively). On the basis of data from 65 developing countries, the normal proportion of schools through access to computers and the Internet for teaching and learning purposes is above 60 per cent in primary and secondary education. However, the portion is less than 40 per cent in more than half of

⁶⁰ Ibid,2018

⁶¹ Report of the Secretary-General, "Progress towards the Sustainable Development Goals", E/2016/75

⁶² ibid

⁶³ ibid

⁶⁴ Sustainable development goal : knowkedge plateform : <https://sustainabledevelopment.un.org/sdg4>

⁶⁵ ibid

⁶⁶ ibid

⁶⁷ Ibid

sub-Saharan countries with data. Official development assistance (ODA) for scholarships amounted to \$1 billion in 2015, a decrease from \$1.2 billion in 2014. Australia, France and the United Kingdom of Great Britain and Northern Ireland were the largest contributors⁶⁸.

1.4. Knowledge Society and economy

The term “knowledge society”, which the academic Peter Drucker used for the first time in 1969, came into its own in the 1990s, in particular with the detailed studies by researchers such as Robin Mansel⁶⁹ and Nico Stehr⁷⁰. Basically, the knowledge economy or society is a human designed organization based on modern developed knowledge, representing quality of life support systems that are established by its range and its volumes, and contains the necessity to fully understand delivery of knowledge, access to information and competence to transfer information into knowledge. The UNESCO, in particular, has adopted the term “knowledge society”, or its variant, “knowledge societies”, within its institutional policies. There has been a great deal of reflection on the issue, which strives to incorporate a more integral conception that is not only related to the economic dimension (Afgan & Carvalho, 2010). For example, Abdul Waheed Khan (general sub-director of UNESCO for Communication and Information) writes: “Information society is the building block for knowledge societies”. In this point of view, every society has its own knowledge assets. It is therefore necessary to work towards connecting the forms of knowledge that societies already possess and the new forms of development, acquisition and spread of knowledge valued by the knowledge economy model (Pavel, 2012). Today the term of knowledge society or economy” it is developed in the whole world and If we will search on the internet „knowledge society/ economy” we will find thousands of references (Tocan, 2012). In various publications we can find various definitions of the term knowledge economy⁷¹

- A knowledge driven economy is one in which the generation and the exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the more effective use and exploitation of all types of knowledge in all manner of economic activity. [DTI: 1998]
- The OECD defines the knowledge economy by following way: —Knowledge-based economies are economies which are directly based on the production, distribution and use of knowledge and information. Knowledge-based economies are characterized by growth in high-technology investments, high-technology industries, more highly-skilled labour and associated productivity gains.[OECD: 1996, pp. 7].
- Knowledge economy is what you get when firms bring together powerful computers and well-educated minds to create wealth. [Brinkley: 2006, pp. 3]
- Knowledge-based economies are “economies in which the proportion of knowledge-intensive jobs is high, the economic weight of information sectors is a determining factor, and the share of intangible capital is greater than that of tangible capital in the overall stock of real capital” [Foray: 2004, pp. ix]

⁶⁸ Report of the Secretary-General, "Progress towards the Sustainable Development Goals", E/2017/66

⁶⁹ See Robin Mansell and Ulrich Wehn, Knowledge Societies: Information Technology for Sustainable Development, New York, United Nations Commission on Science and Technology for Development, Oxford University Press, 1998

⁷⁰ See Nico Stehr, Knowledge Societies: The Transformation of Labour, Property and Knowledge in Contemporary Society, London, Sage, 1994.

⁷¹ Vladimír Zitek, Ph.D. – Viktorie Klimová, Ph.D., KNOWLEDGE ECONOMY AND KNOWLEDGE INFRASTRUCTURE, International Conference On Applied Economics – ICOAE 2011, Masaryk University, Faculty of Economics and Administration, Lipová 41a, Brno, Czech Republic

- The knowledge economy consists in creation of added value on the basis of knowledge use (not only on the basis of manual work) and in this economy the importance of learning and applications of scientific findings for global competitiveness is growing. [Jahn et al]
- “The knowledge economy is an increasingly pervasive and useful concept used to capture important aspects of contemporary economic reality” [Cooke - Piccaluga: 2006, pp. ix]
- The key characteristics of knowledge economy have been summarized by Brinkley [Brinkley: 2006, pp. 13]:
 - o The knowledge-based economy is not new economy with new rules. It represents a soft discontinuity from the past.
 - o The knowledge-based economy is present in all sectors of economy.
 - o The knowledge-based economy is characterized by high and growing intensity of ICT usage by well-educated workers.
 - o A growing share of GDP devoted to knowledge intangibles compared with physical capital.
 - o The knowledge economy consists of innovating organizations.
 - o Organizations reorganise work to allow them to handle, store and share information through knowledge management practices.
- Nicolescu O. synthesizing the definitions from the specialized literature, considers that “ the knowledge based economy is characterized by the transformation of the knowledge in base material, capital, products, production factors essentials for the economy and through economic processes in which the generation, selling, acquisition, learning, stocking, developing, splitting and protection of the knowledge became predominant and decisive for the profit obtaining and for the assurance of the economic sustainability on the long term”. (Tocan, 2012)

Even though the various definitions of knowledge economy, it is possible to formulate its general characteristic as follows: It is the economy which is directly based on the production, distribution and use of knowledge and information. Knowledge-based economy is characterized by a high and growing intensity of ICT usage by well-educated workers (Qamruzzaman & Ferdaous, 2015). But, Expanding the OECD definition of the knowledge-based economy, the executive committee of APEC considers that “the production, distribution and the fructification of the knowledges is the main driver of economic growth, wealth, creation and employment at all industries levels”⁷². In 2002, European Commission published the paper “.Towards a knowledge-based Europe- The E U and the information society”. Starting from the EU goal- “to become the most competitive knowledge based society in the world by 2010”, they establish the action plans for the period till 2010. EU considers that, the EU’s success in achieving this goal will help determine the quality of life of its citizens, the working conditions of its workers and the overall competitiveness of its industries and services”⁷³. World Bank and OEDC had cooperated and cooperate in their activities to create knowledge based economies, being helped in their effort also by the transition countries (Tocan, 2012). In the opinion of Carl Dahlman, manager of the program knowledge for development from the World Bank Institute: to advantage from the knowledge uprising are necessary clear approaches which can satisfy the 4 pillars of knowledge economy:

- An institutional and economic framework which promotes the knowledge efficient utilization (Dahlman,2005)
- An educated population for the creation and utilization of the knowledge(ibid,2005)
- A dynamic information infrastructure (ibid,2005)

⁷² APEC Economic Committee, Towards Knowledge-based Economies in APEC, 2000

⁷³ European Commission, Towards a knowledge-based Europe- The European Union and the information society, 2002.

- An efficient innovation system within the organizations and research centers which can satisfy the people new desires (ibid, 2005)

From the above different view point of knowledge economy or society, we can say, Turning to more specific and measurable definitions, it is clear no single definition will capture all aspects of the knowledge economy. All pointers have advantages and disadvantages. An important anxiety is that of international comparability on the “new challenges of education, innovation and sustainability, given the shift to a knowledge-based economy are a global phenomenon taking place in practically **around the world as a knowledge society**. From our present observation of the knowledge society, it is useful to emphasize the role of the knowledge society in the future development of society. The life support systems are essential pillars of human society development⁷⁴. In this regard, the knowledge society represents a new paradigm for future development and it is strongly correlated to education, innovation and sustainable development. The importance of education, innovation and sustainability thinking underscores that, in building real and strong knowledge societies, the new prospects held out by the internet and multimedia mediation tools must not reason us to lose interest in outdated knowledge sources i.e. Press, radio, television and, above all, the school. Most of the people in the world prerequisite books, textbooks and teachers formerly computers and internet access. For this reason the education, innovation and sustainability paradigm of the knowledge society is a potential framework for human socio-economic development foremost to social cohesion, economic competitiveness and stability, use and gather of information resources and socio-economic development, purpose of safeguarding biodiversity and the ecosystem (Afgan & Carvalho, 2010.)

1.4.1. Why knowledge Economy has entered in our social system

Higher education and research establishments are currently facing two important and associated challenges, which also encouragement innovation in society. Notably, this includes expectations to contribute to technological innovation, societal impact and regional development (Geuna & Muscio, 2009). Traditionally having been loosely coupled organizations that were characterized by a high degree of professorial self-governance, universities increasingly pursue organization-level strategies (McKelvey, Buenstorf, & Broström, 2018). Internal professional management and the systematic use of performance indicators have gained importance (ibid, 2018), sometimes at the expense of professorial self-governance (Musselin, 2013). Adam Smith's notion of the ‘invisible hand’ is countered with Chandler's notion of a ‘visible hand’ that replaces market mechanisms in coordination and allocation of resources (Burton-Jones, 2000). From the perspectives of economic system of Adam Smith, there are two mechanisms (Bozk, 2006). The first one is related to division of labor and the use of specialized knowledge (Bozk, 2006), the second mechanism is the market which drives “the growth of knowledge by restructuring the system of knowledge” (Potts, 2001, 414). In this traditional economic model, knowledge is seen as an instrument just like the market (Bozk, 2006). Besides, in neo-classical economic models of the twentieth century, the economic system is reduced to a market mechanism which “is a rule system for communicating price information” (Potts, 2001., 415). Therefore, in neo-classical economic models, the market is “viewed as an information-processing mechanism” (Potts, 2001. 414). That is why knowledge and information are used interchangeably and static in the economy and society. In neo-classical sense, since the market is an information processing mechanism, by definition, it is a closed-mechanism. “In a closed – form mechanism, knowledge is either a synonym of information or it is meaningless” (Potts, 2001, 417). One of

⁷⁴ Giarini, O., Jacobs, G., Lietaer, B., Šlaus, I., Afgan, N. H., Carvalho, M. G., ... Nagan, W. P. (2010). cadmus. Retrieved from http://cadmus.newwelfare.org/wp-content/pdf/cadmus_1.pdf

the main assumptions behind these traditional economic models is that knowledge is embedded in capital goods (Saviotti, 1998, 843). This theory can easily be pragmatic in ICT technology policies engaged by governments in these days on the issue of digital boundary (Bozk, 2006).. Governments and public administration suppose to investment on capital goods, i.e. As services empowering internet connection or ICT information and communication technologies by themselves is satisfactory to solve the problem of digital division and information limitations, and to bring about the desired knowledge economic and social development (Bozk, 2006).

Additional traditional assumption of neo-classical economics is constructed on the inkling of perfect information and knowledge (Bozk, 2006). These economic models focus on individuals and prices as the principle source of market information (Lambooy, 2005, 1139), and assume that all agents in the market share the same information, and act in a fully rational manner (ibid. 1141). In these models, knowledge economies are collected of “autonomous mildly self- reflective individuals optimizing their objective function subject to constraints, and these individuals have been assumed to know what they wanted and to know their environment” (Paquet, 1998, 344).

Since neo-classical economic models equate information and knowledge, and ignore the cognitive dimension, the economists in this discipline think of “knowledge as a public good which is easily produced and diffused” (Cowan, Jonard, Özman, 2004, 469) and it is “impossible for its creator to prevent it being used by economic agents who do not pay anything in exchange for it” (Saviotti, 1998, 875). In neo-classical paradigm, information and knowledge are available and open for every individual agent in the market, and an agent makes its choice to enhance its unbiased purpose according to this available knowledge and information in the market (Bozk, 2006) and in this paradigm, this decision-making procedure is fully rational.

The three assumptions of neo-classical economic models(Bozk, 2006), namely (i) perfect information, (ii) perfect competition, and (iii) focus on resource allocation in a static environment, create many problems for economists to struggle⁷⁵. Some economists prefer to be stuck into the assumptions of neo-classical economics, and try to make some slight amendments in traditional analytical tools of this economic perspective(Bozk, 2006). On the other hand, some economists have left the presuppositions of neo-classical economic models “in favor of the study of adaptive or Schumpeterian efficiency and chaotic evolutionary processes” (Paquet, 1998, 344-45). Ronald Coase and Oliver Williamson are among the people who follow the first way to struggle with the problems created by neo-classical assumptions (Bozk, 2006). According to Williamson, modern enterprise is a response to “market imperfections” (Lazonick, 2002, 6). Even though he accepts the role of cognitive abilities and behavioral incentives in an organization, he does not step forward from constrained-optimization methodology to analyze the cognitive abilities and behavioral incentives (ibid., 12). He accepts that “in entering into transactions, economic actors have incomplete access to information and a limited ability to absorb that information to which they do have access” (ibid., 9), however he presupposes that “cognitive, behavioral and technological conditions as given”, and he tries to find an answer the question of “how those who control corporate resources optimize subject to these conditions as constraints” (ibid., 12). After all, it can be summarized that in neo-classical economic tradition, knowledge is reduced to information, they are synonyms and used interchangeably(Bozk, 2006). Reasons for this attitude mainly based on the argument that market is just a mechanism to exchange price information, it is closed and static, and moreover the information in the

⁷⁵ Bozk, B. B. (2006.). The Characteristics of Knowledge in Evolutionary Economics. 18.

market is available to every agent in the market as unbounded, costless and unbiased (ibid, 2006). In this tradition, information is fully available to agents, and information imperfections are constraints for agents to optimize their objective functions (ibid, 2006). However, evolutionary perspective in economics appreciates the difference between information and knowledge, and treated knowledge as a social product and endogenous to the agent (ibid, 2006). In evolutionary perspective, “knowledge generation and accumulation are also seen as endogenous components of economic development” (Saviotti, 1998, 843). In this regard, knowledge has a central role in evolutionary economic models as a crucial part of competence-building process which is necessary to be competitive in the market (Bozk, 2006).

Dugger and Sherman (2000, 7) restate the fundamental dimensions of evolutionary perspectives of society (Bozk, 2006). They emphasize that evolution means, first of all, “not only incremental change in all aspects of society, but also structural change in the basic institutions and relationships of society” (Bozk, 2006). Second, evolution means endogenous change; the change is created by internal dynamics rather than external causes (ibid, 2006). Third, evolution is not a consequence of a single factor, but instead, of “the operation of the relationships of the whole of society” (ibid, 2006). Finally, evolution involves conflict between groups, especially in all stratified and class divided societies (ibid, 2006). Even though evolution is a biological term, this does not mean that evolutionary perspectives are consequences of “biological reductionism or imperialism” (Hodgson and Knudsen, 2004, 284). Darwinian mechanisms, which are referred in evolutionary perspectives, do not always mean the process of genetic variation and selection; however evolutionary perspectives share “the common features of variation, inheritance and selection” (ibid.). According to Klaes (2004, 360), “at its object level, evolutionary economics refers to evolutionary phenomena”, because it deals with endogenously caused change (Bozk, 2006). Besides its concern with endogenous change, evolutionary economic models also concern the three processes of evolution, namely, selection, inheritance and selection (Metcalf, 1998, 22). Nevertheless Metcalfe emphasizes on two additional processes: replication and interaction (ibid., 30). Before any discussion on how knowledge can be resided in these processes, it is preferred to restate the differences between neo-classical and evolutionary economic models in terms of knowledge and information (Bozk, 2006). Different from neo-classical economic models, evolutionary economics describes a dynamic world (ibid, 2006). The general concept of evolutionary theory covers an attention to variable or a set of variables that changes over time and “a theoretical quest” towards “an understanding of the dynamic process behind the observed change” (Nelson, 1995, 54). Evolutionary economics emphasizes on the importance of structures and contexts, and accepts the interaction between individuals and groups of individuals (Lambooy, 2005, 1140). Therefore, in this perspective the knowledge is a consequence of interaction between individuals and groups of individuals, and between individuals and their environment (Bozk, 2006). Evolutionary economic models, while denying the argument that firms gradually evolve towards a more profitable ways of doing things, and towards an equilibrium, emphasize on four major considerations (ibid, 2006): “variety, behavioral continuity, profit-induced growth and limited path dependency” (Nelson and Winter, 2002, 27). As it is noted before, neo-classical economic models emphasize on the rationality of choice (Bozk, 2006). In this sense, the neo-classical economic models treated rationality as un differentiated and inherent in all actors in the market (ibid, 2006). However, the evolutionary economics argues that real actors do not have the vast computational and cognitive powers to employ optimization – based theories (Nelson and Winter, 2002, 29). In evolutionary theory, rational decision making processes are replaced by experimental ones, and in such a case the search for rationality reflect to the inferior choices (Metcalf, 1994, 933). Therefore competences of agents in evolutionary approach are based not on rationality but on skills and routines which are learned and perfected through practice (Nelson and Winter, 2002, 29). The question of where the knowledge resides depend on the level of research (Bozk, 2006). From the stand point of evolutionary economics, the levels of research can be restricted with two

(ibid, 2006).: individual and organization. Hodgson (2004, 286-87) put habits as the repository of knowledge on the individual level, and he claims that through replication of habits, which are the basis of reflective and non-reflective behavior, and repositories of potential behavior, tacit or other kind of knowledge is transferred from person to person (ibid, 2006). Hodgson (2004) accepts that the knowledge exist in in behaviors has implicit and collected magnitudes. On the other hand Nelson and Winter (1982) put skills as the repository of knowledge on individual level(Bozk, 2006).

There are three forces driving in the new knowledge economy⁷⁶

- **Knowledge** – intellectual capital as a strategic factor; a set of understandings used by people to make decisions or take actions that are important to the company (Kotelnikov V ,2007)
- **Change** – continuous, rapid and complex; generates uncertainty and reduces predictability(ibid ,2007)
- **Globalization** – in R&D, technology, production, trade, finance, communication and information, which has resulted in opening of economies, global hyper competition and interdependency of business(ibid,2007)

Methodically, the concept of the Knowledge-Based Economy (KBE) was first introduced by the OECD, which defined it as an economy which is directly based on the production, distribution and use of knowledge and information (OECD, 1996). Later, APEC (Asia-Pacific Economic Co- operation Forum) (2000&2004) and the WBI (World Bank Institute) (1999) referred to KBE as an economy in which the production, distribution and use of knowledge are the main driver of growth, wealth creation and employment across all industries(Qamruzzaman & Ferdaous, 2015) . The Economy is stronger and more directly rooted in the production, distribution and using of knowledge than even before because new ideas and innovation produce comparative advantage of KBEs (Lundwall, 1996). In 1999 the World Bank Institute launched a project entitled “Knowledge for Development” (K4D). Its aims were to raise awareness among national policymakers about the powerful growth effects of knowledge and to encourage economists to combine global and local knowledge in order to accentuate comparative advantages (World Bank, 2008).

Jones(1999) Suggested that knowledge based economy represented “the fundamental changing of the economy based primordially on the physical resources to the economy based primordially on knowledge; It has been determined that successful transition to the knowledge economy often includes four elements(Qamruzzaman & Ferdaous, 2015): long-term investments in education, the development of innovation capability, the modernization of the information infrastructure and the creation of a conducive economic environment(Burton-Jones, 2000) . A Knowledge-Based Economy (KBE) is shaped not only by the development and diffusion of computer hardware and software, but also buy cheaper and rapidly increasing electronic connectivity (M.Daley, 2000). In economic terms, the main feature of the IT revolution is the ability to manipulate, store and transmit large quantities of information at a very low cost (Sheehan, 2000). For this reason that of its little cost, knowledge and information flows through the Internet and, therefore, the application of knowledgeand information to all features of the economy are significantly facilitated.

Several studies have attempted to identify the contributing factors for developing knowledge based economy as well as figure out those issues which are preventing other countries from becoming a Knowledge Based Economy (Qamruzzaman & Ferdaous, 2015). Some of those studies are as follows, (Lorena

⁷⁶ Kotelnikov V (2007) New economy: key features of the new rapidly globalizing and changing knowledge economy. . Accessed on 3 April 2009

et al., 2007) forecasts that Europe want to become the greatest modest and energetic KBE in the in globe, accomplished of sustained economic development with more and better works and superior social consistency by confirming competence in converting its innovation contributions into innovation yields. Laura James et al., (2011) study revealed that the development of KBE Needs individuals to gain assessable knowledge or skills in the in terms of qualifications through recognized education and exercise, which will supposedly progress national economic attractiveness and output(ibid, 2015). Nyende et al., (2008), indicated that in meanness of its major development challenges, Africa is showing signs of a reversed **trend**: economies had been growing for the sixth consecutive year, conflicts were declining and many countries were now managing democratic political transitions(ibid, 2015). Krmpotić, (2011) Study result revealed that that there are a number of significant factors and variables of knowledge economy that have an impact on the achieved development of the three income groups. Đonlagić, (2012) revealed in his study that higher education is of great importance for the knowledge economy in Bosnia and Herzegovina(ibid, 2015) . Junoh, (2004) Study revealed that, the neural network technique has an increased potential to predict GDP growth based on knowledge based economy indicators compared to the traditional econometric approach(ibid, 2015)

1.4.2. Initiatives of World Knowledge Society and Economy

The world knowledge society reflects the human capital generated in the form which is quantified as economic knowledge, environmental knowledge and social knowledge (Afgan & Carvalho, 2010). In this regards human capital contains completeness of the life support systems and Economic knowledge and information are at the heart of economic development and the steady rise in levels of social welfare. The ability to invent and innovate, which is to create new knowledge and new ideas that are then embodied in production, processes and organisation has always served as the bases for future development (ibid, 2010). Mainly, it is a recently coined term i.e its use is meant to signify a variation of economy growth from an previous period to the current day. Besides, it relates to Environmental knowledge that represents the agglomerated knowledge of human environment development, collection of historical data decrying world climate changes through the history of our planet. Also following the variations of planetary historical environment knowledge is one of the essential knowledge theory for understanding the creation and development of life style on our planet. For this reson, the world agglomerated environmental knowledge is the base for experiences concerning our past and future achievement of our effective initiatives. Here Social knowledge also needs to describe the human socio-economic contribution. It follows the knowledge of different levels of the social well being structure and its transformation through history. A Knowledge Society/ Economy is one that utilizes knowledge to develop and sustain long-term economic growth and its framework which states that continuous investments in education of HERE, innovation, information and communication technologies, and conducive economic and institutional environment which will lead to increases in the use and creation of knowledge in economic production, and consequently result in sustained economic growth to focuses on four pillars of knowledge economy that will be suggested to support a successful knowledge society. In order to facilitate for country to make the transition to the knowledge economy, the *Knowledge Assessment Methodology* (KAM) has developed to provide a basic assessment of countries' readiness for the knowledge economy, and identifies sectors or specific areas where policymakers may need to focus more attention or future investments (Chen & Dahlman, 2005) .

1.4.3. Existing components and drivers of knowledge Society and Economy

The Expansion of a knowledge economy involves changes across many facets of the economy. There are numerous knowledge economy frameworks which provide a basis for knowledge economy development (Kurti, 2012) that are not applicable for each country and its specifics. Based on experiences of specific countries, t h e World Bank Institute (WBI) familiarized indicators that deliver the guidancelines

for measuring knowledge economy (KE) development and the progress of a country in development. Besides, based on empirical studies by the OECD and WBI a framework of KE has been introduced to support the policymakers for KE development. In this regards,, the conceptual framework has designed and applied by WBI indicates that developing a knowledge economy requires the following key pillars: (1) effective government institutions and economic incentives, (2) education and training, (3) ICT and infrastructure and (4) developed system of research and development. For the purpose of the World Bank's Knowledge Economy framework is to evaluate the quality, adaptation, and use of knowledge in an economy, with the goal of creating effective knowledge economies capable of competing in the global economy⁷⁷

- ***Effective government institutions and economic incentives***

The first pillar of the framework is an economic and institutional regime that is encouraging to the formation, distribution, and operation of knowledge. The influence of effective government on economic performance for developed countries. The regime that provides incentives for encouraging the use and allocation of existing and new knowledge efficiently that will help to foster policy change of socio-economy. From Experiences in developing countries that demonstration a strong relationship between good governance, GDP and per capita income. Economic incentives in the form of good tax laws, financial initiatives and flexible intellectual property regulation create a more competitive business environment (Qamruzzaman & Ferdaous, 2015). This is significant for the construction and buildup of new knowledge by the information and technical facilities. For example- in a country with poor competition and with the lack of burden to produce new products and services with the level of creation of new knowledge that is very low and therefore the degree of economic growth as well. So, the county's economic environment sould have good policies and be favourable to market transactions, such as being open to free trade and foreign direct investment (FDI). In this areas, The Role of government should have protect the property rights and encourage entrepreneurship and knowledge investment

- ***Education and training***

The second pillar of knowledge economy is a n effective and productive educational system that creates, shares, and uses knowledge efficiently to fulfill the requirements of the economy. Education, especially in the scientific and engineering fields, is essential to achieve technological growth. The effect of information, knowledge creation and knowledge accumulation on the degree of efficiency indicates that an acceptable education system is required to confirm information and knowledge allocation in the society. A more rech educated and knowledge society tends to be more technologically sophisticated, producing advanced demand for knowledge. The importance of human capital is a result of the need for better skills (e.g. Team work or cognitive skills) and lifelong learning in order to be able to cope with business challenges (ibid, 2015), creation of state-of-the-art and innovative culture, and confirm knowledge stream between individuals, companies and institutions through support to HERE and companies;

- ***Information-communication technologies and infrastructure***

Literature on the knowledge economy emphasizes the importance of ICT on the knowledge economy and the country's economic development (Qamruzzaman & Ferdaous, 2015).. But the full potential of ICT and ICT infrastructure cannot be utilized with uneducated workforce, traditional management practices and an inadequate legal framework (ibid, 2015). ICT does not automatically generate information and knowledge, but they permit individuals, establishments and other institutes to access, use and allocation of knowledge in a rapid and cost competent manner, leading to superior communication, efficiency and

⁷⁷ Toolkits, Knowledge Economy Framework, January 2009

yield. Thus the developing dynamic information infrastructure that facilitates the communication, dissemination, and, processing of information and technology. Development of ICT and their application have contributed to a significant increase of demand for educated workers (ibid, 2015). For transition countries development of ICT can be an especially significant factor for achieving economic development and growth (ibid, 2015).

- **Research and development (R & D) and innovation**

The last pillar is a resourceful innovation scheme of firms, HERE, consultants, and other bodies that spread over and adapts global knowledge system to local desires to create new innovation and technology. The gather and generation of real-world knowledge leads to productivity development to the place and country that can be developed a KE and sustain long-term economic progress. Thus the Appropriate frameworks have been developed by international organizations i.e. World Bank (WB), Organization for Economic Co-operation and Development (OECD), and Asia Pacific Economic Cooperation (APEC). According to a newly published paper of Organization for Economic Co-operation and Development, OECD science, technology and industry policies should be expressed to maximise performance and well-being in “knowledge-based economies” which are directly based on the production, distribution and use of knowledge and information. This is replicated in the trend in OECD economies to progress in high-technology reserves, establish high-technology industries, capable labour related productivity gains. Although knowledge and information have been important factors in economic development, economists are now finding discovering ways to integration with knowledge and technology in their theories and models. “New growth theory” reflects the attempt to understand the role of knowledge and technology in driving productivity and economic growth⁷⁸

From the trend of the knowledge economy is also seen as the up-to-date stage of development in global economic reformation. Even though the given importance status of knowledge and its role in economy, it is significant to notice the boundaries of what is denoted by the term of knowledge in overall economic understanding. The expert and scientist of knowledge-based economies, while determining on the degree of knowledge-intensity in any economy, states to high-tech industries or how intensively information and communication technologies (ICTs) are used. All human activity involves theoretical and practical knowledge, information and therefore all economies are knowledge economies.

To investigate the relation between economic progress and knowledge economy, the dynamics of the proportion of change of some components of knowledge economy (Table 1.4) that must be analysed first based on the statistics for the period between 1996 and 2011 for Ukraine, Poland, Germany and Lithuania⁷⁹.

Table 1. 4 Components of Knowledge Economy

Components of Knowledge Economy	Indicators of knowledge economy components
Innovation System	Patent applications, residents
	Patent applications, non-residents
	Researchers in R&d (per million people)
	Scientific and technical journal articles
	Research and development expenditure (% of GdP)
	GERd in '000 current PPP\$

⁷⁸ The knowledge-based economy, organization for economic co-operation and development report

⁷⁹ The rate of change (%) and the corresponding average rates for each indicator component of knowledge economy were analysed using the statistics for the period between 1996 and 2011 for Ukraine, Poland, Germany and Lithuania.

	high-technology exports (current US\$)
	high-technology exports (% of manufactured exports)
	ICT goods exports (% of total goods exports)
Education and human Resources	Gross enrolment ratio, ISCED 5 and 6, total
	Number of students in tertiary education per 100,000
	Public spending on education, total (% of GDP)
Information and Communication Technology (ICT)	Mobile cellular subscriptions (per 100 people)
	Telephone lines (per 100 people)
	fixed broadband Internet subscribers (per 100 people)
	Internet users (per 100 people)
	Personal computers (per 100 people)
Economic and institutional regime	Regulatory quality index
	Control of corruption index
	Government Effectiveness index
	Rule of law index
	Index of economic freedom

Source: Accumulated by the authors from <http://data.worldbank.org>; <http://info.worldbank.org/governance/wgi/index.aspx#home>; http://stats.uis.unesco.org/unesco/Reportfolders/Reportfolders.aspx?CS_referer=&CS_ChosenLang=en

1.4.4. The Engagement of Knowledge Economy

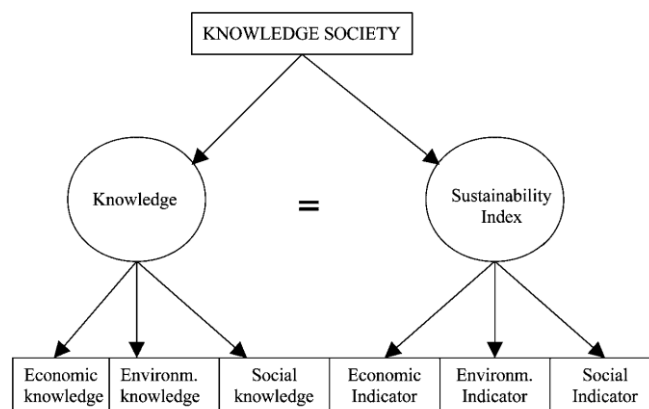
A transformer to new challenges of education, sustainability and innovation by identifying strategies, agents for change and values for a new global agenda: The global transition has begun a planetary knowledge economy will take place over the coming decades due to competition and movement of the world through a period of extraordinary confusion reproducing the beginning and intensification of profound economic, social, political, and cultural changes. In our time, the very coordinates through which the historical trajectory moves 'time and space' seem transformed (Raskin & Global Scenario Group, 2002). Sequential time is accelerating as the pace of technological, environmental and cultural change quickens. The speed and magnitude of global change, the increasing connectedness of the social and natural systems at the planetary level, and the growing complexity of societies and of their impacts upon the biosphere, result in a high level of uncertainty and unpredictability, presenting new threats (and also new opportunities) for human kind (Gallopín, 2011). The globalization (economic, cultural, political, and so on) process is interacting with global ecological interdependency, leading to a situation that is unprecedented in the history of human civilization, with consequences very difficult to anticipate (Young et al., 2006). The Current trends set the direction of departure for the journey of knowledge, not its destination just depending on how environmental and social conflicts are resolved and the global expansion can outlet into melodramatically different pathways. We know, Humanity has the power to foresee, to choose and to act, it may seem improbable, a transition to a future of enriched lives, human solidarity and a healthy planet those will solve the new challenges of education, sustainability and innovation for new global agenda. Now a day, The Great Transition has been happened and the world has now entered the Planetary and well-informed Phase for the *great transition*, the culmination of the accelerating change and expansion of the Modern Era. Only with the knowledge that our actions can endanger the well-being of future generations, humanity faces an unprecedented challenge to anticipate the unfolding crises, envision alternative futures and make appropriate choices (Raskin & Global Scenario Group, 2002). Perusing the broad frameworks of chronological variation, the varying global passage can be observed over substitute windows of perception interruption of the planetary atmosphere, economic interdependence, revolution in information science and technology, growing control of dominant cultural patterns and new social and geo-political gaps. Similarly, there are new challenges of sustainable development to be globally faced, among them how to create, educate and gain skill for innovation taking into account the demands for sustainability. This particular concern is huge, since education, innovation and sustainability are complex issues, demanding attention to the rapid dynamics with the way knowledge is produced and transferred nowadays (Mota & Oliveira, 2014). From this point of view, we have to understand the relationships between scientific knowledge and information and other forms of knowledge creation, and the method and ways in which integrity and standards should be addressed to become an essential force within the innovative education contribution to sustainability. Even though the epistemological struggle that inspires the numerous societies of knowledge production, diffusion, distribution and use has become one of the main grounds of the detachment between the production and distribution of knowledge and its claim to solving society's problems

1.4.4.1. Sustainability Paradigm: The Knowledge Society and Economy

Sustainability is a conception on the quality of human life metrics which includes the multi-criteria validation of the economic, environmental and social system. If we want to know the common connection between knowledge economy, society and sustainability, we need to consider the transformation among these terms. Since, knowledge society is based on the agglomeration of ECO-Knowledge, ENV-Knowledge and SOC-Knowledge; it may be evaluated as the complex knowledge of quality of life support systems

(Afgan & Carvalho, 2010). We also need to introduce proper metrics of Sustainability Paradigm which will consent us to present knowledge as the pattern of the number of indicators for confirming advancement made those are considered to combine actions of economic, environmental and social performance of any system. It can imply as an outline for estimation of the availability of knowledge around an arrangement and its performance. In precise the decision making process for variety of the system under deliberation must be based on availability of knowledge and information. The link between knowledge and sustainability makes it possible to visualise that the sustainability paradigm is the essential frame of the knowledge society (Afgan & Carvalho, 2010).

Figure 1. 8. Knowledge and Sustainability Index



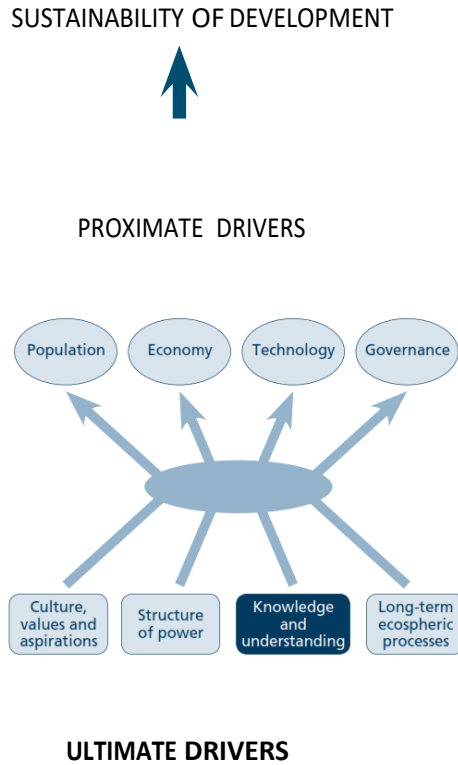
Source: Afgan, N. H., Carvalho, M. G. (2010). *The Knowledge Society: A Sustainability Paradigm* | Cadmus Journal

Meanwhile, every life support system requires planetary knowledge concerning its assembly, competence, action and preservation. Also, the sustainability of the same system is described by the appropriately selected criteria and corresponding indicators organised in the appropriate paradigm describing its functionality (Afgan & Carvalho, 2010). The mutual relation among knowledge economy, knowledge society and sustainability interpretation the possibility of anticipating the knowledge society as a sustainability paradigm. As shown on figure 1.8, the knowledge society is organised as the equity among the knowledge, information and sustainability index i.e. economic knowledge, Environmental knowledge and social knowledge of the system. The Sustainability Index is self-possessed of economic indicators, environmental indicators and social indicators as the basic indicators of sustainability that are related to material intensity, energy intensity, water consumption, toxic emission and pollutant emission. Complementary metrics inside each of these categories can be developed as support for the need for the knowledge and information about area decision.

Unfortunately, Many of the current trends of the world are seen to be unsustainable environmentally, socially, and economically (Gallopín, 2011). Environmentally, have to change of direction that was officially documented at the Earth Summit in June 1992. However, the state of affairs remains to deteriorate globally as demonstrated in UN reports, Earth Summit in Rio, Brazil, 1992, Earth Summit in Rio-“Agenda 21”, the international summit (August 26 - September 4, 2002), and supplementary studies. Socially, the Millennium Development Goals (United Nations, 2008) i.e. prominently poverty in its diverse surfaces that are not being extended in many regions of the world. Economically, the existing global economic crisis is quiet describing and no one can predict what will happen. The sustainability (or unsustainability) of development is influenced by a number of fundamental driving forces to proximate, immediate causal processes directly impinging upon society and the environment, but behind them lie the deeper, ultimate drivers that condition human choice by determining the direction taken by the proximate drivers(Gallopín,

2011). A conversion to a sustainable development direction that is fundamentally unbiased and harmonious with the environment aspects requires the application of deep variations in the ultimate drivers and not only in the adjacent ones

Figure 1. 9: Proximate and ultimate drivers of sustainability of development

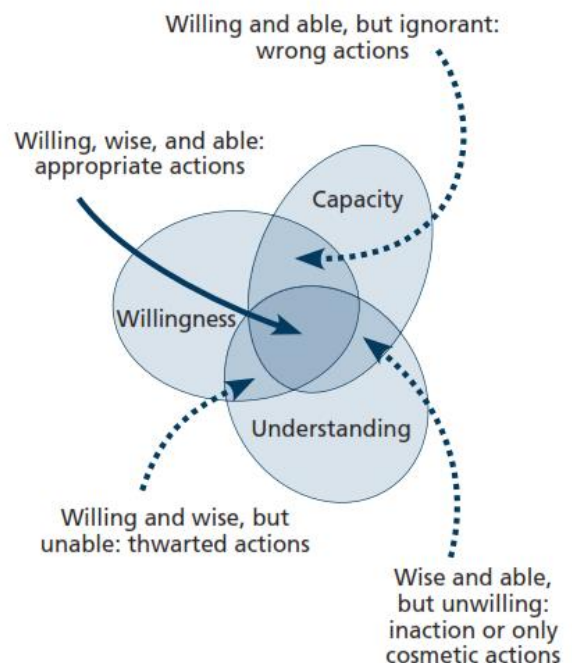


Source: raskin et al., 2002

The ultimate drivers of the global system include the basics of human motivation and social construction (figure 1.9) Thus, the role of information and knowledge technological in the sustainability conversion and create a knowledgeable society is very important. Knowledge acting an important part in terms of the actions required to move towards sustainability: the major obstacles to sustainable development being understanding, capacity, and willingness (Gallopín, 2002). The three are required to produce the appropriate actions and changes (figure 1.9)

Figure 1. 10: The basic conditions for moving towards sustainable development

Source: redrawn from gallopín, 2002



1.4.4.2. Education Paradigm: The Knowledge Society and Economy

We are living in a society that dominated by technical, economical and social evolution. It is of dominant importance for world, regional and state economic development to have broad access to the modern knowledge bases economy and society. In this regards, it is immanent to the utilization of knowledge bases to have appropriate knowledge production and distribution systems. The education system is the basic means in the dissemination of knowledge and Close links between knowledge bases and education system promote knowledge transfer to all levels of human organisation (Giarini et al., 2010.). The globalized markets, the technical and technological revolutions are transforming the modern economy into a *"knowledge based society"* in which new ways of organizing the work are governing the world, demanding a perpetual build up of competences, a rapid spread of high performance technologies, solid knowledge and increasing responsibilities(Pârgaru, Gherghina, & Duca, 2009). In our knowledgable society of the future, education will show the important part in the method of life precise to this education and knowledge-based economy and society; The educational system is accountable for the state of the nation, and this system is trained by the quality of the educational system and performance, even though the understandable fact that the apex of high quality education today is added demanding than just creating the capacity to generate information, knowledge and new competences

Presenting in the educational system of new learning and teaching techniques is a prerequisite of national education and cultural success that a prerequisite of economic attractiveness. Increasing demand among learners for enhanced user-friendliness and convenience, lower costs, and direct application of satisfied to work settings is radically changing the environment for higher education and research establishment in the world. In this speedily changing environment of HERE, which is increasingly based within the context of a global, knowledge-based economy and society, traditional universities are attempting to adapt purposes, structures, and programs, and new organizations are emerging in response. According to A. Töffler (1995) *"we are living a moment in which the whole power structure that kept the world together is falling apart and a new power structure is being born, affecting the human society on every level, and this power structure is knowledge"*. The connection between the knowledge-based economy and society itself is made by combining four interlaced elements (Pârgaru, Gherghina, & Duca, 2009): the build-up of knowledge, its transmission via education and training, its dissemination as information via media and its utilization in technological innovation. At the same time, new shapes of production, transmission and application of knowledge are evolving, and their consequence is to involve a greater number of players, typically in an increasingly internationalised network- driven context (Giarini et al., 2010.). Thus, the developed countries of the world will swiftly evolve on the coordinates of a so-called knowledge based economy and society, and the new direction of society will be towards construction of knowledge and learning. Given this framework, education viewpoints as the base for a knowledge economy and society focused for the upcoming days at the future, and knowledge becomes the key component of economic, and social progress.

The developing knowledge economy and Society and Economy has increased the priority of education and learning in society e.g. The Lisbon summit in 2000, FICCI MSME Summit 2012, Platform Economy Summit In Europe in 2018, World Green Economy Summit 2018 set the objectives of creating the most cooperative knowledge based economy and society in the world. In order to encourage, sustenance and organise actions foremost to the development of the knowledge Economy and society as a whole of education and teaching of indispensable information and knowledge in sustenance of a new social construction created on the new quality of life is of dominant status.

Higher education and research establishments, such as universities, are involved in knowledge generation and creation, curation and transfer of knowledge to students, as well as to the community. Universities are

placed at the intersection of research, education and innovation. In many regards, they hold the key to the knowledge economy and society. They play an important role in the creation of the knowledge society. Besides their classical role as HERE, they are now a pool of knowledge and research institutions for generation of knowledge. In a sense, knowledge should be the medium of the HERE. Through the activities of discovery, shaping, achieving, transmitting, and applying knowledge, the university serves society in a myriad of ways: educating the young, preserving our cultural heritage, providing the basic research so essential to our security and well-being, training our professionals and certifying their competence, challenging our society and stimulating social change (Duderstadt, 2005). Close links between society and HERE has generated communication that proves to be an indispensable force in progress. The knowledge gained through education via HERE gives strength to a person, as well as to society, enabling them to face the new challenges of the modern world with confidence. Well-formulated higher education policies and procedures stimulate deep analytical intelligent, positive attitudes, skills, and competencies for get-together information in the interest of problematic solving solution, finally skilled a person who can share an optimistic influence to economy and society. The education one receives is for the advantage of not only the specific but also society, nations and the world at large.

1.4.4.3. Innovation Paradigm: The Knowledge Society and Economy

The indispensable factor of discovery and innovation is knowledge. The allocation and broadcasting of knowledge growth ability to invent and innovate, that is to create new knowledge and new ideas that are then entrenched in production, processes and organisation. Organizations and institutions accomplished of the formation and dissemination of knowledge are always part of the education system of HERE. A feasible HERE project should be shaped to improve the idea of universities as a knowledge mediation gateway and spaces for deliberative dialogue and meeting places for different kinds of knowledge, perspectives, interests, cultures, peoples and communities.

A. Changing drivers

Education and training, and higher education and research establishment (HERE) in particular, are arguably the most significant policy areas that governments superintend in the knowledge based economy of the 21st Century. Education has become the silver bullet that policymakers fire at a wide range of targets – from enhancing global competitiveness and creating and preserving high-quality jobs, to narrowing wage inequality and promoting innovation⁸⁰. Ernst & Young's view is that the higher education sector is undergoing a fundamental transformation in terms of its role in society, mode of operation, and economic structure and value. According this report, five mega-trends will transform the higher education sector that will be the methods and policy in which the HERE, poised to enter the 21st century's knowledge economy agenda and can be an even more effective innovator in education.

Major factors that will most directly affect education over the coming decade⁸¹:

Democratisation of knowledge and access: Democratisation of knowledge and access will drive a global 'education revolution' of a scale never before seen, creating both new opportunities and new sources of

⁸⁰ David Finegold(2006), The Roles of Higher Education in a Knowledge Economy, A Seminar paper - Higher Education, the Economy, Labour Markets

⁸¹ David Finegold(2006), The Roles of Higher Education in a Knowledge Economy, A Seminar paper - Higher Education, the Economy, Labour Markets

competition⁸²

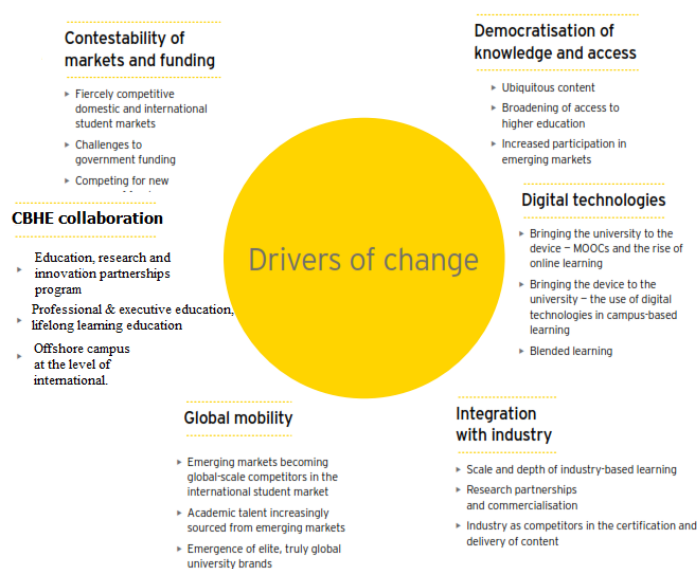
Contestability of markets and funding: Contestability of markets and funding will deepen both in Australia and internationally, with any growth in funding coming from highly competitive, non-government sources⁸³

Digital technologies: Digital technologies will transform the way education is delivered, supported and accessed, and the way value is created in higher education and related industries⁸⁴

Global mobility: Global mobility will continue to grow for students, academic talent and university brands, with the likely emergence of a small number of elite, truly global university brands⁸⁵.

CBHE Collaboration: Creating a collaborative educational environment can build a community of caring individuals who are all working towards one common goal: Increasing the students' positive outcomes. Whether you are collaborating with another educator to team teach, working hand-in-hand with other adults such as the school's administration or parents or are encouraging the students themselves to learn together, collaboration in education can benefit everyone who has a stake in the school setting⁸⁶

Figure 1. 11: Changing drivers of future university



Source: modified, originally collected from EY research report on "University of the future - A thousand years old industry on the cusp of profound change"

Integration with industry: The relationship between the higher education sector and industry will deepen — industry will be a key partner, and also a competitor in specialist professional programs⁸⁷

B. Changing model of the university:

The current expansions of the worldwide Mediation of web portals and new solicitations of virtual reality to build simulated learning atmospheres are forecast to have predominantly melodramatic effects upon learning atmospheres at all levels. former Director of the U.S. National Science Foundation, Erich Bloch,

⁸² Ibid, 2006

⁸³ Ibid, 2006

⁸⁴ Ibid, 2006

⁸⁵ Ibid, 2006

⁸⁶ Ibid, 2006

⁸⁷ Ibid, 2006

stated it well when he noted,

“The solution of virtually all the problems with which government is concerned: health, education, environment, energy, urban development, international relationships, economic competitiveness, and defense and national security, all depend on creating new knowledge—and hence upon the health of our universities” (Bloch, 1988).

Now days, HERE are exploring with cultivating accessibility to existing programs, re-designing new programs to take benefit of these developing technologies, and are marketing their programs to new viewers and in new ways. Establishments are also involved in investigation and have shaped both new organizations interior to the establishment and brand new coalitions with universities to promote learning using knowledge mediation gateway. Completely new models for universities are also being developed to respond to the opportunities created by a growing worldwide market for learning and new technologies (Hanna, 1998). The result is a dynamic competitive environment among traditional universities that are adapting learning processes and administrative procedures, alternative nontraditional universities that are adapting technologies to better serve their existing primarily adult constituencies, and new universities that are being formed around the promise of virtual environments (Ibid, 1998). Seven emerging organizational models of higher education are placed in modern education arena and each of them represents organizational efforts to respond to new educational, learning opportunities to increasingly global in scope and of critical importance to individuals, organizations, communities, and governments at a national and international level (Ibid, 1998). Most of the models deliberated are resulting from investigating trends, features and examples of emerging organizational practice, including:

- Extended traditional universities
- For-profit adult-centered universities
- Distance education/technology-based universities
- Corporate universities
- University/industry strategic alliances
- Degree/certification competency-based universities
- Global multinational universities

While the more than three thousand traditional institutions in the United States vary greatly in mission, size, curriculum, selectivity, faculty expertise and background, level of offerings, and type of location, they share a number of characteristics that serve to define them(Ibid, 1998), as these features are broadly recognized and implicit, they proposition a point of exit for this analysis. The basic characteristics that help to define traditional universities and colleges are the following⁸⁸:

- a residential student body(Ibid, 1998);
- A recognized topographical provision area from which the majority of students are drawn that can be a local community, a region, a state, and in the case of a few elite institutions, a nation;
- full-time faculty members who organize curricula and degrees, teach in face to face settings, engage in scholarship, often conduct public service, and share in institutional governance;
- a central library and physical plant(Ibid, 1998);
- non-profit financial status(Ibid, 1998);
- Evaluation strategies of organizational effectiveness based upon measurement of inputs to instruction, such as funding, library holdings, facilities, faculty\student ratios, faculty qualifications, and student qualifications (Ibid, 1998).

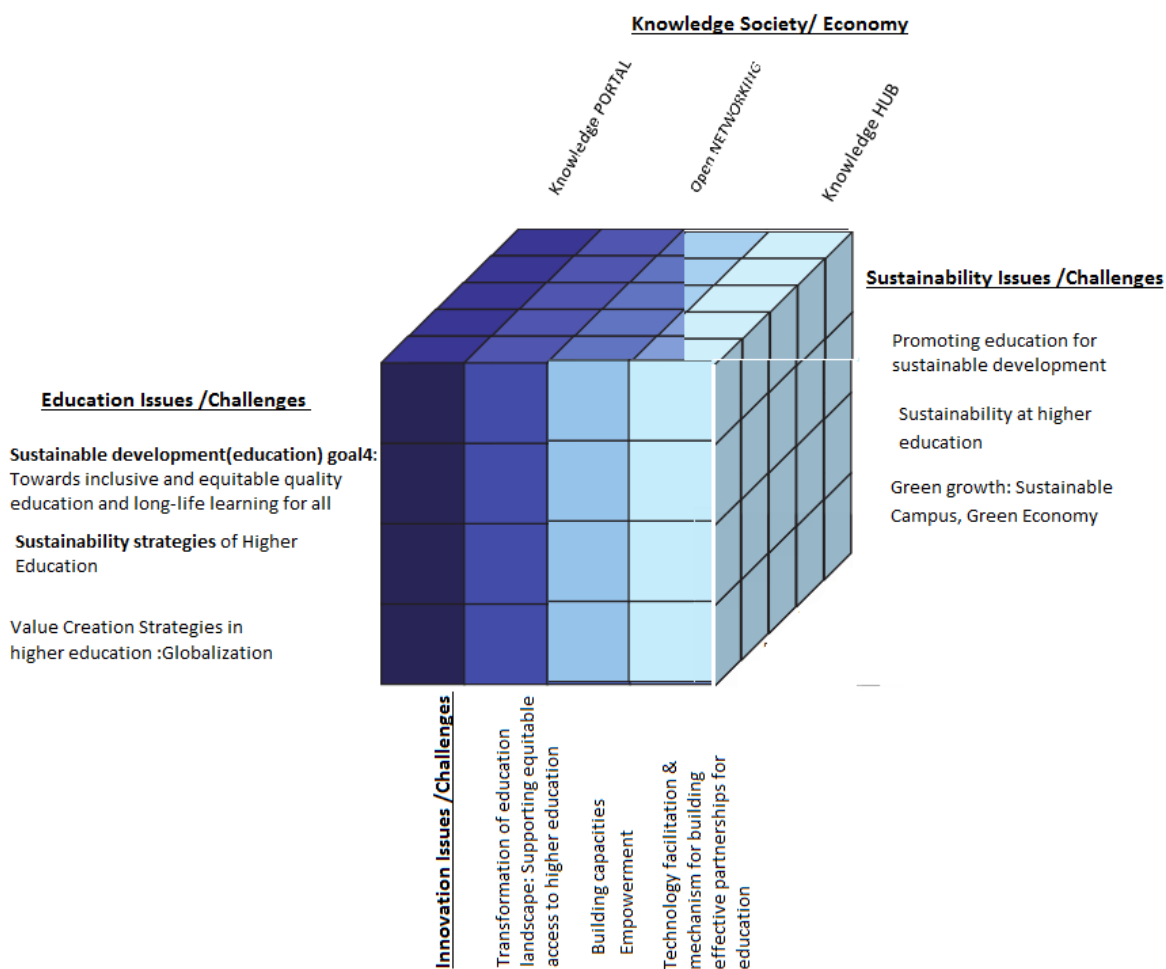
⁸⁸ Ibid

Changes in the method of teaching and learning, the way that education and research is done has also changed. Education does not exist to take place within classrooms anymore. Besides, education is not just the transfer of old knowledge and attitudes to the new generation by lecturing, note-taking, memorizing or reproducing. Maclellan and Soden (2004: 254) argue that “Lecturing is based on a model in which teaching is predominantly telling and showing. If we want people to know what we know, we tell them and/or show them.” In this traditional teaching model, it is assumed that knowledge is “some sort of commodity which can be passed from person to person in inert form.”

1.5. Triangle issues: Innovation, Education and Sustainability to knowledge Economy

The advent of the knowledge economy disrupts the entire education ecology, including general education and higher education. Educators and researchers are convinced of the necessity to prepare learners to be productive citizens in knowledge economy & society, and many initiatives have been launched worldwide. The concept of knowledge economy requires simultaneous and balanced progress in three dimensions (innovation, education and sustainability) that are totally interdependent and correlated. There are Nine (9) important issues /challenges are highlighted in my study those are totally Cross-linked each other in terms of knowledge economy. Moreover, the two foundations of innovation and sustainability should be combined in a new education system that can form a new generation of citizens able to manage the complete world along these huge challenges. The education system must be the foundation for building the necessary society, which must manage the innovation process through a more sustainable world

Figure 1. 12: Three-dimensional framework for Knowledge Societies/Economy



Source: accumulated by myself

In this view point, Innovation is becoming more and more central in our society and it is directly associated to the possibility of education, sustainability, economic & social development. They are the key aspects for a better global wealth distribution, however, how human beings can satisfy their needs without compromising future generations implies in significant changes in human behaviour only achievable by a new educational paradigm (Mota & Oliveira, 2014). In this new scenario, the HERE have increasingly assumed and expanded a central role in science, technology, innovation, and knowledge based economic development and the roles of HERE have evolved from performing conventional research and educational functions to serving also as an innovation promoting knowledge hub. A contemporary education, covering innovation solutions for a sustainable existence on our earth, has the chance to contribute to correct the adopted paths so far, so that the economic balance could be achieved with environmental preservation and social development (Mota & Oliveira, 2014). The united nations decade for ESD (DESD, 2005-2014) has encouraged innovative approaches in education in order to contribute to the societal transition towards sustainability through both the formal education system and non-formal and informal learning settings (Buckler and Creech, 2014). The innovative strength of sustainable education could be the variety of methodologies and stakeholders elaborate, creating new chances to foster the sustainability transition. The accountability towards future generations requires a global ecological transformation as an eco system to be a superintendent principle for world economic development and is closely depending on the way our population is educated to face such challenge.

In fact, one of the targets for the Sustainable Development Goals declared by the United Nations in September 2015 that intentions to ensure that all learners acquire the knowledge and skills needed to promote sustainable development e.g. thorough education on sustainable development and innovation in the light of uncertainty and the multiple meanings of the new challenges .The solution to the enormous challenge of sustainability is the deep understanding of the involved technologies, the management methods, as well as the tools for analysis and compatible education, among other associated elements. Innovation should be the protagonist enabler for human life quality on our planet (Mota & Oliveira, 2014). In this regard, the innovation progression necessity includes substantially the sustainability goals, corresponding not only the success of a business or marketing idea, but also their possibility and ecological benefits to the human race. In this view, the Networking is the key word of innovative way to the better connection between education and Sustainability, at policy level, that education, sustainability, innovation and growth policies are well coordinated, co-related and has linked. The “Open networking” scenario to be the best solution for facing the new challenges of education, sustainability and innovation in concerning to the knowledge economy and society. This scenario involves intensive networking among institutions, scholars, students and with other actors such as industry (Marita Aho,2008)⁸⁹. It is a model based more on collaboration than on antagonism, sometimes on mutually at the same time. The geographical boundaries do not edge the intensivity nor extent of the networks. According to castells (2000), networks constitute a new social morphology in society, where dominant functions and processes are increasingly organised around networks. These networks are enhanced through new information technologies that provide the material basis for their expansion throughout the entire social structure. Castells (2000) conceptualises his notion of ‘network’ as a highly dynamic, open system consisting of nodes and flows. In the wake of these general societal trends and structural transformations, networks have also become increasingly attractive in educational systems (CoDeS, 2016). Ideally, networks are conceived as an interface and effective means of pooling competencies and resources (Posch, 1995; OECD, 2003).

⁸⁹ OECD(2008). Conference Speakers- Higher education for 2030: What futures for quality access in the era of globalization ?

The new technologies are more important networking enablers in this scenario (ibid, 2008), There is another important element in this scenario, important in the view of relations with HERE and industries: the fact that cutting-edge vocational education institutions generate similar global networks as universities and link with them may be this could be the launch towards the true inclusive and equitable quality education and lifelong learning paths for all? ; International collective research is also reinforced by the compressed networking between and among institutional openness that links with HERE, industry, stockholder, communities etc, as well as openness to change, and accountability driven by the availability of free and open knowledge and information. There is a need for a common strategy for education, research, innovation and skills development at the different levels in the society. Even though, assuring and Improving Quality as number one future challenge for HERE and this expansion must cover all the performers in the higher education (HE) model based on Open networks. Even Quality assurance and improvement is a prerequisite for the trust needed in the Open networking scenario to become a reality (ibid 2008). There are several sub-challenges of quality assurance and improvement. Now question is, How to build systems that serve constant improvement, accountability as well as allocating purposes? It is important to build capacity, to secure legitimacy and to make processes and outcomes transparent and visible for different categories of customers and stakeholders (students, employers, governments, funding providers and partners)⁹⁰. A acceptable and diversity of methods is needed, including self-evaluation and auto evaluation to new indicators, e.g. those measuring HE's dimensions to build corporations at national and international level, concentrating at taking benefit of international complementarities and construction international learning and research. In the United States, the most probable scenario is that we will see increasing attempts to improve both oversight and quality assurance, given the growth in both public and private investment in higher education (Richard Arum⁹¹, 2008). It is likely that quality assurance structures will focus on monitoring organizational competence in instructional inputs, research productivity and student retention. The Vital point of higher education systems is the increasing commodification that associated threats to student and institutional academic cultures that are conducive to high quality learning. Given the high rate of economic yields for individuals with college diplomas, other significant challenges, such as identification of adequate resources to provide expanded access by innovative network, will in advanced economies with the combination of public and private investment likely be more easily resolved. The best way to deal with this challenge is to modify the organizational cultures in schools so that educators' responsibility and authority to define academic culture in terms of a moral imperative is restored and institutions are discouraged from being responsive to student preferences emerging from the privileging of students' institutional role as consumers and clients(Richard, 2008); Besides, the worst way to handle the challenges to positive school cultures conducive to student learning would be to further accelerate the differentiation in higher education that is occurring and increasingly restrict access to elite high quality programs to those with the greatest aptitude, motivation and resources(ibid, 2008).

Higher education as a dynamic partner in the development of sustainable, humane, and dynamic future for the global knowledge economy and society. In order to understand the progress of higher education for sustainable development in the world over networks, social network theories might help. In this respect the authors⁹² consider the following aspect of a network to be paramount⁹³:

⁹⁰ OECD(2008). Conference paper on Higher education for 2030: What futures for quality access in the era of globalization

⁹¹ Richard Arum is Professor of Sociology and Education, New York University; and Program Director of Educational Research, Social Science Research Council

⁹² Wim Lambrechts and James Hindson

1. Mutual Intention and Goals (Liebermann and Wood, 2003);
2. Trust orientation (McDonald and Klein, 2003; McLaughlin et al., 2008);
3. Voluntary participation (boos et al., 2000; McLaughlin et al., 2008);
4. Principle of exchange (Win-Win Relationship) (OECD, 2003; McCormick et al., 2011);
5. steering platform (Dobischat et al., 2006);
6. synergy (Schäffter, 2006);
7. Learning (Czerwanski et al., 2002; O’Hair and Veugelers, 2005).

According to the proposed framework (Combining innovation and sustainability on educational) of Ronaldo Mota⁹⁴ and João FG Oliveira⁹⁵, It is only feasible way to a methodological change in the medium and long-term direction of development on our earth: the search for knowledge in university groups in international cooperation that address the challenges and solutions for sustainable innovation in their teaching syllabus and learning methodologies. The “Open networking” scenario serves best the interests of students, as well. Only a contemporary education, covering innovation solutions for a sustainable existence on our earth, has the chance to correct the adopted paths so far, so that the economic balance could be achieved with environmental preservation and social development (Mota & Oliveira, 2014). In this regards, with commitments from over 300 universities from around the world. i.e. the University of Versailles Saint Quentin-en-Yvelines(UVSQ), HESI⁹⁶ accounted for more than one-third of all the voluntary commitments that were launched at Rio+20. Through its strong association with the United Nations, HESI provides higher HERE with a unique interface between higher education, science, and policy making. All HERE may joint connection the network freely that part of HESI commitment to:

1. Teach sustainable development across all disciplines of study,
2. Encourage research and dissemination of sustainable development knowledge,
3. Green campuses and support local sustainability efforts, and
4. Engage and share information with international networks

To establish the green growth (latest version of Green Plan) Framework, share knowledge, information and experience feedbacks relating to territories innovation strategies and their implementation modalities via knowdge mediation gateway, the University of Versailles Saint Quentin-en-Yvelinesn has been signed the Commitment for Sustainable practices in higher education institutions by initiative of Sylvie Faucheux⁹⁷. The HERE believes in its ability to federate public and private actors of its territories to develop innovative projects in sustainable development and to build together an open-minded platform to meet the 21th

⁹³ CoDeS(2016). Research and Innovation in education for sustainable development. Wim Lambrechts / James Hindson (editors)

⁹⁴ Centro Universitário UNISEB, 14095-175 Ribeirão Preto, SP, Brazil.

⁹⁵ Engineering School of São Carlos, University of São Paulo, 13566-590 São Carlos, SP, Brazil

⁹⁶ The Higher Education Sustainability Initiative (HESI), a partnership between United Nations Department of Economic and Social Affairs, UNESCO, United Nations Environment, UN Global Compact’s Principles for Responsible Management Education (PRME) initiative, United Nations University (UNU), UN-HABITAT, UNCTAD and UNITAR, was created in 2012 in the run-up to the United Nations Conference on Sustainable Development (Rio+20).

⁹⁷ Professor of environmental economics and sustainable development; Ex-Hon’ble President of the University of Versailles Saint-Quentin-en-Yvelines; Co-President of the Sustainability Commission of the French Council of University Presidents at the origin of the French approach of sustainable development in universities and colleges named the Green Plan Framework

century challenges of innovation, Education and sustainability. Even if, It is a phenomenon deeply connected with meeting new demands coming from a globalized society that is increasingly modulating the way we teach and learn, requiring new methodologies (Mota & Oliveira, 2014), and open networking and knowledge gateway platform as solution. Also, there are many new challenges of HERE as knowledge economy and society to be globally faced, among them how to skill and educate for innovation taking into account the demands for sustainability challenges. This particular concern is huge, since education, innovation and sustainability are complex issues, demanding attention to the rapid dynamics with the way knowledge is produced and transferred nowadays (ibid, 2014). The increased networking of institutions and the gradual harmonisation of systems allow students to choose their courses from the global post-secondary education network, and to design their own curricula and degrees (Marita⁹⁸,2008).

The proposed ePLANETe Blue (A Multi-Faceted Approach to Sustainability) is a good example on how this can be articulated for the strongly connected case of Innovation, sustainability and education. Our innovative ePLANETe's open networking solution help us to resolve the new issues or challenges of education, sustainability, innovation as perspective of knowledge economy and society. Its deliberation process is really remarkable and landmark for upcoming issues or Challenges of Education, Innovation, and sustainability at HERE for the purpose of knowledge Economy and society. Even though, this development process is ongoing and normally one question can arise-"is it really operative knowledge portal/hub/networking for future generation to define new issues or Challenges of Education, Innovation, and sustainability?"; To answering this question, tremendous solution and how can it works on these challenges that I will be discussed simultaneously in next chapters 2, 3,4

⁹⁸ Marita Aho works for the Confederation of Finnish Industries EK since 1994; She is responsible for anticipation and foresight activities in the areas of corporate environment, skills needs, education and research and business development; She is a Senior Adviser in charge of relations with university education, as well; She is an active member of the Education Committee of the Business and Industry Advisory Committee of the OECD. She is also one of the evaluation experts for the EU education and training programmes. She finds it extremely important to share experience and knowledge. Sharing knowledge creates new ideas, innovations and win-win situations.

CHAPTER 2: ANALYSIS OF THE CHALLENGES OF THE TRANSITION OF UNIVERSITY VERSAILLES SAINT-QUENTIN-EN-YVELINES TO UNIVERSITY OF PARIS SACLAY

2.1. History of University of Versailles Saint Quentin-en-Yvelines (1991-2015)

Versailles Saint-Quentin-en-Yvelines University (French: *Université de Versailles Saint-Quentin-en-Yvelines*, **UVSQ**) is a French public university created in 1991, located in the department of Yvelines and, since 2002, in Hauts-de-Seine. Consisting of eight separate campuses, it is mainly located in the cities of Versailles, Saint-Quentin-en-Yvelines, Mantes-en-Yvelines and Vélizy-Villacoublay / Rambouillet. It is one of the five universities of the Academy of Versailles (Wikipedia). It is one of the four *universities nouvelles* (new universities)⁹⁹ inaugurated in the Île-de-France region after the 2000 University project¹⁰⁰. It has a population of 19,000 students, a staff of 752 people, and 1,389 teachers and researchers, as well as an additional 285 external teachers¹⁰¹. The main motto of the university is to provide the dynamics knowledge and innovation

The University of Versailles Saint-Quentin-en-Yvelines (UVSQ) has thrived to occupy an important place in the national university system for in specific in the Île-de-France Region. It is considered by a strong multidisciplinary subject, such as- science, human and social sciences, legal and political sciences, medicine, engineering and technology. This consents it to ensure quality within the framework of the LMD reform and a rich and innovative training proposition reformed to the evolution of the skills which are frequently at the interface of two, even numerous disciplines and promotes active education and research advancing from the cross-fertilization of these diverse disciplines. In 2014, The UVSQ has associated university of University of Paris Saclay which composed of 4 Training and Research Units (sciences, social sciences and humanities, legal and political sciences, medicine) with 29 recognized laboratories (13 of which are associated with the CNRS, 1 with the IRD and 2 with INSERM) those contribute to research training through 3 own doctoral schools and 2 doctoral schools in co-operation accreditation¹⁰². The deployment on several sites allows a real implantation of the university in its environment and strong partnerships with educational and research institutions, local authorities, the socio-economic fabric (UVSQ/Projet d'établissement report 2006-2009). The balanced progress in the number of enrollments (annual growth rate of 5.5% since 1996 to reach 15186 students in 2004/2005) and in specific doctoral students (614 in 2005 against 541 in 2004) appears to the robust attractiveness of the University. The increasingly balanced distribution between the various training cycles reflects both the maturity of the university, offer of the the quality of training with its research skills and the much appreciated campus conditions. . The main objective of the UVSQ's strategy for the period 2006-2009 is to enable new actions to progress in these different areas that define its specificity (ibid, 2006-2009). It also reproduces the desire to increase the visibility of the university and strengthen its influence at the regional, national and international levels by participating in the creation and development of innovation, research and higher education cluster (PRES) South of Paris with Paris 12-Val de Marne, Paris-Sud 11, Évry Val d'Essonne and the École Normale Supérieure de Cachan as first partners. The short-term objective is to stimulate collaborations in teaching, research and innovation in the field of both evaluation and international cooperation by the improve the recognition and effectiveness of all partner institutions. The

⁹⁹ With the University of Évry Val d'Essonne, the Cergy-Pontoise University, the University of Marne la Vallée and the UVSQ itself

¹⁰⁰ From Wikipedia, the free encyclopedia

¹⁰¹ From Wikipedia, the free encyclopedia

¹⁰² UVSQ/Projet d'établissement report 2006-2009

management of the PCEM1 from the start of the 2005/2006 school year on the Saint-Quentin-en-Yvelines site appears as a first step. Recognition of a number of clinical and biomedical research teams is the second (ibid, 2006-2009).

Over the period of the four-year establishment project, the University sets itself five broad policies orientations¹⁰³:

1. Teaching policy:

This is to reinforce and unite of the LMD training offer, particularly in its multidisciplinary and partnership aspects, or by the application (on an experimental basis) of the LMD in the Paris-Île-de-France medical department, where is specific status will be placed not only on the fight against failure in L1, the development of new pedagogical practices constructed on ICTs, and assessment of teaching program; but also on the offer of vocational training by emphasizing alternation as well as training throughout life or international mobility¹⁰⁴.

2. A dynamic scientific policy:

It aims to reinforce and restructure the university laboratories to ensure greater consistency and critical size associated to current values. It also targets to promote the emergence or the reception of new research units i.e; LSCE, CESDIP that will strengthen centers of excellence in research. It is also developing dealings with the socio-economic world concluded the extension of innovative partnerships competitiveness clusters, mechatronics pole of the Mantois, European Foundation for the Development of Territories, Fondation Garches, etc. in order to promote the enhancement of research, innovation, technological and methodological knowledge transfer as well as the professional integration of Phd students.

3. Improvement of policy on the quality of life within the establishment:

The university want to provide both students and staff with tools, work and life environments that are efficient and user-friendly. The scheme to figure a Student House on Saint-Quentin-en-Yvelines demonstrates this desire. This one will be devoted to the response of the students as well as to the social, sporting and cultural life of the students and the staffs. Specific consideration will be paid to the response of disabilities, foreign students or lifelong learning spectators. Confirming the well-being, the hygiene and environmental standards of all premises is a urgency. The development of IT systems will be chased, among other things by the placement of wireless networks (WiFi), a digital workspace, and the extension of knowledge mediation educational platform for MOOC training, and implementation TICE projects and use of free software.

4. A multi-stakeholder partnership policy:

In previous policy, the UVSQ intends to increase its existing partnerships and to create new ones in a will to openness nation-wide and globally in a targeted way. The UVSQ desires to reinforce its role as a major actor in the expansion of the region by promoting closer public private research by the participating in cultural outreach to contributing to social promotion. For the international policy, it is both a substance of attractive benefit of the openings accessible by pooling within the PRES (opening of a joint office in China and of a European office) and educating strong geographical partnerships for student exchanges, co-graduation, cotutelle of thesis, scientific collaborations. Original mediation knowledge gateway operations

¹⁰³ ibid, 2006-2009

¹⁰⁴ Ibid

of science / society knowledge will be advanced in partnership with local authorities, local associations, colleges and high schools. Correspondingly, supplement and support programs are deliberate for students in effort in high schools in Yvelines in relation with other associated higher education institutions

5. A steering policy serving the missions of the UVSQ:

It is a question of ongoing and strengthening the quality of subtleties initiated through the preceding contract concerning all the stakeholders of the university. The objective is to deliver the qualitative university with real methods, tools and indicators to progress both its action and the excellence and recital of its various actions. This involves with specific training, communication and liability creativities and the operation of fitting evidence and steering systems. Besides, the management of university's assets in a concern of forward-looking management and high environmental quality will be privileged. It is important to emphasize that the university UVSQ has made this thoughtful change to programs offer with its own resources. Definitely, the reform challenges of sustainable development of higher education happening during the period of the previous quadrennial contract. It is true that the UVSQ has established its ability to reallocate its resources in favor of a determined project. Nevertheless, it is indispensable that this contract appear with new resources to reinforce the UVSQ in the period of thoughtful change that it is facing throughout Europe.

The UVSQ has substituted to the LMD system since the 2004/2005 academic year for the offer to the students with a intelligible and ambitious courses offer in the Bachelor's, Master's and PhD's, with the exception of medical UFR, DUTs and engineering degrees. The Bachelor's degree and master program policy was based on the multidisciplinary skills, to offer general training and pre-professionalization. The course contents of the Professional Licenses courses benefited among other things from the know-how of the IUTs. The licensing curriculum is reliable across the entire UVSQ course offer. Six(6) semesters prepared in three stages: transition to secondary education, highly multidisciplinary general education and specialization. The offer of programs in Bachelor's degree includes 35 mentions including 11 professional mentions among which 8 are opened in apprenticeship. These remarks are grouped into 4 areas: "Law and Political Science"; "Humanity and Corporate Sciences", "Economic and Management Sciences", "Science and Technology"¹⁰⁵. In Master, the program policy has been constructed on research skills of the partners in the socio-economic world, and collaboration with other HERE. The Program offer includes 23 research masters, 38 professional masters of which 7 open in apprenticeship. These fields are organized in 4 domains: "Science and Technology, Health", "Science, Environment, Territory and Economy", "Culture, Humanity and Sciences of the Companies", "Law, Management Sciences and Political Science". PhD students follow their course module and thesis in one of the 5 doctoral schools of the university.

2.2.1. The teaching programme MASTER SETE (2004-2015)

The programme on environment and sustainable development was at the heart of UVSQ's important achievements. The programmes mainly have been organized by the research centre REEDS and run by OVSQ-UVSQ that I have discusses in next section (**See- ANNEX 2.1**). It has responded to the challenges of environment and climate change by creating an interdisciplinary observatory: the Observatory of Saint-Quentin-en-Yvelines, whose mission is to support research, observation and training based on high quality laboratories in the field of climate science, atmospheric sciences (terrestrial and planetary), humanities and social sciences. The 35 programmes from bachelor to master degrees represent a very unique offer in the framework of the national and European higher education and research system. This offer developed a

¹⁰⁵ *ibid*, 2006-2009

critical mass enabling our students to find jobs with responsibilities within private sector, local councils, NGOs and State organizations. It also confirmed the position in Europe by participating actively in the new KIC Climate “Knowledge and Innovation Community” selected by the European Institute of Technology. It continues to contribute to the dynamics of the Paris-Saclay cluster, a pole of excellence founded by UVSQ and other higher education institutions.

The first challenge: the complexity of sustainable development issues- Issues of climate, environment and sustainable development, through their multi dimensionality, require an interdisciplinary approach while rooting expertise in subjects themselves. The University of Versailles Saint-Quentin-en-Yvelines the challenge using a single disciplinary approach combining reinforcement multidisciplinary and interdisciplinary reflection construction. This approach has resulted in less than ten years to develop a teaching Program offers over 30 degrees.

A second challenge: the institutionalization of interdisciplinary- In addition to providing an interdisciplinary training, institutional support, the University place for the perpetuation of this dynamic: the Observatory of Versailles Saint-Quentin-en-Yvelines. This is a real benefit to have a component fully dedicated to thematic studies, thematic transcending disciplinary boundaries traditional.

A third challenge: a new job market, changing and very dynamic- Train competent people in the field of environment and development sustainable is not the only aim of the University of Versailles Saint-Quentin-en-Yvelines. Once the license or master it makes its graduates to serve people private, public and voluntary. To achieve this, we implemented monitoring mechanisms proactive market needs green jobs through building strong partnerships with both the private sector and with state and local authorities and the voluntary sector. Obtaining a degree in the field climate, environment and sustainable development at the University of Versailles Saint-Quentin-en-Yvelines, Career opportunities materialize to the graduate.

The Research Center REEDS was determined to build on its past achievements and so enhance its research and teaching resource capacities. The Research centre REEDS anticipated that it will remain a State-of-the-art of a research centre and continue to exploit the advantages of size by encouraging online education resources in a wide range of disciplines on humanities and social sciences, economics, natural sciences, engineering science, science of the universe, formal sciences, professions and applied sciences with two different teaching fields in Innovation, and Management of territory and local development. It has worked as a hub of the Sciences of the Environment, Territory and the Economy

The Sciences of the Environment, Territory and the Economy (SETE) is a domain of teaching programme which plays a pivotal role in the UVSQ teaching activities on the sustainability practices. There are four teaching fields which bring together all its best practices on sustainable teaching programmes target, linking everyone with learning interests in environmental and territorial development.

SUSTAINABILITY SCIENCE TOOLS AND TECHNIQUES (IDD):

IDD mention offers interdisciplinary programmes with a strong corresponding linking different academic domains, theory with practice, and building knowledge partnerships for sustainability. Each field assembles an international panel of teaching capability over partnerships with major universities to offer students a cutting-edge for analysis of contemporary sustainability challenges; it includes following specialties:

- Environmental Knowledge Mediation, Partnerships for Sustainable Development (MEDIATIONS)
- Ecological Economics & Integrated Environmental Assessment (EE & IA)
- Using Environmental Information Systems (UEIS)
- International Professional Master in Management of Eco-Innovation (ECO-INNOV)
- Economic Intelligence and Sustainable Development (IEDD)
- Environmental Applications of Geomatics & Remote Sensing (TGAE)

- Health, Environment, Territory and Social Sciences (SSEnTS)
- Arctic Studies (ARCTS)
- Environmental law, Safety and Quality in Business (ESQ)
- Environmental History (HENV)

PLANNING, ENERGY AND TERRITORIAL ECOLOGY (AmEnET):

in order to follow-up the interdisciplinary courses in sustainable development to the realistic scenarios, orient students towards embattled urban planning professions related to sustainable neighborhood and eco-mobility and eco-system issues, and to realizing answerable approach within an organization (company, local authority or NGO). This domain is organized by UVSQ and OVSQ including following specialties

- Science and Techniques of Logistic Engineering, e-Logistics, Sustainable Supply Chain (LOGISTIQUE)
- Sustainable Construction and Eco-living (CDEQ)
- Sustainable Development Strategies and Corporate Social Responsibility (STRAT-RSE)
- Economic Analysis and Risk Governance (AEGR, **See ANNEX 2.2**).
- Climate Change Adaptation Strategies for Sustainable Territories (STARTED): Low Carbon Energy Performance (PEC)
- Climate Change Adaptation Strategies for Sustainable Territories (STARTED): Eco-mobility, innovation and sustainable services (EMOSID)
- Sustainable Real Estate : Management of technical equipment & property services (GETSIM)
- Sustainable Real Estate : Management of projects & property programmes (GEPPIM)

ENVIRONMENTAL SCIENCES (SEN):

It is an Interdisciplinary branch of science that transactions with human impressions on the environment. The purposes of this domain are:

1. Know the problems and solutions of environmental
2. scientific practices to realize how the environmental behavior works
3. Exercise critical thinking and best practices of enviromental issues
4. Identify how your existence life style and actions affect by the environment
5. Understand the affects of society on the environment

This domain is organized by UVSQ and OVSQ including following specialties/

- Air Quality & Noise Measurement & Management (QUALUB)
- Planetology (PLANETOLOGIE)
- Physical Methods in Remote Sensing (MPT)
- Interactions of Climate-Environment (ICE)
- Arctic Studies (ARCTS)

ENVIRONMENTAL AND TERRITORIAL ECONOMICS AND GOVERNANCE (EGET):

The rate and difficulty of environmental changing insolences reflective economic, social and political challenges for contemporary knowledge economy and socity. Sustainability developing ways to address these challenges demands knowledgeable rigour, innovation and flexibility as well as the volume to think across prevailing disciplinary boundaries. This domain is stranded in the principle that responses to political and environmental challenges requires experts, researchers and practitioners skilled in the social sciences with the ability to think compliantly across disciplinary and sectorial limits. It will allow developing a theoretically sophisticated and empirically stranded considerate of the dynamic relations between environment, society and policy through the following courses:

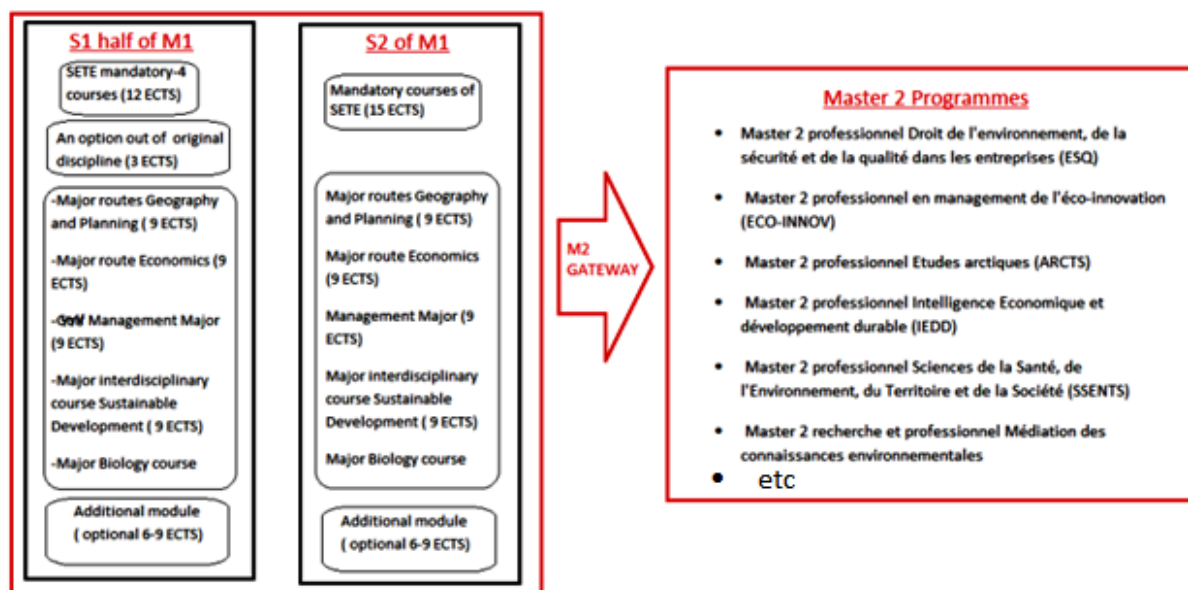
- Transport Security (SECURITE)

- Theoretical and Applied Economics of Sustainable Development (ETADD)
- Tourism and the Environment (TOURISME)

According to the last degree, professional experience, an applicant may apply directly or in the first year or second year M1 M2:

- ✓ For direct entry into M1 license holder, high school students can apply for enrollment in the first year of the Master
- ✓ For direct entry into M2 any holder of master's, first year Master (60 ECTS) graduate can register in second year of master degree for a specific specialty (see below).
- ✓ Any student who wishes to follow the master course SETE complete the two years can also register M1;

Figure 2. 1: Formal gateway of master SETE programmes



Source: own accumulated

However, continue the practice to the challenges for sustainable development as perspectives of knowledge economy, UVSQ has been contributed teaching potentials to the dynamics of the Paris Saclay cluster that is a pole of excellence founded by UVSQ and other higher education and research establishment. In February 2001, Université de Versailles Saint-Quentin-en-Yvelines (UVSQ) became a founding member of scientific cooperation foundation foreshadowing the future campus on the Saclay plateau. Recently, UVSQ has got some programs affiliation for exercising as a program participant from the Université Paris-Saclay (UPSay) under two teaching fields, such as Innovation, Enterprise and Society (IES) & Territorial governance and local développement (GETEDEL0). Therefore, from 2015, UVSQ's constructed Programme has re-constructed by UPSay (**ANNEX 2.2. : Moderation of Teaching Programs and Transition from UVSQ to UPSaclay**). Besides some courses are under processing for the approval of Université Paris-Saclay(ANNEX 2.2): Master SETE to Paris Saclay teaching programmes).

2.2. Building the University of Paris Saclay (2014-2018)

As part of a tremendously rapid changing and viable research and training environment, the University Paris-Saclay is developing a strategy and plan of international academic collaboration based on high-quality of education, research and innovation. The main challenge of it is to establish a international notorious campus in three areas - Research, Education, and Development.

2.2.1. LABEX BASC in the University of Paris Saclay (Phase 1: 2014-2019)

The overarching objectives and scope of the LabEx BASC (Biodiversity, Agroecosystems, Society, Climate) remain unchanged since its inception: developing and mobilizing science to support improvements in the provision of food, fiber and bioenergy for people, while at the same reducing the negative impacts of human activities on biodiversity, ecosystem services, the climate, and the quality of air, water and soils. Research within BASC covers organizational scales from organisms to socio-ecological systems¹ and spatial scales from patches to regions, with a focus on territorial scales. In order to achieve this, the research strategy of BASC focuses on "i) applying and developing shared concepts and tools to understand the dynamics of organisms and ecosystems across a broad spectrum of human use intensity in developed and developing countries, ii) reinforcing interdisciplinary approaches to studying socio-ecological systems that bring substantial added value to our existing strong disciplinary research and teaching programs in climate

sciences, genetics and genomics, evolutionary biology, ecology, agronomy, social sciences, economics and iii) mobilizing this knowledge for technical, technological and organizational innovation, as well as decision support for action and governance."i

The creation of the Université Paris-Saclay in 2014 has been accompanied by major efforts to define common research and training strategies for its 19 member institutions. Scientific "Departments" were the first structures put in place to articulate research at the university. BASC researchers helped coordinate and write the White Papers ("Livre Blanc") that defined the strategic orientations of these departments, especially the Life Sciences Department. The establishment of a theme in the Life Sciences Department focusing on "Sustainability of agroecosystems, ecosystems and territoires", which corresponds to the disciplinary scope and scientific objectives of BASC, was an important success. BASC researchers also ensured the coherence between the objectives of the LabEx and other themes of the Life Sciences Department, especially genomics, as well as themes in the Sciences of Planets and the Universe and the Human and Social Sciences Departments. BASC has also developed ties with the "Maison des Sciences de l'Homme Paris-Saclay" (MSH) which has two main objectives: foster cooperation between laboratories, and promote interdisciplinary research within social sciences but also between social sciences and other sciences. Research conducted in BASC is in line with the second research axis of the MSH, dedicated to "Environment and health", which explores in particular relations between environment and territoire. In the context of research on periurban territoires, we have also started to build ties with food sciences researchers so that we can collectively work on sustainable food systems covering all aspects from production to consumption.

BASC researchers were also heavily involved in the restructuring of Master's programs at the Université Paris-Saclay to create an interdisciplinary school entitled "Biodiversity, Agriculture and Food, Society, Environment" (BASE). This school brings together life, physical and social sciences to provide students with strong disciplinary training and the broad perspective that is needed to address important social and economic issues. The concurrent emergence of the LabEx, themes in scientific departments and a Master's School with congruent objectives has created a coherent set of research and training programs that did not exist prior to the creation of the university. BASC researchers were heavily involved in the restructuring of Master's programs to create an interdisciplinary school BASE "Biodiversity, Agriculture and Food, Society, Environment", which brings together life and social sciences and is coordinated by BASC researchers. The focus of this School is highly congruent with BASC research and educational objectives.

2.2.2. School BASE and Mention GTDL (Phase 1: 2015-2019)

Recently, UVSQ got programs affiliation from the Université Paris-Saclay (Paris Saclay) under two teaching fields, such as GTDL . So, in 2015, UVSQ's Selected Courses will be re-constructed by Paris Saclay.

Presentation of school BASE:

LMLD (Land Management and Local Development) (in french, GTDL (Gestion des Territoires et Développement Local). At national level, there are less than 10 LMLD mentions in France. It aims to train professionals to the new challenges of the territories and their dynamics. Territory is the product of space and power. This physical perimeter been a social construct that can refer to administrative boundaries, physical boundaries, socio-technical, economic configurations (organization of production systems, movement of products ...), ecological ... It brings together the public and private actors to positions and sometimes conflicting interests, subject to forms of regulation constantly changing (political and administrative decentralization, but decentralization of management systems and distribution of energy, urbanization, globalization, etc..) and falling more levels (multi-scalar dimension). It is therefore a complex dynamic that requires cross-and multidisciplinary skills, in order to understand the logic of accelerated interaction between human activities and land environments, to think change and action on a range of

issues that require to put into perspective the links between companies, technologies and environment interaction-territory local atmosphere; feeding territories, short and local chains; producer communities, for example energy; development of local services; concept of ecosystem services; introduction of ecological cycles in production systems; innovation. In these fields as diverse as agriculture and food, energy, mobility, urban development, biodiversity and the environment, realize innovative and experimental actions to build sustainability and resilience territories. The purpose of this note is to provide students with the skills necessary to analyze and anticipate, raise awareness, educate and mobilize stakeholders around collective adaptive and innovative strategies. This is to provide evaluation frameworks relevant actions to enable them to think of ways of construction agreements, regulations and policies by incorporating the terms of the transition. Formations Imprint GTDL meet, each with its specific disciplinary and interdisciplinary terms, directly to the needs of applied skills keenly felt among governance bodies, enterprises, researchers ... It is, for example, form managers of the relevant environment in a sustainable development perspective, directly tailored to the needs of the territory (Agenda 21, the evaluation of governance issues, communication strategy) and those of the company (prospective issues, quality of product and services, social responsibility of business, etc..). Graduates specialties Imprint GTDL be specialists with a multi-inter-disciplinary training, communicating able to analyze the territorial issue, environmental as well as local development in their various components (physical understanding, analysis economic, social impacts, territorial, legal and political). It is therefore to train professionals in the various analysis (institutional, discursive, quantitative, analytical, etc..) And adapted to the worlds of territorial development assessment and communication procedures (management issues, obligations methods regulatory, budgetary decisions, etc..) and the worlds of public policy. This training meets the needs of the job market through the establishment of strong partnerships with both the State and local authorities, with the private sector and the voluntary sector.

The master programme is organised in a Master 1 “Land, risks and environment Governance” and three Master 2 (see ANNEX 2.1): **detailed presentation of Master 1 and Master 2**)

MENTION GTDL – Land Management and Community Development (version 1)

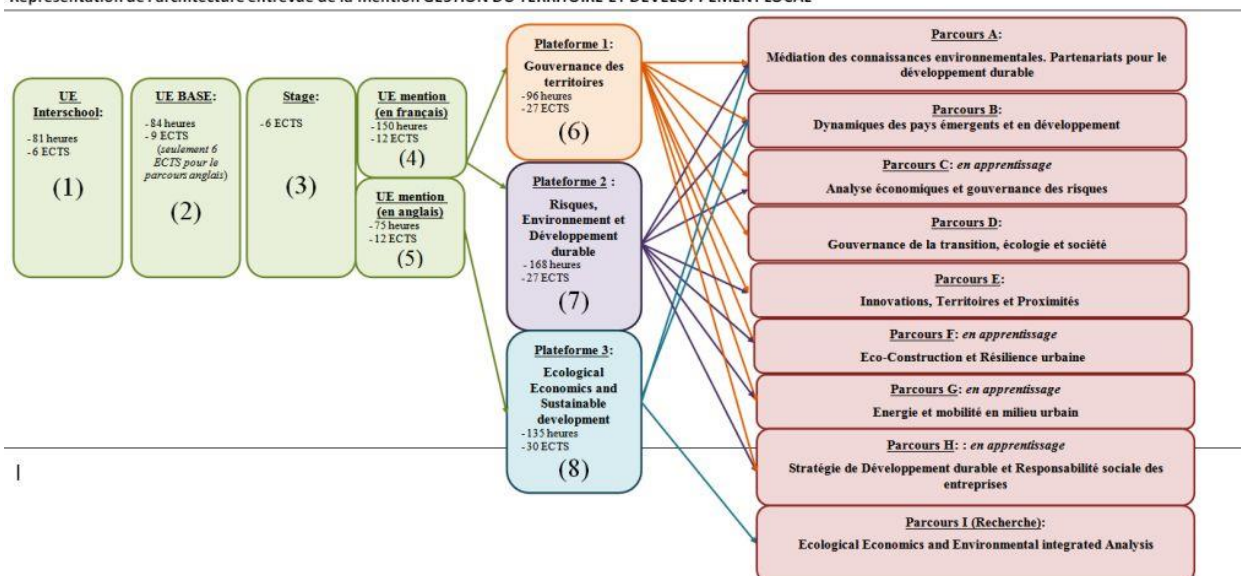
The master programme is organised as:

- Master 1 “Land Governance”
- Master 1 “Risk, Environment and sustainability”
- Master 1 “Ecological Economics and sustainable development” (in English, only)

And 6 masters 2:

- Master 2 “Transition governance, ecology and society”
- Master 2 “Dynamics of emergent and developing countries”
- Master 2 “Economic Analysis and Risk Governance”
- Master 2 “Innovation, Land and proximity”
- Master 2 “Environmental Knowledge Mediation, Partnerships for Sustainable Development”
- Master 2 “Sustainable Construction and urban resilience”
- Master 2 “Sustainable Development Strategies and Corporate Social Responsibility”
- Master 2 “Ecological Economics & Integrated Environmental Assessment”

Figure 2. 2: Mention GTDL (version 1)



Organismes participants à la mention

- Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)
- AgroParisTech (APT)
- INRA Centre Versailles-Grignon (INRA)
- Université Paris Sud (UPSUD)
- Ecole Centrale de Paris (ECP)
- Ecole Polytechnique
- Université d'Evry Val Essonne (UEVE)
- INSTN (CEA): Institut National des Sciences et Techniques Nucléaires (INSTN)
- CNRS (interventions ponctuelles)

Les partenaires de la formation étaient :

- Les partenaires de la KIC Climat (CEA, INRA, UPMC, GDF-Suez; Wageningen UR, Utrecht University)
- Université Paris 7
- Université Paris 1
- CEZ de la Bergerie Nationale de Rambouillet (BN)
- US Observatoire Développement Rural (INRA)
- Albion College (USA)
- Grand Valley State University (USA)
- ENA-V : Ecole Nationale Supérieure d'architecture de Versailles
- CEPN: Centre d'étude sur l'Evaluation de la Protection dans le domaine Nucléaire
- Universitat Autònoma Barcelona (Espagne)
- AgResearch (Nouvelle Zélande)
- Massey University (Nouvelle Zélande)
- Institut Euro-méditerranéen pour la Maîtrise des Risques (IEMSR)
- OME : Observatoire Méditerranéen de l'Energie

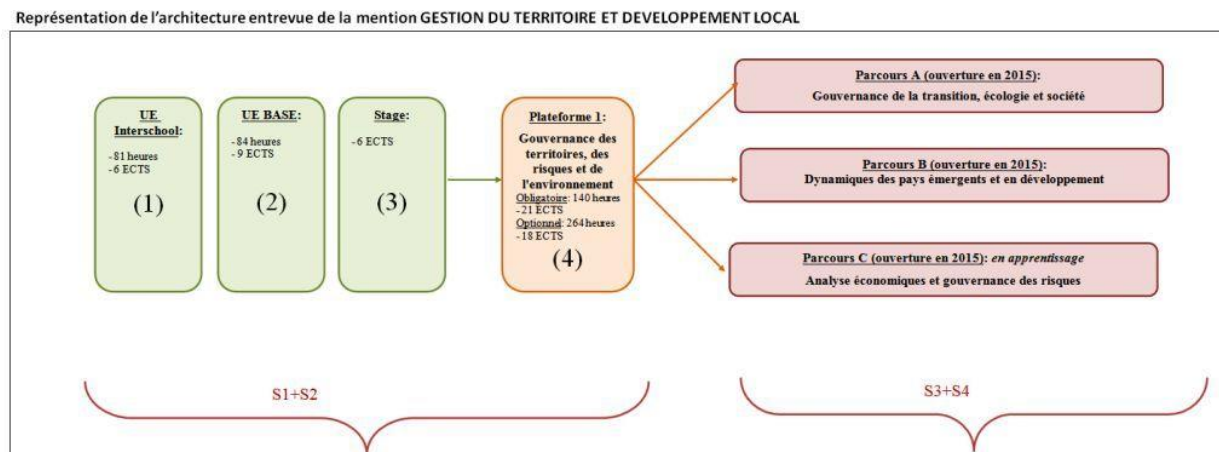
GTDL (version 2)

The master programme is organised as:

- Master 1 "Land, risks and environment Governance"
- Master 2 "Transition governance, ecology and society"
- Master 2 "Dynamics of emergent and developing countries"
- Master 2 "Economic Analysis and Risk Governance"

Coordination of the mention: Dr Jean-Marc DOUGUET (UVSQ) and Prof. Cécile BLATRIX (AGROPARISTECH)

Figure 2. 3: Mention GTDL (version 2)



Organismes participants à la mention

- Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)
- AgroParisTech (APT)
- INRA
- Université Paris Sud (UPSUD)
- Ecole Centrale de Paris (ECP)
- CNRS (interventions ponctuelles)

The training partners :

- Les partenaires de la KIC Climat (CEA, INRA, UPMC, GDF-Suez; Wageningen UR, Utrecht University)
- Université Paris 7
- Université Paris 1
- US Observatoire Développement Rural (INRA)
- Institut Euro-méditerranéen pour la Maîtrise des Risques (IEMSR)
- OME : Observatoire Méditerranéen de l'Énergie

Another Master 2 of Master SETE has been integrated in the Mention INNOVATION: The Innovation Master's aims to bring together all the formations of the University Paris-Saclay with SHS approach mainly on the theme of the proposed 3 universities and 7 schools Saclay. To provide both students SHS, it aims to students engineers and scientists of high-level training on all aspects of the innovation process (detection, financing, project management, valuation, etc.). It is aimed at both students in science and technology education (universities, engineering schools) - who wish to gain expertise in both social science and increase their ability to apply their knowledge to various socio-economic contexts - that economists students, managers, sociologists, historians, lawyers seek to adapt their training in the social sciences to specific technical environments. For engineering students, pursuing their own teachings training is possible. This reference is betting offer a truly multidisciplinary training, and from the M1, is one of its originality. Multidisciplinary involves two vectors. In the first place, is completely new, a common core in the early M1 gathers different audiences, whether from SHS training or technical and scientific, ie enrolled in three universities as Engineer (Polytechnic with a possible opening to other schools in the future). The other

vector is the diversity of courses offered, covering different fields of social sciences (economics, management, sociology, law, history). The original M1 is the unifying center of this new indication. He focused the attention of the steering committee at this stage. However, the hope is to continue working in the future, in two directions: developing proposals missions and student projects that can be achieved by building multidisciplinary inter-institutional groups, but also working on possible pooling of purposes of M2 to improve their readability and differentiation.

Master 2 “International Professional Master in Management of Eco-Innovation (**See ANNEX 2.3): detailed presentation of International Professional Master in Management of Eco-Innovation**) ” that has become M2 Climate Change Adaptation Strategies for Sustainable Territories (STARTED): Eco-mobility, innovation and sustainable services (EMOSID)

2.2.3. Evaluation on strategic project of Paris-Saclay University

The strategic policy of Paris-Saclay University participates for each of the fields taken into account (governance, research, training, valorisation / innovation, international, student life / life of campus, communication) a route that declines the achievements. This route is punctuated by three(3) things : the academic year 2015(real start of the grouping; the 2016 IDEX review), stock valuation time carried out until then and projected towards a desired renewal, the autumn of 2018, another moment assessment and affirmation of a new roadmap. If all the things in this route have been weighed by the ComUE and have meaning and importance those will favours the major strategic choices shared by the group and the MENESR.

The choice of milestones is that of major achievements that wish to emerge the ComUE and the ministry to lead to the founding of this "university of research and innovation class world "which is projected:¹⁰⁶

- Structural, with the integration of new members and the evolution of the configuration of the grouping
- Scientists, with the synergy of laboratories and the development of their activities, especially at the international level
- or on the quality of the training and services that will be offered to students on campus in full construction

Teaching programmes: 2016 IDEX Review (milestone 2017)¹⁰⁷:

- Development of the teaching self-evaluation approach, quality approach.
- *Establishment of 1st job surveys on all diploma courses.
- Progress report on the evolution of the offer of training in master (the observation of this milestone will not to be conducted only after the exploitation of the data of the autumn of 2017).
- State of reflection on the site-wide continuing education strategy. Identification opportunities for the development of continuous training in intra-EU cooperation.
- Back in 2016: setting up of a shared learning management system (LMS) on the perimeter of the Paris-Saclay group, interfaced with the IS. Back to university 2018 (milestone 2019):
- State of play in the harmonization of information systems (IS) applied to training and their interoperability.

¹⁰⁶ see report on “comue université paris-saclay contrat 2015-2019 » volet commun du contrat 2015-2019 communauté d’universités et établissements université paris-saclay

¹⁰⁷ Ibid, 2015-2019

- Implementation of an "Innovation and Industrial Relations in Training" plan that complements and strengthens the actions of the institutions.

Valorisation and relationship with companies for practical exercises: 2016 IDEX Review (milestone 2017)¹⁰⁸:

- Realize the "industrial club" partners of the ComUE through the first memberships and a link program. Streamline the various initiatives proposed by different components of the ComUE (departments, Labex, schools, etc.).
- Measure the strengthening of the participation of the territorial research teams in the contracts European countries (ERC, H2020).

Research: Back to 2015 (milestone 2016):

Implementation of a common policy of signature of the scientific publications revealing the University Paris-Saclay while allowing to each member the perceptibility of their contributions (IDEX commitment and text of the Statutes of the ComUE). 2016 IDEX Review (milestone 2017)¹⁰⁹:

- Publication of the final document describing the shared research strategy, which will serve as a basis for the preparation of the end-of-probation report of the IDEX.
- Progress report on the concerted development of the human and social sciences, in particular around the action of MSH (this milestone also concerns training).
- Progress report on the involvement of competitiveness clusters in connection with the research strategy.
- Prepare together the process of evaluation and renewal of research units, in line with the research strategy proposed in 2016, possibly revised following feedback IDEX international jury.

¹⁰⁸ ibid

¹⁰⁹ ibid

Table 2. 1: ComUE UPSay milestones (2015-2019)

Année d'observation	2016	2017	2019
<u>Institutions /</u>			
<u>Gouvernance</u>			
			Nouvelle feuille de route prenant en compte l'évaluation de l'IDEX
	Conventions d'associations signées		Accord sur de nouveaux statuts permettant en particulier l'intégration de membres associés dans l'IDEX et
		Définition d'indicateurs de performance de site pertinents	
Recherche			
	Politique commune de signature des publications en place		
		Document Stratégie partagée de l'UPSaclay	
			Evaluation et renouvellement des unités de recherche
		Point d'étape sur les SHS	
		Point d'étape sur l'implication des pôles de compétitivité	
Formation			
		Autoévaluation des enseignements	
		Mise en place d'enquêtes 1 ^{er} emploi sur toutes les formations	
		diplômantes	
		Point d'étape sur l'évolution de l'offre de formation en master	
		LMS (learning management system) mutualisé en place pour tous les établissements membres, interfacé avec les	
		Etat de la réflexion sur la stratégie de formation continue. Identification d'opportunités de développement en	
			Etat des lieux de l'harmonisation des SI appliqués à la formation
			1 ^{er} plan « Innovation et relations industrielles en formation »
Valorisation / Relation avec les entreprises			

		Concrétiser le « club des industriels » partenaires de la ComUE	
International			
		Accroître la participation des équipes à H2020	
Vie étudiante / Vie de campus			
	Carte étudiant unique, multi-services		
	Plan Santé pour tous les étudiants et personnels		
	Schéma régional d'amélioration de la vie étudiante et de promotion sociale		
			Ouverture du «Learning Center »

Source : report on "comue université paris-saclay contrat 2015-2019 » volet commun du contrat 2015-2019 communauté d'universités et établissements université paris-saclay

2.3. Initiatives of University of Paris-Saclay for future challenges of sustainability development

The development expectation of University Paris-Saclay by 1 January 2020, in the form of an Exceptional EPSCP which will propose an institutional integration original project built around the components of the current Université Paris-Sud, of 5 member schools (CentraleSupélec, ENS Paris-Saclay, IOGS, AgroParisTech, HEC) and IHS. Member schools and IHS retain their personality Moral and Legal (PMJ). This new offer facility will be more powerful, more agile, tighter, more visible and more stable than the current ComUE.st by Founding National Research Organizations (NROs) that closely associated with the creation and operation of these new facilities. They will be stakeholders in its governance and actions. In particular to their involvement in combined units, they will implement their research activities in the form of own units registered in the Paris-Saclay University. Having the objective of integration with the University Paris-Saclay, in 2025, the universities of Versailles Saint-Quentin-en-Yvelines and Evry-Val-d'Essonne from 2020 under the name of "Member Universities". These universities will be involved in some of its innovative training activities, research, integrated into the governance of the new establishment. They are eligible for IDEX contributions as part of their involvement in the global strategy of the Paris-Saclay University. The overall strategy of the University Paris-Saclay based on subsidiarity and on the operational by the associated HERE, (see APPENDIX 2). Member HERE retain their financial resources and HR, lead a consistent strategy their mission including all of their actions in the context of the overall strategy of the University

The University Paris-Saclay relies, to ensure its reputation and its on the common signature of scientific publications and on the brand common to all its degrees. The resulting global visibility ensures that it appears in international rankings at a high rank (OBJECTIVE:TOP 20 ARWU).

Models for key missions :

Perspectives of the above present needs and 21st centuries scenarios regarding on the future challenges of education, sustainability and innovation at HERE, University Paris-Saclay has setup three fundamental missions

1. **Education (Academic/Training)**
2. **Research and,**
3. **Innovation, driven by an international ambition strong.**

For the implementation of these missions, the University Paris-Saclay also setup some strategies. These strategies will apply to a scope of competencies corresponding to the perimeter of the Université Paris-Saclay brand. The below proposes for each of these fundamental aspects, a specific route defining the overall strategy and the scope of the mark of the university.

Education (Academic and Training) :

- Convey knowledge concluded training and research to build sustainable educational models that meet the targets of students and taking into account the knowledge economy, economic development and innovation,
- Reinforce the coherence of the courses offered¹¹⁰ to students and ensure the employability of graduates, at all levels of training,
- Structure around the Paris-Saclay undergraduate university school - innovative and inclusive training model,
- Offer attractive training at the international level¹¹¹. A quality expansion process has been put in place since 2015 and frequently expanded since:
 - Common ways for inspection the knowledge by the defense of thesis (2015) for doctoral students;
 - online application platform (2015) for master programs that extended in 2017 to the setting up an infocentre for automated data collection from teaching level to the awarding of diplomas;
 - Implementation of a doctoral charter (2015) that setting the circumstances a quality approach, and ISO 9001 certification of the Doctoral College (2016);
 - Autumn launch for a common Learning Management System to support education & innovation and student monitoring (2017);
 - Implementation of annual surveys¹¹² on student satisfaction, the employability of graduates, etc.
- The creation of the international programs offer of the University Paris-Saclay that similar experience of the Commission and the expertise of its Members and Components through pursue four objectives:
 - advance the attractiveness of the formations of courses in particular by pursuing their internationalization;
 - make straightforward operational operation with the introduction of tools digital systems allowing international colleberation, supported by information to Members and Components;
 - launch the Doctorate of Paris-Saclay University as a reference national and international levels, and to certify greater recognition of PhD by socio-economic actors and the higher administration of HERE;
 - Strengthen the connection between the Master and the PhD with support for the research.

¹¹⁰ ComUE "Université Paris-Saclay" is already offering an offer rich and successful Master's degree programs, with 45 mentions and over 350 courses for 9,000 registered students. In three years, the number of applicants from 44,000 to 96,000, of which 40% are newly arrived foreigners, guarantee of the development of international visibility

¹¹¹ Students today, from the entrance to the university, tend to determine in favor what they see as the best institution possible reception for them, more and more more independently of borders. See by example the article of the World on "Students French: a Swiss passport to succeed » http://www.mpublicite.fr/education/2017/ SUPPLEMENT_%20TENDANCES_20_SEPT_2017.pdf), or the detailed analysis of Djamil Salmi, in "The Challenge of Establishing World-Class Universities "

¹¹² first results show very good employability of the M and D diplomas, and a good index of satisfaction, in progression over two years

This last objective will be ensured by a progressive arranging course offer in "graduate schools" by offering high multi-disciplinary perceptibility or thematic. The aim is to invite and retain the best students of the Doctorate, but also to make the courses noticeable for the industrial partners

Research:

The university Paris Saclay's research potential is exceptional with a unique contribution to France research organizations and HERE whose researchers constitute more 55% of the total number of researchers and teacher-researchers. It will be totally specific the university of Ile-de-France bringing together medicine, pharmacy, science and engineering as well as a great shutter in SHS with exceptional visibility. This potential says about lying interdisciplinary, founded the capacity of the University Paris-Saclay to develop an international research and to answer the the needs of society of the world in the face of major challenges of 21 century by the frontier of knowledge to applications and technological innovation.

The development and annual nursing of the research strategy, and its quality evaluation of five years, institute advantaged flashes to deliberate collectively of support and of the evaluation of the research units of the University perimeter Paris-Saclay that addressing in particular:

- A balancing strategy between recurring and financing by Call project, the profile of the units, and certifying both end and renewal of equipment.
- Proposals for the evaluation of the units to support their means interference, their influence and their attractiveness, in the framework of a cooperation and consistency of research actions within the strategy overall.
- Sustenance for contract applications, in specific European, by example by spreading and reinforcing what the ComUE is doing successfully with ERC applications.

For the purpose of research, the best European Scientifics level worldwide research centers are-

- The SOLEIL synchrotron,
- Nanotechnology Center of the Nanosciences and Nanosciences Center technologies,
- means of manufacturing and characterization of accelerators particles
- The means of instrumentation in the field of detection,
- The femtosecond and attosecond laser platforms,
- Pet stores,
- Calibration platforms for space, nuclear physics, robotics, genomics, bioscience imaging, materials, climate modeling, geosciences, etc.

While large research arrangements were formerly limited to only certain disciplines that mobilization the knowledge platforms and tools recently concerns all fields. Contribute the research at the best level assumes right of entry to these means. These large tools establish university master cards of Paris-Saclay. This is one of this big métier mostly because the space the University has likened to Paris intramural. One of the objectives of the UPSaclay to maintain and develop cooperatively these means at the best international level, to attract researchers and establishments of HERE, and to create knowledge and value for knowledge economy and society.

The attraction of talent in the University Paris-Saclay can only be considered in an international framework driven by a international strategy. In steadiness with the actions already started by the ComUE, IDEX support, coming of subsidy from the establishment and resource these external that will show a role of booting to financing recruitment of students and staff level concerned by the standing of University Paris-Saclay. The Way of raising fund for best teacher-researchers and researchers International being often little well-matched with the French standard, Collective approach and co-financing of IDEX that play a key role

for raising funds required.

The talents attachment for implementing Research:

- Institut Pascal, an institute of advanced studies carrying together for "thematic programs" of three or six months with strong link with the teacher-researchers, researchers and students of the territory. Specificity of the University Paris-Saclay, this institute will carry programs from all disciplines.
- The Alembert Chairs, which attract high-level scientists' level for stays of 12 months, cumulated over 2 to 3 years, to reinforce links with the perimeter teams.
- IDEX actions support to PhD students (doctoral contracts) and International Master's degree students.
- funding program for PhDs with the cooperation with partners strategic of international organizations research priorities of Paris-Saclay University.

INNOVATION

Promotion on Innovation and Valorisation of Research is the Heart of Tasks of The Paris-Saclay University, which encourages partnerships; UPSaclay already Establish connection with the Industrial Sector, Socio-Economic Environments and Public Administrations, The Media and The Associative Actors. It stimulates debate and the public misappropriation of scientific knowledge, the image of the Diagonale Paris-Saclay organ of dialogue Science and Society of the COMUE "Paris-Saclay University". It participates alongside EPA ParisSaclay and local authorities to optimize development tools territorial knowledge economy. The direct relations of the Get-togethers with the companies constitute a pillar of the global recovery policy of the University Paris-Saclay. In order to encourage the development of these relationships, the University brings its Parties who wish to strengthen their cooperation with the socio-economic world; it is also an entry point for companies, especially the great clusters, who desire to have access at many Parts of the University Paris-Saclay in the framework with a partnership strategic who born himself substitutes not the relationship developed by the Parts concerned but the increases.The applicable case the University can as well as with his partners industrial, identify issues of high significance and organize all strong point of its perimeter to best respond to it I.e. agreement strategic with PSA. The UPSaclay's take advantage of the accomplishments of its institutions founders and the first achievements of the ComUE and SATT ParisSaclay to densify the academic and industrial cluster in which it is implanted and participate in the economic prosperity of the country.

The activities of UPSaclay towards innovation and economic development on several fronts:

- Training and talent networking for industrial attachment will be intensified.
- Accompaniment by shared tools already created. Students or staff of the University supported by its scientific and technological advances since the development until the beginning and creation of new companies. These tools already show remarkable outcomes that demonstrate their value added.
- The partnership in research and training with companies of all by reinforcing the actions of recent years (implementation relationship by SATT, Plug in Labs ...) and emphasizing international partnerships with major international groups i.e. laboratories Mixed public-private and industrial chairs should be developed at larger scale.
- Participation of the local innovation ecosystem that including the organization of an annual fair that will bring together all actors: investors, politicians, researchers, business creators, great groups, SMEs or students with the aim of stimulating of the crossed meetings and constitute an attractive and fertile showcase of University Paris-Saclay.
- The growth of the Design Center created by the ComUE in 2017

From the above discussion on next target of Paris-Saclay University, we can say, the internationalization of the Paris-Saclay University is a major axis in support of its future target, for trained actions to education, research and innovation.

As such, the University Paris-Saclay:

- In order to develop of international attractiveness on training and research, the University Paris-Saclay using in particular the program lever of contributions and calls for international projects, the development of an offer of international programs and doctoral cotutelles;
- For support of scientific cooperation operations (summer schools, workshops, colloquia) and the mobility of teacher-researchers, researchers and students between Parties and strategic partners of University Paris-Saclay abroad with a goal of mobility aunt for all his students;
- supports, coordinates the contribution of projects and programs, emerging capability and a political influence in order to increase this participation in a sensitive way.
- The mobility of their students for research and training within them and in consultation with the other Parties of Paris-Saclay University through conventions and partnerships that they already signed. Also concerning their specific training and their mixed units, the Parties contribute to the development of University of Paris-Saclay. .

2.4. Global initiatives of future challenges/issues of Innovation, Education and Sustainability for the 21st century's knowledge economy

Modes of learning have shifted dramatically over the past two decades with changes in the ways people access, exchange and interact with information. Schools have changed far more slowly with the fundamental aspects of learning institutions remaining essentially familiar for 200 years or more (Davidson et al., 2009). Educationalists debate the many ways in which the content of education – at all levels – and the process of learning, will need to change over the years ahead (Peter Fisk, 2017). Globalization, knowledge economy and society, innovative technologies, sustainability issues, migration, international competition, changing markets, and transnational environmental and political challenges all drive the fulfilment of skills and knowledge needed by students to survive and succeed in the twenty-first century. Educators, education ministries and governments, foundations, employers and researchers refer to these abilities as twenty-first century skills, higher-order thinking skills, deeper learning outcomes, and complex thinking and communication skills (Scott, 2015). Awareness in these skills is not new; researchers at Harvard University have been studying student learning processes and approaches to teaching higher-order skills for over forty years (Saavedra and Opfer, 2012, p. 4). Future educational systems are predictable to transform from institutions with a strong emphasis on teaching to organizations with an increased emphasis on learning. Recognition of multiple pathways for acquiring education learning skills will follow. Teachers will plan and design challenging learning mediation knowlegd getaway, tools & actions for dealing sustainable development at HERE and students will learn anytime or anywhere at a pace comfortable for them, using whichever tools they choose. The roles of teachers will be transformed from experts on subjects to that of guides and coaches (Ericsson AB, 2012; Frey, 2007). Twenty-first century teachers will assess their student's abilities, identify and design learning actions to help them attain deeper understanding. Ongoing formative assessment is most operative for this methodology as it consents teachers to adjust their approaches within education modules for maximum dynamic effectiveness.

2.4.1. The changing content and methods of learning in the 21st century

Educators have repeatedly argued that present approaches to teaching and structuring learning environments are inadequate to addressing and supporting twenty-first century learning needs (Carneiro,

2007; Delors et al., 1996; P21, 2007; VISIR Consortium, 2012). Now we are in an environment of knowledge society and economy. The knowledge based societies become more knowledgeable, HERE must evolve to ensure the information and skills needs for students. Over the last two decades, no fewer than ten international organizations and commissions, governments, private consortia and private institutions have proposed frameworks and outlined competencies needed to address twenty first century challenges (Scott, 2015). Dede (2010) and Salas Pilco (2013) linked several outlines to identify the progress of refrains over time and the point out they have in common. The key focus of twenty-first century learning is adaptation to keep pace with demand and expectations (Punie, 2007).

Personalization, collaboration, communication, informal learning, productivity and content creation are central to the competencies and skills learners are expected to develop and the way in which these skills are taught (Scott, 2015). These elements are key to the overall vision of twenty-first century learning (McLoughlin and Lee, 2008; Redecker and Punie, 2013). Besides, personal skills (initiative, resilience, responsibility, risk-taking and creativity), social skills (teamwork, networking, empathy and compassion) and learning skills (managing, organizing, metacognitive skills and 'failing forward' or altering perceptions of and response to failure) are vital to peak performance in the twenty first century workplace (Learnovation, 2009). While many of these competencies and skills may seem modern they 'are not new, just newly important' (Silva, cited in Salas-Pilco, 2013). Current thinking about twenty-first century learning emphasizes the need to radically transform the purpose of institutes and expectations of what students should learn in the classroom (Scott, 2015). Approaches to measuring school success must also therefore be re-evaluated (Bull and Gilbert, 2012; Facer, 2011; Leadbeater, 2008; Robinson, 2006). Overall, the focus has shifted away from access towards equitable quality education to lifelong learning, strengthened training and skills for work and life, and improved learning outcomes at all levels of education (Anderson, 2014; UNESCO and UNICEF, 2013). There is a clear consensus that new approaches to learning must accommodate the characteristics of today's students, become more inclusive and address twenty-first century interdisciplinary themes (Carneiro, 2007).

There are a number of effective, research-based curriculum models capable of guiding twenty-first century learning. Sternberg and Subotnik (2006) argue for a curriculum focused on fostering learners' capabilities in 'The other 3 Rs'¹¹³: *Reasoning* (analytical, critical thinking and problem-solving skills), *Resilience* (life skills such as flexibility, adaptability and self-reliance) and *Responsibility* (wisdom or the application of intelligence, creativity and knowledge for a common good)' (p. 1). Wagner (2010) and the Change Leadership Group at Harvard University identified another set of competencies and skills. Informed by several hundred interviews with business, nonprofit and education leaders, Wagner stressed that students need seven survival skills to be prepared for twenty-first century life, work and citizenship¹¹⁴:

- Critical thinking and problem solving
- Collaboration and leadership
- Agility and adaptability
- Initiative and entrepreneurialism
- Effective oral and written communication
- Accessing and analysing information
- Curiosity and imagination (p. 4).

Wagner et al. (2006) advocate a curriculum founded on very different principles – 'The new 3 Rs': *Rigour*,

¹¹³ Scott, C. L. (2015). WHAT KIND OF LEARNING FOR THE 21st CENTURY? 14.

¹¹⁴ Ibis, 2015

Relevance and Respect. Rigour refers to the abilities and capacities students acquire as a result of their learning. *Relevance* refers to their understanding of how their learning connects to current real-world challenges and future work. *Respect* refers to the promotion of respectful relationships among teachers and students that foster academic and social competence (pp. 1-2). Ackerman and Perkins (1989, pp. 80-81) have endorsed 'thinking skills being taught as a "meta-curriculum" interwoven with traditional core subjects'. Conley (2007) emphasizes the importance of learners developing 'habits of mind' including analysis, interpretation, precision and accuracy, problem-solving, and reasoning to support thinking and reflection. Levy and Murnane (2004) favour building skills in 'expert thinking' and the use of detailed knowledge and metacognition to support decision-making (p. 75). Prensky (2012) advocates a student-centric curriculum founded on 'The 3 Ps'; these consist of '*Passion* (including character), *Problem solving* (including communication) and *Producing* what is required with creativity and skill' (pp. 23-25). Perkins (cited in P21, 2007b, p. 2) has endorsed the teaching of 'thinking skills' ... as a "meta-curriculum" interwoven with traditional core subjects'. Tucker and Coddling of the US-based National Center on Education and the Economy (1998) also urge schools to adopt 'a thinking curriculum – one that provides a deeper understanding of the subject and the ability to apply that understanding to the complex, real-world problems that the student will face as an adult' (pp. 76-78).

The notable features of the above models are inquiry, design and collaborative learning for effective instruction (Scott, 2015). A curriculum based on these learning methods blended with more direct forms of instruction is necessary to build knowledge, understanding, creativity and other twenty-first century skills (Trilling and Fadel, 2009, pp. 134-135). Research carried out by OECD/CERI on 'New Millennium Learners' (Ananiadou and Claro, 2009) described three dimensions for learning in the twenty-first century — *information, communication, and ethics and social impact*. An international survey of CEOs carried out by IBM (2010) also found that chief executives believe *creativity* will be essential to successfully navigate an increasingly complex world (Scott, 2015).

The Assessment and Teaching of 21st Century Skills project (ATC21S)¹¹⁵ categorized twenty-first century skills internationally into four broad categories – *ways of thinking, ways of working, tools for working and skills for living in the world* (Griffin, McGaw and Care, 2012). Meanwhile, the US-based Apollo Education Group, a leading provider of higher education programmes for working adults, cited ten skills needed by students to survive as twenty-first century workers (Barry, 2012): *critical thinking, communication, leadership, collaboration, adaptability, productivity and accountability, innovation, global citizenship, entrepreneurialism, and the ability to access, analyse and synthesize information*.

The Asia-Pacific Economic Cooperation (APEC)¹¹⁶ has identified the development of twenty-first century competencies among youth as a 'pressing international concern' (Scott, 2015). These competencies are defined as the knowledge, skills and attitudes necessary to be competitive in the twenty-first century workforce participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces (ibid, 2015). APEC members defined four 'overarching 21st century competencies' that should be integrated into existing educational systems – *lifelong learning, problem solving, self-management and teamwork* (APEC, 2008).

Lastly, the US-based Partnership for 21st Century Skills (hereinafter P21), a coalition of business leaders and educators, proposed a *Framework for 21st Century Learning*, which identified essential competencies and

¹¹⁵ ATC21S is a worldwide multi-stakeholder partnership consisting of the University of Melbourne, Cisco, Intel and Microsoft, based in Australia, Costa Rica, Finland, the Netherlands, Singapore and the United States, with more than 250 researchers spread across sixty institutions worldwide.

¹¹⁶ APEC is an alliance of twenty-one Pacific Rim member economies promoting free trade, economic cooperation and economic growth throughout the Asia-Pacific region.

skills vital for success in twenty-first century work and life (P21, 2007a, 2011). These included *'The 4Cs' – communication, collaboration, critical thinking and creativity*, which are to be taught within the context of core subject areas and twenty-first century themes (Scott, 2015). This framework is based on the assertion that twenty-first century challenges will demand a broad skill set emphasizing core subject skills, social and cross-cultural skills, proficiency in languages other than English (ibid, 2015), and an understanding of the economic and political forces that affect societies (P21, 2007a, 2013).

2.4.2. Availability of Innovative Mediation Tools and Platform for facing the future learning challenges

In a speech at the 2006 TED Conference, Sir Ken Robinson, a leading thinker and speaker on creativity remarked, 'We do not grow into creativity, we grow out of it – or rather, and we are educated out of it'. Traditional education, with its emphasis on rote learning and memorization of static facts, has long valued conformity over novelty of thought (Wan and Gut, 2011). However, in today's world of global competition and task automation, innovative capacity and a creative spirit are fast becoming requirements for professional and personal success (Brown, 2019). Robinson (2006) argues that humanity's future depends on the ability to 'reconstitute our understanding of human capacity and place creativity and innovation in the forefront of our educational systems'. Divergent thinking (the courage to 'seize' problems) and enthusiastic experimentation boost creativity and innovation even further (Center for Curriculum Redesign and OECD, 2012). The capacity to 'break new ground', invoke fresh ways of thinking, put forth new ideas and solutions, pose unfamiliar questions, and arrive at unexpected answers further advance innovation and creativity (Gardner, 2008; Sternberg, 2007). Successful individuals will be those who possess the creative skills to envision a strategy for making the world a better place for all (ibid, P21, 2007a, p. 14).

Now days, students want to desire an active learning involvement that is social, participatory, supported by active knowledge media and within learner mechanism. Conole and Creanor (cited in McLoughlin and Lee, 2010) report that today's students 'have high expectations of how they should learn, selecting the technologies and learning environments that best meet their needs with a sophisticated understanding of how to manipulate these to their advantage' (p. 3). Today's learners pursue learning by exploring, expressing and exchanging ideas using technological means (Ben-David Kolikant, 2010), often tinkering and using trial and error to try different strategies until they arrive at solutions (Papert, cited in Ben-David Kolikant, 2010; Facer, 2011). The continual growth of web-based multimedia and social media incorporating text, audio, photo and video capabilities provide increasing opportunities for educational institutions to integrate these technologies into teaching, learning and assessment (McLoughlin and Lee, 2010). Such technologies and platforms must be integrated with sound pedagogical strategies and tied to learning goals, in order to facilitate genuine communication and interaction among students and to support their creation of user-generated content (Scott, 2015).

The 21st century learners seem to have a diverse methodology to learning and have different potentials about the use of innovative technology in learning than their predecessors. The new learning paradigms of connectivism, navigationism, Social Networking, connecting the Dots, Education 4.0 (Pedagogy 1.0, Pedagogy 2.0, Pedagogy 3.0, and Pedagogy 4.0) are described and discussed in the light of the role of HERE, academic staff and students. All of these patterns have robust social constructivist learning concept supporting their foundations and as such still have at their centre a vital role for academic staff and student. This is a part not in spite of the technology but rather one that is reinforced and allowed by the innovative technology, particularly with high opinion to the social networking tools, and Education 4.0.

2.4.2.1. Social networking tools

Social media online is an innovative knowledge mediation network for unified learning designs, through

share, collaboration and cooperation. Besides, the research findings, many inventors are looking for applied examples of applications that consequence in valid learning. Mentors, teachers, and learners are beginning to use social networking tools in ways that promise to revolutionize the way e-Learning is produced and consumed (Signorelli, 2009.), including-

- online learning sites driven by Wikipedia-style collaborations;
- classroom-based efforts which benefit from social networking tools, including online discussion boards and live chats, Twitter, and Jott, many of which eventually become online learning modules through postings on YouTube; and
- online sites where communities of learners use a variety of tools to create and share learning resources and modules

The result of innovations in social networking online is another tremendous move forward in learner-centric, rather than teacher-centric, instruction (Signorelli, 2009). Examples of such instruction include:

Smarthistory.org (<http://www.smarthistory.org>), a free collaborative online art history site which was designated one of the “Top 100 Websites” worldwide by PC Magazine in July 2009, and which won an international “Best Education Website” Webby Award earlier this year. The site adds value by¹¹⁷:

- Creating a strong element of collaboration by showing that contributors are trainer-teacher-learners
- Forming a community of learners through the Smarthistory <http://en.wikipedia.org/wiki/Blog> blogs
- Providing <http://en.wikipedia.org/wiki/Rss> RSS feeds for those who want to remain aware of new additions
- Incorporating well-produced Podcasts as an integral part of the learning mix
- Using <http://www.flickr.com/about/> Flickr for images
- Supporting extremely easy navigation

Reaction from users has been strong and positive (ibid,2009). Institutions listing Smarthistory as a resource include:

- The Corcoran Gallery and College of Art;
- Education Network Australia;
- The Glasgow School of Art;
- Princeton University;
- UNESCO Bangkok;
- The University of Amsterdam;
- The University of Hong Kong; and the University of Melbourne.

□ **Guild Research**(<https://www.elearningguild.com/content/4126/about-the-research-library>): Guild Research brings six categories of research resources absorbed on portion you make sense of the gravity, complexity, and future of research field for industry analysts and leading experts to investigate existing and new sources of knowledge and bring brief information and applied insights that can use to make important decisions, inform practice, and stay current. This is where will find out about research in the field, new technologies, and what your peers are doing and thinking, in practical language, including- Case studies. Presentations, Resources, Research reports, Guild white papers, Industry perspectives.

- **Lifelong Education @ Desktop (<http://www.leadonline.info/history.cfm> LE@D) project :** Philip Turner, Vice Provost for Learning Improvement and Professor in the School of Library and Information Sciences, was instrumental in creating the Lifelong Education @ Desktop (<http://www.leadonline.info/history.cfm> LE@D) project in 2003. LE@D began as a collective effort

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between the University's School of Library and Information Sciences and the Northeast Texas Library system. An Institute of Museum and Library Sciences grant provided funding. The project lengthened beyond the School of Library and Information Sciences in 2006 to become part of the University's Center for Distance Learning. It currently work for online learners through Texas library systems, state libraries, the American Library Association, and other establishments.

- **N-Gen project :**

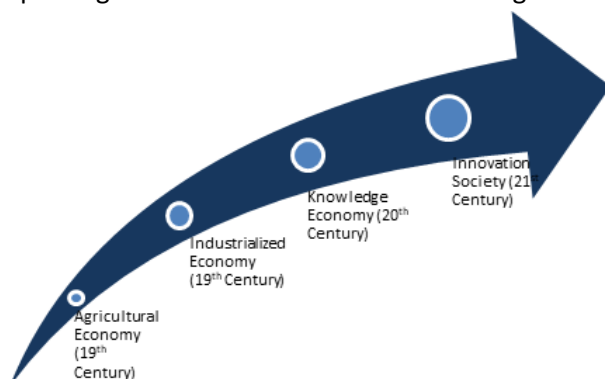
The commitment to effectively using online resources and social networking tools in the N-Gen project begins with

(http://media.unt.edu/cdlpod/qep/BORvid_HQ.html?CFID=2644885&CFTOKEN=f8045379a7ce2afe-38689D35-FECA-90FD-88E0D570A15EE2B2&jsessionid=12304a276b8c4008a002695101e346b10e79TR) an online video which defines the project and documents its successes. It leftovers with technical assistance on condition that to faculty through the University's Center for Teaching, Learning and Assessment, and continually focuses on the aim of creating improved learning experiences that totally participate students. Students use a variety of tools with Blackboard Vista and Moodle to facilitate online communication that adds to the usefulness of classroom-based mechanisms of the courses.

The e-Science movement: The *e-Science* movement is offering right to use to exclusive and rare high-level tools, presenting learners with exclusive prospects to participate in the kinds of research directed by professional scientists. Another example is the *Global Hands-On Universe (HOU)* programme, which is designed to stimulate collective learning in astronomy; while the Cardinal Humanities movement propositions innovations such as the *Decameron Web*, which constitutes an excellent example of the Web providing access to scholarly materials and offering students opportunities to observe and emulate scholars at work (Brown and Adler, 2008; Facer and Selwyn, cited in Sharpe, Beetham and de Freitas, 2010; Punie, 2007).

- **Four generations model of education: Education 4.0**

In the last 250 years, society has vast experienced four Industrial Revolutions, which have completely transformed the face of industry as we know it. We accept as true that the changes in industry should and must have a direct influence on the way we build the education system for today's students. If your aim is to create students for next challenging world who can become valuable asset of the staff and independent problem solvers, educational paradigms need to be reconstructed alongside each new revolution in society.



Education 4.0 is a hybrid version of such types of rebellion that comes from a digital code. This code had initially been used to mark the disruptive change, which takes place in the manufacturing industry through the pervasive application of Information and Communication Technology (ICT), coining the term Industry 4.0 (Thomas & Gerold, 2016). Since then 4.0 has been applied to many other fields, which are equally affected by the rapid changes we are facing in the world of today in general, such as Work 4.0 or Healthcare 4.0, you name it (ibid,2016) . The changes in reading and learning mothedlogy need that educationalists devise new pedagogical methods). When rethinking academic education to meet these future challenges, we developed a set of propositions, to describe the fundamental principles we should

follow, if we want to prepare our students for the future. Incidentally, some of these principles parallel those from industry 4.0 (ibid, 2016). The speedy pace of appearance of Industry 4.0 necessitates that Education 4.0 also leapfrogs from the current Education 2.0 framework to Education 3.0/4.0.

- **Education 1.0:** centuries of experience with memorization
- **Education 2.0:** Internet-enabled learning (**touchdown, still fluid, and abandon position, , we are leaving!**)
- **Education 3.0:** Consuming & producing knowledge (**we are here now!**)
- **Education 4.0:** Empowering education to produce innovation (**we will be there in future!**)

Education 1.0 is, corresponding the first generation of the Web, a principally one-way process. Students go to universities to get education from professors, who supply them with information in the form of a stand up routine that may include the use of class notes, handouts, textbooks, videos, and in recent times the World Wide Web(Keats & Schmidt, 2007) . Students are largely consumers of information resources that are delivered to them, and although they may engage in activities based around those resources, those activities are for the most part undertaken in isolation or in isolated local groups(ibid 2007). Infrequently do the consequences of those actions contribute back to the information resources that students devour in carrying them out?

Education 2.0 ensues when the technologies of Web 2.0 are cast-off to increase out-of-date styles to education. Education 2.0 involves the use of blogs, podcasts, social bookmarking and related participation technologies but the circumstances under which the technologies are used are still largely embedded within the framework of Education 1.0(Keats & Schmidt, 2007). The progression of education itself is not transformed meaningfully although the groundwork for wider conversion is being laid down. Moreover, Web 2.0, the name given to the second stage of development of the World Wide Web, which is characterized by the move from static web pages to dynamic or user-generated content and the growth of social media (Wikipedia, 2014). Web 2.0 sites allow users to interact and collaborate as creators of user generated content in a virtual community. It has also made possible the building of communities of learners and scholars. Social learning tools such as *Second Life* facilitate the creation of online study groups in which learners work together(ibid,2015). This participatory culture provides greater opportunities to initiate, produce and share creations, and to engage in peer-to-peer learning (Scott, 2015). The web 2.0 movement increased digital tools and affordances which had an impact on teaching. It's a learning model that empowers learners by giving them new means to develop and create knowledge, to communicate and to have a certain control over their learning process¹¹⁸. Besides, Pedagogy 2.0 is a term for 'an emerging cluster of instructional practices that advocates learner choice and self-direction as well as engagement in flexible, relevant learning tasks and strategies' (McLoughlin and Lee, 2008a, p. 15). At the heart of Pedagogy 2.0 is freedom of choice that allows learners to select which media to access, which resources to exploit, which tools to use and how, when and where to use them (Scott, 2015). Learners now have many modalities accessible to them including text and web based multimedia integrating rich audio, photo and video capabilities.

Education 3.0. We are beginning to apply educational technologies but still largely within this paradigm, although uptake is happening at a more rapid pace than we expected (**Derek. K¹¹⁹ & J. Philipp¹²⁰**, 2007).

¹⁰⁹ Information retrieved from the following website: <http://www.igi-global.com/dictionary/pedagogy-2-0/22171>

¹¹⁹ Professor Derek Keats is Executive Director of Information & Communication Services at the University of the Western Cape in Cape Town, South Africa.

¹²⁰ J. Philipp Schmidt is the Freecourseware Project Manager at the University of the Western Cape, South Africa; and a Researcher and PhD candidate at the United Nations University MERIT in Maastricht, The Netherlands.

Education 3.0 is considered by rich, cross-institutional, cross-cultural educational opportunities within which the initiates themselves perform a key character as designers of knowledge work of art that are shared, and where social networking and social benefits outside the immediate scope of action performance a robust role. The distinction between artifacts, people and process becomes blurred, as do distinctions of space and time. Institutional arrangements, including policies and strategies, change to meet the challenges of opportunities presented. Education 3.0 as used here is embraces many of the concepts referred to by Downes (2005). In his concept of e-learning 2.0, but accompaniments them with an emphasis on learning and teaching progressions with a focus on institutional variations that attend the collapse of restrictions (between teachers and students, HERE, and disciplines).

Education 4.0 is a respond to the needs of IR4.0 where human and technology are aligned to enable new possibilities (Aziz Hussin, 2018). Fisk (2017) explains that the new vision of learning promotes learners to learn not only skills and knowledge that are needed but also to identify the source to learn these skills and knowledge. Learning is built around them as to where and how to learn and tracking of their performance is done through data-based customization (ibid, 2018).

Table 2. 2 : Educational generations in higher education

Characteristics	Education 1.0	Education 2.0	Education 3.0	Education 4.0
Primary role of professor	Source of knowledge	Guide and source of knowledge	Orchestrator of collaborative knowledge creation	
Content arrangements	Traditional copyright materials	Copyright and free/open educational resources <i>for</i> students within discipline, sometimes across institutions	Free/open educational resources created and reused <i>by</i> students across multiple institutions, disciplines, nations, supplemented by original materials created <i>for</i> them	
Learning activities	Traditional, essays, assignments, tests, some groupwork within classroom	Traditional assignment approaches transferred to more open technologies; increasing collaboration in learning activities; still largely confined to institutional and classroom boundaries	Open, flexible learning activities that focus on creating room for student creativity; social networking outside traditional boundaries of discipline, institution, nation	
Institutional arrangements	Campus-based with fixed boundaries between institutions; teaching, assessment, and accreditation provided by one institution	Increasing (also international) collaboration between universities; still one-to-one affiliation between students and universities	Loose institutional affiliations and relations; entry of new institutions that provide higher education services; regional and institutional boundaries breakdown	
Student behaviour	Largely passive absorptive	Passive to active, emerging sense of ownership of the education process	Active, strong sense of ownership of own education, co-creation of resources and opportunities, active choice	
Technology	E-learning enabled through an electronic learning management system and limited to participation within one institution	E-learning collaborations involving other universities, largely within the confines of learning management systems but integrating other applications	E-learning driven from the perspective of personal distributed learning environments; consisting of a portfolio of applications	

Source: Elaborate by myself (modified version of Derek et al, 2007, <http://firstmonday.org/ojs/index.php/fm/article/view/1625/1540#k2>)

The following construct shows how things have changed from education 1.0 to the emerging education 4.0 paradigm.

Meaning is	
"Download" Education 1.0	Dictated
"Open Access" Education 2.0	Socially constructed, usually with aid of Internet access
Knowledge Producing Education 3.0	Socially constructed and contextually reinvented knowledge
Innovation Producing Education 4.0	Built through selective individual and team-driven focused innovations practices
Technology is	
"Download" Education 1.0	Confiscated at the classroom door (digital refugees)
"Open Access" Education 2.0	Cautiously adopted open access (digital immigrants)
Knowledge Producing Education 3.0	Everywhere (digital natives in a digital universe) for ubiquitous knowledge construction and transmission
Innovation Producing Education 4.0	Always changing with the direct input of learners acting as a major source of tech evolution in the service of innovation production
Teaching is done....	
"Download" Education 1.0	Teacher to student
"Open Access" Education 2.0	Teacher to student and student to student (progressivism); Internet resources are a normal part of learning activities
Knowledge Producing Education 3.0	Teacher to student, student to student, student to teacher, people-technology-people (co-construction of knowledge)
Innovation Producing Education 4.0	Amplified by positive innovation feedback loops; ubiquitously and creatively 24/7 in all phases of living, learning, and working;
Schools are located in.....	
"Download" Education 1.0	In a building (brick)
"Open Access" Education 2.0	In a building or online (brick and click), but increasingly on the Web through hybrid and full internet courses
Knowledge Producing Education 3.0	Everywhere in the "creative society" (thoroughly infused into society: cafes, bowling alleys, bars,
Innovation Producing Education 4.0	In the globally networked human body, a continuously evolving instrument innovatively supplementing

Source: Framework of John Moravec¹²¹ as adapted by Arthur M Harkins¹²²

¹²¹ John Moravec, Ph.D. Researcher, futurist, author, knowmad scholar on the future of work and education; a global speaker; editor of the Knowmad Society project; a co-director of the Invisible Learning project; and founder of Education Futures LLC.

¹²² Arthur M. Harkins (March 8, 1936 – May 17, 2016) was an American futurist who was an associate professor in the Department of Organizational Leadership, Policy and Development and faculty director of the Graduate Certificate in Innovation Studies program at the [University of Minnesota](#) (UMN). Harkins' contributions to the field of [futures studies](#), include raising anthropologists' awareness of the field and expanding the scope of future studies to include the concept of "culture", starting with the [American Anthropological Association's "Futuristics Sessions"](#) which he co-chaired with [Magorah Maruyama](#) in the early 1970s. Harkins co-authored [StoryTech](#) with [George Kubik](#).

2.5. Pedagogic Innovation: An Experience on REEDS Corporate Learning Platform (ePLANETe)

REEDS was an International research unit of OVSQ - UVSQ for Research in Ecological Economics, Eco-innovation & Engineering Sustainable Development (EA 4456 at OVSQ - UVSQ). It was a converted project of the Center of Economics and Ethics for Environment and Development (C3ED) and of the C3E (University Paris Pantheon Sorbonne that founded by René Passet. It was an interdisciplinary research center organized by Prof. Dr. Martin O'Connor, engaged of 18 researchers, 23 contract researchers, 12 administrative staff and technical and 29 PhD students, included sufficient adjunct faculty, trainees and on a network of 50 guests of honor and scientific associates both in France and internationally. It is part of the Observatory of Versailles Saint-Quentin-en-Yvelines, component of the University from Versailles Saint-Quentin-en-Yvelines. It engaged three main missions, which are the research, innovation, and teaching. The main implementation of REEDS was the Bergerie Nationale de Rambouillet, and its members were spread over three UVSQ sites: Rambouillet, Guyancourt (Saint-Quentin-en-Yvelines), and Mantes-en-Yvelines.

The main scientific activities of REEDS were the creation, adaptation and application of knowledge in ecological economics for exploring the Interdisciplinary sustainable Development on Dynamics of socio-economic and environmental systems, Economic and environmental assessment & indicators of sustainable development (micro, meson & macro scales), Strategy of eco-innovation and corporate social responsibility, Help with private, public and collective decision, Socio-economic Observation and Environmental Values by the using methods of Modeling & Integrated Economic and Environmental Analysis, Techniques of quantitative analysis (economics, economic accounting and Environmental ..., Geographic Information Systems (GIS) and Spatial Analyzes, Technological and social watch and foresight, risk and scenario analysis, Interactive multimedia techniques (knowledge mediation, platform ePLANETe [KerBabel]), Multi-criteria and multi-stakeholder analyzes, Participatory and action research methods, Observatory of eco-innovation and territorial development. _The REEDS International Center was engaged in a variety of research, enhancement and knowledge mediation activities in the field of ecological economics. Grouped into seven types listed below, these activities are associated with the REEDS members primarily involved

Projects:

- Thesis
- Educational Resources
- Knowledge Mediation Tools
- Networks
- Education Programs
- Dissemination: Documentation / Publications

At REEDS research Centre, where I was the enrolled Ph.D (primarily online) student of economics Science, my experiences during that time, REEDS was positioning itself as a scientific player in the development of capabilities and the deployment of multimedia tools for 21st century challenges. It was a commitment to provide innovative e-Learning by innovative platform; Social networking tools were an integral part of what the Research Centre offers; Course materials are easy to access; asynchronous and synchronous online discussions ; the conditions for establishing dialogue between different categories of actors in society concerned with education, innovation and sustainable development - See ANNEX- Liste des Actions (EVADDES). The members of REEDS have established a wide profile of research activities centred on ecological economics and sustainable development. They were prominent in European research projects, notably on the science/society interface and in integrated innovation, education and sustainability assessment. The REEDS had determined to build on its past achievements and enhanced its research and teaching resource capacities, anticipates State-of-the-art of a research centre and continue to exploit the advantages of size by encouraging online education resources in a wide range of disciplines on humanities

and social sciences, economics, natural sciences, engineering science, science of the universe, formal sciences, professions and applied sciences with two different teaching fields in Innovation, and Management of territory and local development - See ANNEX The EVADES (2012) Performance Categories . Of course, it had good enough potentials for facing the Education 3.0/4.0 Paradigm that interlink to innovation, sustainability, knowledge Economy/ Society.

2.5.1. What ePLANETe is doing towards Future Issues/Challenges Education, Sustainability and Innovation?

Prof. Dr. Martin O'Connor, Ex-director of REEDS and Professor of Economies in Paris Saclay, was instrumental in creating the “ePLANETe” project. ePLANETe began as a collaborative effort between the University’s UVSQ and the Laboratory Resources system. The project expanded with its key feature on the design and exploitation of multimedia knowledge mediation and learning tools (trademark KerBabel™) in research partnerships (e.g., the Deliberation Matrix, and interactive multimedia deliberation support tools for agriculture, biodiversity, coastal zone management and climate change domains) and teaching programs (the Brocéliande system of on-line teaching resources) to become part of the knowledge society domain. Currently it has reorganized and prepared to serve future challenging solutions on education, sustainability, and innovation for knowledge economy learners through UVSQ and Paris Saclay. How it will deal with those issues/challenges that I will give the details presentation in the next chapter.

Here, some of the specific initiatives that has been taken ePLANETe are described in the table below.

Table 2. 3 : Initiatives of ePLANETe for future challenge

Initiatives of ePLANETe that could become the precursors of our work in future issues/challenges of Education, Sustainability, and innovation	
Initiative	Target
Creation of the Free teaching platform for education Unit	Face the fourth generation education issues/ challenges, includes Sustainable development(education) goal4 : Towards inclusive and equitable quality education and long-life learning for all, Sustainability strategies ’ of Higher Education, alue Creation Strategic in higher education : globalization, Improving learning processes and outcomes
Creation of the Free knowledge sharing Spaces for sustainability practice Unit: IDEAS & ACTIONS : innovations.eplanete.net/ideasgreeneconomyall	Established “connecting dot” framework, includes best practices in Promoting education for sustainable development, sustainability at higher education, green growth: sustainable campus, green economy
Creation of the knowledge platform for Innovation Unit	

2.5.2. Connecting the Dots strategies: Perspectives of ePLANETe Blue

Learning outcomes depend on engaged teachers, effective instruction and resource, appropriate tools, supportive environments, and positive relationships between teachers and Students. ePLANETe Blue platform ¹²³is the leader in connecting these elements — methods, tools, environments, and relationships for humanized, high-impact learning experiences. The ePLANETe Blue is an online “Collaborative Platform” oriented toward the social learning and the deliberation support addressing sustainability challenges (O’Connor and Lancelaur, 2015).

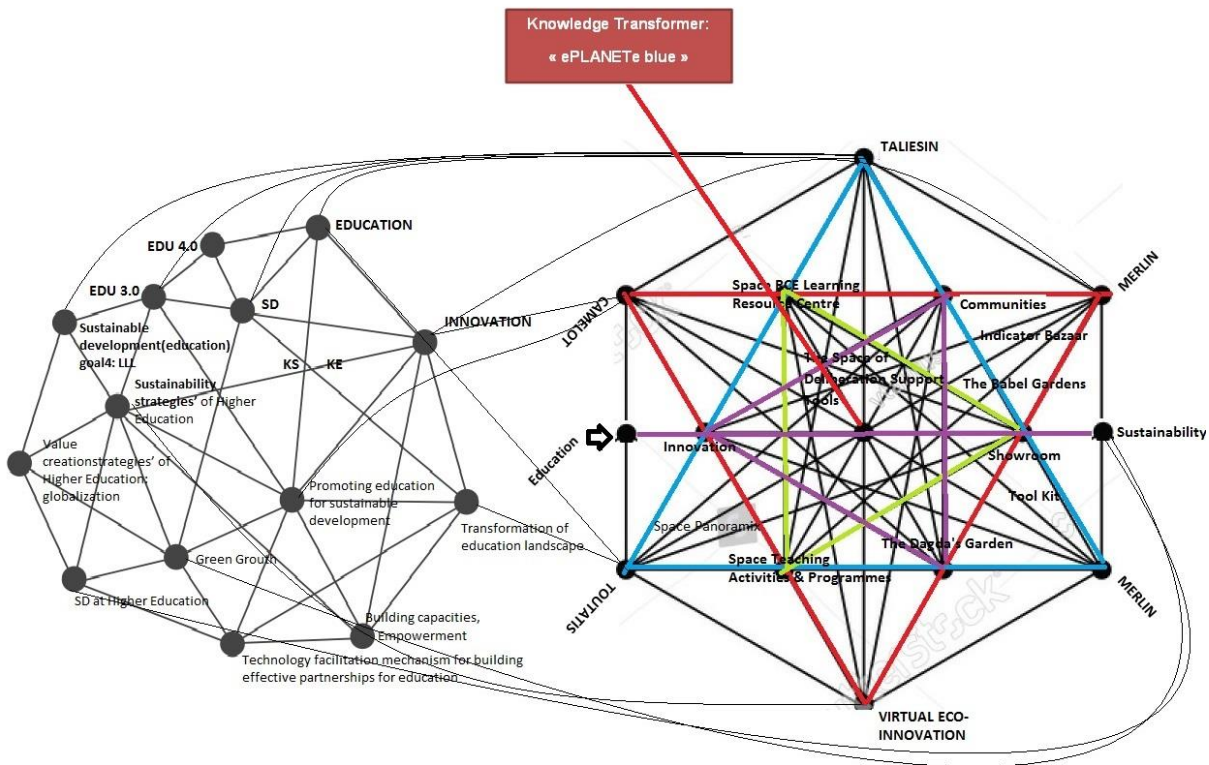
The ePLANETe Blue platform was developed at the Centre international REEDS. It is simultaneously (1) a modular “Knowledge Gateway” with a spectrum of collaborative learning support functions; (2) an innovative approach to the “integrative” and participatory modeling of “ecolo-socio-econo” systems; and (3) a “deliberation support tool” (DST) simplifying the appraisal of sites, scenarios or other situations related to multiple criteria (ibid, 2015). The platform is composed by six distinct ‘Doorways’ (i.e., Top levels) relating, in a didactic way, to the “four spheres” of the ‘Tetrahedral Model of Sustainability’ i.e., social, environmental, economic, and political (Mariana Bittencourt, 2017). The six ‘Doorways’ are presented in the Table 2.4 and more details about the actions of platform to answering the questions-“ *Which learning strategies engage students as active learner in supporting education, social and economics sustainability? How are these strategies aligned with 21st century learning skills including collaboration, creativity, communication and critical thinking?*” will be presented in the next chapter.

¹²³ See <https://proxy.eplanete.net/portals/eplanete/>.

Table 2. 4 ePLANETe Blue Doorways

SL	DORWAY	FUNCTION
1	TALIESIN—BUILDING KNOWLEDGE PARTNERSHIPS FOR SUSTAINABILITY	It proposes the discovery of training programs and teaching aids carried out within and outside the University of Paris-Saclay.
2.	VIRTUAL ECO-INNOVATION FAIRGROUND (THE ECONOMIC DIMENSION)	It offers the opportunity to discover the eco-innovations, evaluate their performance and the challenges of the governance of the green economy and the circular economy.
3.	TOUTATIS (THE SOCIAL DIMENSION)	This doorway aims to present the members of the communities and the partners as well as the activities. These Communities are organized and presented via Profiles in three cross-linked galleries, using complementary logics of identity: Persons; Partners (institutions, or operational units within an institution); and the User Communities themselves.
4.	CAMELOT — JUSTICE & ENVIRONMENT (THE POLITICAL DIMENSION)	
5.	MERLIN — ACCENT ON OUR BEING-IN-NATURE (THE ENVIRONMENTAL DIMENSION)	The Doorway 'Merlin', by its name, connotes a desire to establish a mediation between society and its environment. The aim is to discover the environment through the virtual gardens, biosphere cycles, environment-economy accounting systems, and economy-environment models
6.	KERBABEL	It is composed of the galleries that provide a body of knowledge pieces, objects which will be mobilized in other galleries of the other Doorways

Source: EPLANETe Blue (2015).



Note: Informed by a systems approach, this framework encourages repositioning educational activities within the UN Agenda 21 to ensure the suffusion of SD principles. The existence (present) and 21st century learning can enter the following doorways to practicing the future issues/ challenges of education, sustainability and innovation. Our Connecting the Dots strategy will answers the all question regarding on future issues/challenges of innovation, sustainability and how it will work that I will present in the next chapter

CHAPTER 3: PRESENTATION OF INNOVATIVE ‘Eplanete’ — THE CONCEPT AND ITS ORIGINS

3.1. Introduction

The purpose of Ch.3 in this thesis is to present the emerging 'ePLANETe' concept and functionalities as an innovation programme contributing to sustainability goals in higher education. Developed by the KerBabel team at the UVSQ during the years 2000-2015, the suite of Internet-based knowledge mediation and deliberation support functionalities can be seen as an experimentation of the challenges of “ICT for Green”. The new technologies are exploited (i) to facilitate research and student learning about sustainability challenges and (ii) as deliberation support tools in the pursuit of sustainability performance in territorial governance, public policy and business strategy, as well as in the higher education sector itself.

3.2. The “KerBabel Experience” at the UVSQ

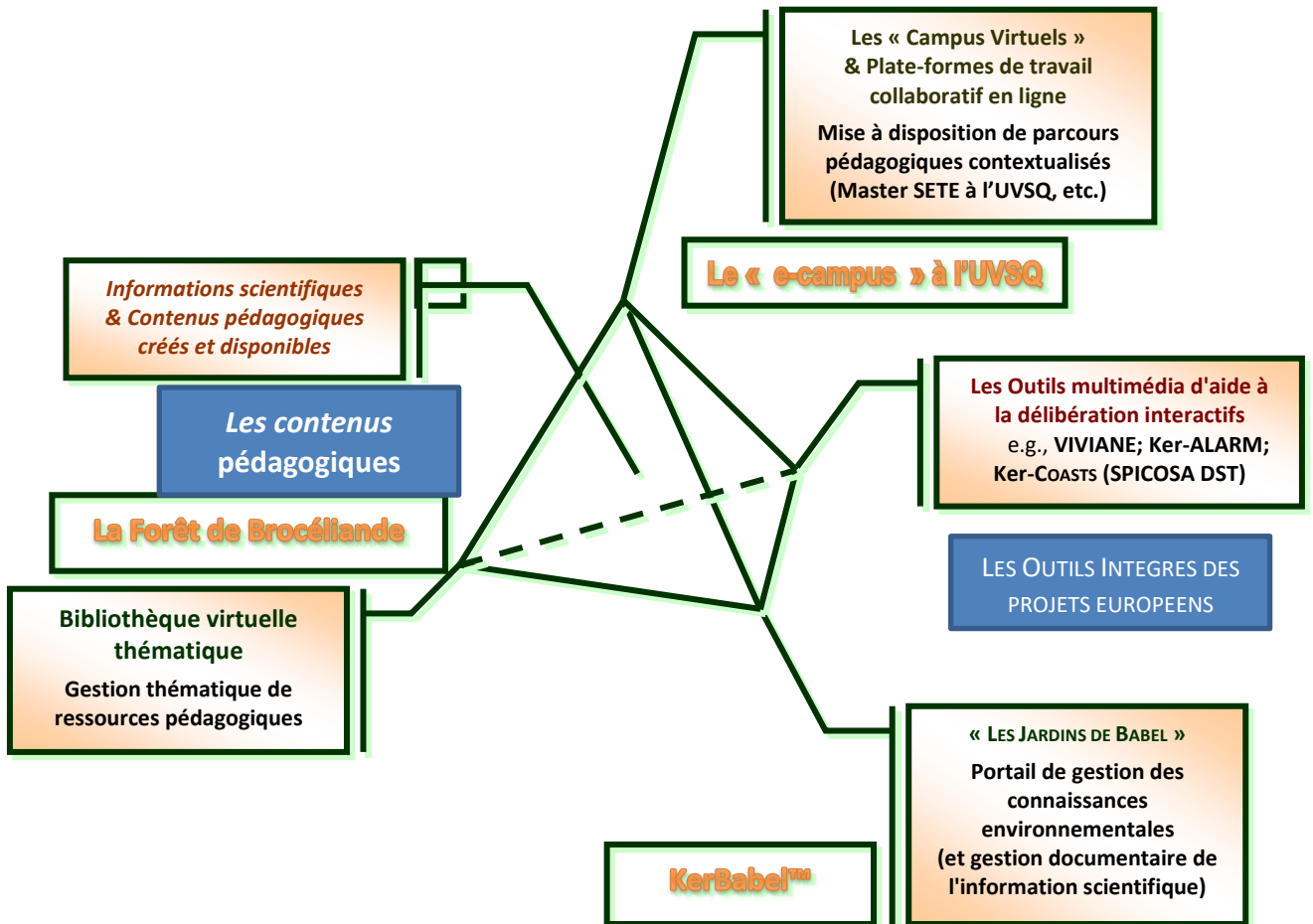
Since about 2000, the KerBabel team based at the University of Versailles St-Quentin-en-Yvelines (UVSQ) until 2015, and now operating within L'Association ePLANETe Blue), has worked with partners worldwide in developing experimental tools, expertise and pedagogic support services for e-Learning in the interdisciplinary fields of ecological economics, eco-innovation, environmental governance and sustainability.

This experimental programme, referred to informally as the “KerBabel Experience”, has its mature expression in technological terms, in the conception and development (during 2012-2015) of the ‘ePLANETe’ platform, whose structure and uses will be described in this chapter a bit later on.

In the early years of KerBabel, several distinct threads of experimentation were pursued, seen always as logically inter-dependant and synergistic, but without the envisaged synergies being expressed (until ePLANETe) by a full integration of the corresponding digital tools. The main facets of experimentation during the years 2000-2008, are summed up in the figure 3.1 below.¹²⁴

¹²⁴ This schematic presentation is taken from an unpublished document by Marie-Sophie Clerc, Christelle Hue & Martin O'Connor (2006), « *Présentation des Composantes Principales du système interactif dynamique de Médiation de Connaissances Environnementales de l'Equipe IACA du C3ED* ». The Equipe IACA du C3ED : « Incertitudes, Analyses, Concertations et Aménagements: — Production et Médiations de Connaissances pour le Développement Durable », was a component of the C3ED (Centre d'Economie et d'Ethique pour l'Environnement et le Développement, UMR No.063 IRD & UVSQ) during 2005-2009, building on the intellectual perspectives methods and tools of earlier phases within the same C3ED.

Figure 3. 1: Experimentation of digital tools (ePLANETe) during the years 2000-2008



Translating from the French, we can see the articulation of four main components, or “moments” of experimentation. These are:

- ❑ The conception and prototype development of Internet-based Multi-média « Deliberation Support Tools (in French: des Outils multimédia d'aide à la délibération). This is epitomized by the “Champigny DST” (in the GOUVERNe Project 2000-2003), then ViViANE (in the VIRTUALIS Project, 2001-2004) and Ker-ALARM (in the ALARMProject 2005-2008);
- ❑ The conception and experimental development of Internet-based systems for the creation, management, and sharing of electronic teaching resources. This is epitomized by The “Brocéliande Forest” concept, with its various prototypes from 2001 to the present day;
- ❑ The requirement for a comprehensive digital document management system, on the one hand for the cataloguing, management and permanent availability of the increasing array of electronic products from research projects (such as GOUVERNe, VIERTUALIS and ALARM) and, on the other hand for the management of the increasing array of documentary and multimedia materials of potential interest as teaching support materials. This is epitomized by the development, in 2002, of the “Babel Gardens” document management system, utilized in conjunction with the “Brocéliande Forest” until the integration of both “Brocéliande” and the “babel Gardens” into the multi-gallery ePLANETe system in 2012-2013.
- ❑ The deployment of digital Collaborative Learning Environments (in French, ENT = Espace Numérique de Travail) as operational components of the “e-Campus” ambition, that is, the material and software tools and infrastructures providing for university teaching, document sharing, and collaborative learning via “virtual” working environments (personal computer, screen, email and Internet..., visio-conferencing, Smartphone, social networking...).

EXTRACT FROM : Clerc, Hue & O'Connor (2006), « *Présentation des Composantes Principales du système interactif dynamique de Médiation de Connaissances Environnementales de l'Equipe IACA du C3ED* »

Les nouvelles Technologies de l'Information et de la Communication (TIC) sont retenues dans les démarches de médiation de connaissances de l'Equipe IACA du C3ED comme médium à la fois pour la représentation des systèmes et des processus écologiques-économiques et pour l'organisation de la connaissance à des fins pédagogiques (valorisation de la recherche, éducation environnementale, support informatique dans des processus de concertation et de gouvernance délibérative, etc.). Il s'agit de former divers publics aux enjeux du développement durable dans toute sa complexité, associant les dimensions environnementales, économiques, institutionnelles et sociales.

Les formats de médiation de connaissances et les modes d'organisation des ressources pédagogiques en ligne peuvent être très diversifiés en fonction des "usagers" envisagés. Ainsi, a été développée une structure constituée de classes d'objets aux fonctionnalités différentes et complémentaires. C'est la complémentarité entre ces différentes classes d'objets qui constituent la richesse et l'intérêt de ce dispositif.

Notre système multimédia se compose donc de **QUATRE CLASSES D'OBJETS** aux fonctionnalités complémentaires, réunis avec l'objectif principal de rendre accessible l'information scientifique et pédagogique à un large public.

As mentioned, these several distinct threads of experimentation were, from the outset, seen as logically inter-dependant and synergistic. However, throughout the period 2002-2010, the envisaged synergies

were only very imperfectly expressed. The “Brocéliande Forest” system for creation and exploitation of on-line teaching resources, went through several prototypes during the years 2001-2006, with increasing mastery of the uses and opportunities of Content Management Systems (CMS Joomla and Drupal, for example). But its development as a polyvalent learning support tool was hamstrung by a strait-jacketed vision of e-Learning as a matter of providing “Courses on line” within a specific institutional framework. The early experiments with Internet based Deliberation Support Tools (Champagne DST and ViViANE) led on to a fully operational evaluation tool — the KerDST, on-line as from 2006 — and to a mature vision of the modular “SMMAAD” (Système Multi-Media d’Apprentissage de d’Aide à la Délibération) implemented during 2005-2008 as Ker-ALARM. Both of these fields of operation made use of the “Babel Gardens” as a complementary tool for document cataloguing and management. But the integration of these digital functionalities into the institutional environments of teaching and learning was difficult. During the years 2000-2010, notions of “e-Campus” platforms rarely got beyond the facility for depositing documents in a static way for student access on a basis of access rights for this or that course. Visio-conferencing techniques for “virtual classrooms” required investments in equipment and human resources that were out of the reach of the mainstream of teachers and students in French university conditions.

The KerBabel team sought, during the years 2008-2012, to overcome these obstacles, through taking on the challenge themselves of the implementation and demonstration of state-of-the-art technologies for a “digital transformation” in the management and delivery of university teaching. This engagement was expressed along two main axes:

- On the one hand, by the development and demonstration of a comprehensive on-line Internet-based system for the presentation of teaching and research partnership activities, including but not limited to University teaching programmes. This ambition was concretised in the creation of the cross-linked galleries, now components in ‘ePLANETE’, (1) of YGGDRASIL for profiles of teaching programmes and courses, (2) of COLLABORATIVE ACTIVITIES (including research projects, PhD thesis studies, Networking activities and the development of Teaching resources...); and (3) of Partners associated with the various projects and programmes.
- On the other hand, by engagement, through the opportunities (1) of the EquipEx ‘DIGISCOPE’ and (2) of the Climate KIC programme for visio-conference capacities linking nodes throughout Europe, of demonstration activities showing the feasibility of learning and deliberation support exercises linking students, university teachers, professionals and members of research teams in collaborative activities supported by interactive on-line Deliberation Support Tools in the fields of ecological economics and sustainability studies.

The privileged partnership terrains for these experimental activities were (1) the interdisciplinary Master SETE programme based at the OVSQ-UVSQ, (2) the Climate KIC Education Programme bringing together a wide cross-section of research and higher education teams across Europe, and (3) the REEDS research centre’s own activities of collaborative research, networking, including participation in the Greater Western Paris RCE (a node in the UNU of Regional Centres of Expertise, established during 2012-2014 at the initiative of Professor Martin O’Connor for the newly created PRES UPGO).

As a result of hostilities within the UVSQ during 2012-2015, the rug was rather brutally pulled from under the feet of the KerBabel team and their partners working to provide real-life demonstrations of “proof of concept” on the OVSQ, Climate KIC and Greater Western Paris RCE terrains.¹²⁵ Nonetheless, the KerBabel

¹²⁵ It is not within the scope of this PhD thesis to document the political and institutional processes, at the UVSQ and elsewhere, that engendered the force closure of the REEDS research centre, the dismantlement of the FONDaTERRA partnership foundation, and the closure of more than 50% of the teaching programmes initiated at the

team did achieve success during 2013-2015 in the integration of the different dimensions of content management, e-Learning, deliberation support and collaborative “virtual” work, into a unified digital environment — the ‘ePLANETe’ platform. Much of this thesis is therefore devoted to explaining the “ICT for Green” solution concepts deployed, by the KerBabel team, through the ‘ePLANETe’ platform.

The purpose of this chapter of the thesis thus is to outline the key concepts and demonstration activities of the KerBabel team, brought together during 2013-2015 in the ‘ePLANETe’ platform, for the pursuit of Sustainable Campus and (Green) Digital Transformation goals.

- ❑ We will start with an overview of the ‘ePLANETe’ system itself. This provides a synthetic vision of the approach taken by the KerBabel team to “ICT for Green” as a challenge of eco-innovation, that is, inventing tools and processes for “Building Knowledge Partnerships in support of sustainability”.
- ❑ Having set out this overview, we then highlight some of the key functionalities that are incorporated into the integrated ‘ePLANETe’ platform. We first look at the features that address directly the challenges of support for e-Learning in a University environment. These are, as we will see, principally the Thematic Spaces and operational Galleries associated with the TALEISIN Doorway of ‘ePLANETe. Our focus mainly will be on the “Brocéliande” and Yggdrasil” galleries.
- ❑ Then we will look at the KerBabel ambition of providing Internet-based collaborative Deliberation Support Tools, as expressed by the prototype developments through the European Commission funded collaborative projects GOUVERne, VIRTUALIS, SRDTOOLS and Ker-ALARM during the period 2000-2008. Incidentally, this provides a documentation of one facet of the contribution de facto of the European commission to investment in R&D for “ICT for Green” in application to higher education, deliberation support and collaborative learning.
- ❑ We then bring these two strands together, by looking at the vision expressed during 2010-2013 by the KerBabel team, for the implementation of “SMMAAD” structures — multi-modular “Systèmes Multi-Media d’Apprentissage et d’Aide à la Délibération” — as contributions to the challenges of Building Knowledge Partnerships in the context of the European Commission funded “Climate KIC” Education and Innovation Programmes. In effect, it was through the fusioning of the two overlapping SMMAAD concepts (the “KICE” for Climate KIC Education Partnerships, and the “Virtual Ecoinnovation Fairground” for deliberation support in domains of territorial eco-innovation, energy and ecological transition) that the mature design for ‘ePLANETe’ was born.

Summing up, and keeping in mind the author’s own pathway through the M2 programme “Managing Eco-innovation” at the UVSQ (within the framework of the Chaire industrielle Econoving and the Master SETE at OVSQ), it is important to highlight the "triple play" between:

- (i) the specific educational innovation with TICE as carried by KerBabel/IACA/REEDS, with its mature expression in the "KICE" design; which, at the same time,
- (ii) provides a toolkit permitting to document, evaluate and contribute to wider eco-innovation; and

Master level in the context of the Master SETE during 2004-2015. Institutional analysis including the understanding of power relations and ideological conflicts are important facets of higher education management and of the digital and ecological transitions. But the present thesis is focused on the ambitions and technological innovation concepts of the KerBabel/ePLANETe experience as a potential contribution to “Sustainable Campus” ambitions, without seeking to resolve the wider factors and forces.

(iii) opens up, by reflexivity, the opportunity to envisage processes of evaluation of the quality of educational innovations and, more specifically, the quality of HERE institutions and programmes in a sustainability perspective.

This triple play also gives the framing for the later developments in the thesis, which, as already outlined in the General Introduction, provide detailed presentations of chosen fields of demonstration of sustainability education innovations carried out by KerBabel-colleagues at the REEDS research centre during 2010-2015, and retrace some of the experiments at auto-evaluation of these institutional and pedagogical eco-innovations making reflexive use of the KerBabel roots.

3.3. ePLANETe : A multi-faceted approach to Sustainability

As explained by its design team (KerBabel), the ePLANETe system is an ambitious “Knowledge Gateway” addressing the challenge of building knowledge partnerships — in higher education and elsewhere — in support of environmental justice and sustainability.¹²⁶ It is a complex gateway, with many different doors. The different facets of ePLANETe as a communication and capacity building resource, are complementary by design. A variety of angles of attack and learning experience can be adopted, as seems to best fit the purposes of User Communities.

The ePLANETe as it operates since 2015, offers six distinct Doorways. These relate, on the one hand, to the “four spheres” of sustainability (natural, economic, social and political) and, on the other hand, to the technical and wider societal dimensions of learning and understanding. As seen on the frontpages of the ePLANETe website, these 6 Doorways are:

3.3.1. The triple bottom line :

- ◆ **MERLIN — ACCENT ON OUR BEING-IN-NATURE (THE ENVIRONMENTAL DIMENSION).** Understanding our place in Nature in terms of local biodiversity, food sources, ecosystem functions and biosphere cycles (water, carbon, nitrogen...), and on to green accounting and ecological economics models.... The nickname ‘MERLIN’ connotes the multi-language **ENVIRONMENTAL KNOWLEDGE MEDIATION**.
- ◆ **VIRTUAL ECO-INNOVATION FAIRGROUND (THE ECONOMIC DIMENSION):** Situating economic activity in its biosphere context and developing capacities for imagining and assessing innovations responding to the multiple performance challenges of sustainability (People, Planet, Process...). Situating eco-innovations as projects anchored in their territories, relative to challenges of CSR (corporate social responsibility) and governance towards a ‘greener’ or ‘circular’ economy. The term FAIRGROUND connotes ‘trade fair’ and also fun park, science park and so on.
- ◆ **CAMELOT — JUSTICE & ENVIRONMENT (THE POLITICAL DIMENSION):** Initiation to examples around the world of conflicts associated with inequitable access to environmental resources & services and thus, to the “problem of social choice” in its practical and theoretical dimensions and, to the theme of ‘unequal ecological (as well as economic) distribution’. Tools and opportunities for use of participatory ‘deliberation support tools’ for multi-criteria multi-stakeholder evaluations seeking understanding and (to the extent possible) inclusive solutions to situations of conflict. CAMELOT is the gallantry of the Round Table and also (in French) money [*Keep your hands off my stash!*]

3.3.2. The transversal moments :

- ◆ **TOUTATIS (THE USER COMMUNITIES).** Considering ePLANETe as a “Knowledge Gateway” available through the Internet, we put the accent first on the identification of different **User Communities** (whose members may, of course, sometimes overlap), relative to the different opportunities for action and, the spectrum of knowledge/learning resources offered to the users . These Communities are organized and presented via Profiles in three cross-linked galleries, using complementary logics of

¹²⁶ The first uses of the term ‘eplanete’ by the KerBabel team are somewhat uncertain. In a document dating from July 2007, prepared by Martin O’Connor and intended for internal use by members of the then-Equipe IACA du C3ED, the terms kerPLANET and E-PLANET are employed to refer to the programme for the « *Elaboration d’une Plateforme d’Apprentissage en Ecologie Territoriale* ». The methodological vision in this short document centered on the application of the « INTEGRAAL » framework « *pour l’articulation et l’évaluation d’un projet de développement local ou d’écologie territoriale* ». This vision was carried forward, through 2009-2011, with *inter alia* the employment of the bilingual neologism ‘ePLANETe’ to characterise the emerging concept of the Virtual Ecoinnovation Fairground under development for the EURBANLAB Project. With the fusion by KerBabel during 2012-2013 of the ‘Fairground’ and ‘KICE’ functionalities into a single integrated platform design, the terme ‘ePLANETe’ was adopted definitively. The corresponding adoption of « ePLANETe Blue » as a name/URL for the platform’s website and then also for the Association created in 2015 to sustain the system for its User Communities, followed on naturally.

identity: **PERSONS**; **PARTNERS** (institutions, or operational units within an institution); and the **USER COMMUNITIES** themselves. The nickname for this collection of galleries is **TOUTATIS**, the Breton god who, among other things, is the protector of the tribe : the people.

- ◆ **LEARNING & KNOWLEDGE — EDUCATION — BUILDING KNOWLEDGE PARTNERSHIPS FOR SUSTAINABILITY.** Considered as a whole, ePLANETe is an on-line “Collaborative Platform” that seeks to support a broad variety of forms of learning, and of sharing of resources for learning, always with the accent on community and conviviality. It seeks, in particular, to incite new experiments in social networking and knowledge sharing concerning the biosphere and sustainability, and to offer tools supporting debate and deliberation addressing social, political, technological, economic and environmental dimensions of sustainability. *This dimension is currently designated not at present given a nickname, it is, however, in a privileged relation with the **RCE GREATER WESTERN PARIS** (Regional Centre of Expertise), the local node in the world-wide UNU network of RCE’s in Education for Sustainable Development*
- ◆ **KERBABEL — THE BACK ROOM :** the (partly hidden) dimension of conception, design, realisation & reflexion that animates and underpins the ePLANETe collaborative learning and deliberation support on-line system.

The digital objects found in, or through, the various galleries of ePLANETe, may individually be of simple and well-known types, for example electronic files such as photos or PDF documents. More often, they are Profiles or structured presentations of various sorts, composed using state-of-the-art *Content Management Systems* (e.g., the CMS ‘**DRUPAL**’). Most are the creations, or the cross-linked outcomes, of learning, discovery, analysis and documentation work of members of the different ePLANETe User Communities. The overall result is an evolving lattice of cross-linked objects — an always-incomplete “model” of human activity, to which the users contribute in a “bottom-up” way and within which they navigate.

Today, there exist systems for cross-linking digital objects such as social network tools (FaceBook, Instagram, Twitter and the Internet itself) that greatly outrun ‘ePLANETe’ for sheer power of connections. The specificity of ePLANETe resides in the unique spectrum of sustainability-related galleries of objects, the context-driven and user-friendly character of the procedures for creating objects within each gallery and, and the ‘cross-linking’ from one object to another that, in cumulative effect, transforms the entire system into novel sort of participatory and reflexive social modelling — a transparent and evolving expression of the collaborative purposes of the participants in the fields of environmental education and deliberation support for sustainability.

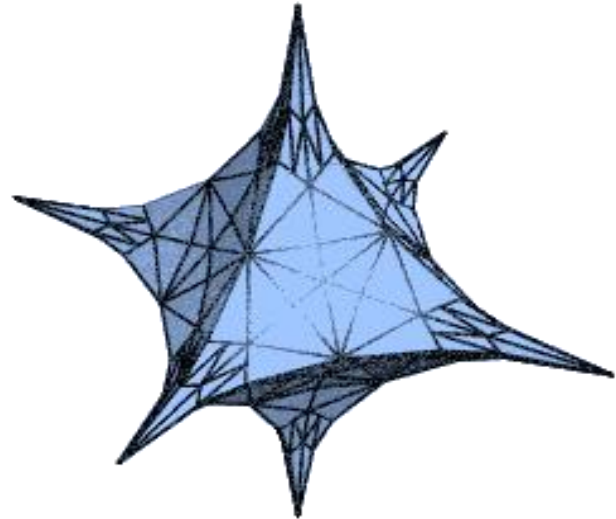
SOURCE NOTES: This summary of ePLANETe is adapted from the presentation brochure produced by L’Association ePLANETe Blue in 2015. A detailed discussion of the technical and conceptual considerations of ePLANETe with its 6 Doorways, is found in the PhD thesis titled *Expériences KerBabel* by Philippe Lancelleur (2019).

On the following two pages, we present in tabular form, some more detail about the internal structure of ePLANETe as viewed through each of the 6 Doorways. In technical terms, there is a hierarchy from the Doorways, to thematic “Spaces” associated with each Doorway, and then to “Galleries” of objects associated with a thematic Space. We first give a formal exposition of this hierarchical structure (**Table 3.1**) which describes the main navigation routes for “top-down” entry into ePLANETe. It can be seen that in a few cases the strict hierarchy Doorway-Space-Gallery is broken with one-to-many or many-to-one relations. Then we give a very short and non-exhaustive narrative presentation (**Table 3.2**), in order to highlight the distinctive character of the access proposed through each of the Doorways.

The 6 Doorways are often portrayed geometrically, as with the octahedron with 6 points shown below. According to Philippe Lancelleur (2019) and the KerBabel team, this representation allows us to think of ePLANETe as structured with three intersecting axes:

Figure 3. 2: intersecting axes of Structural ePLANETe

- Eco-Eco Materiality: The interpenetration of ecosystem and economics system (FAIRGROUND & MERLIN)
- Discovery/Deliberation: The interpenetration of knowledge with action (TALIESIN & CAMELOT)
- Virtual/Reality: The interpenetration of the digital and real worlds (KERBABEL & TOUTATIS).



There are many other ways of exploiting the different Doorway combinations (for example, it can be seen that each face of the octahedron links three of the six Doorways, and each of these faces could perhaps be given a name). In this thesis, we focus mostly on entry through the TALIESIN Doorway, and so will look at only a few of the multiple Doorway interface dimensions.

Table 3. 1: The Main Access Hierarchies (Doorway-Space-Gallery) in ePLANETe

Doorways (6)	Thematic Spaces (12)	Associated Galleries (24)
TALIESIN & KERBABEL	Elemental Catalogues	<i>The Babel² Gardens (Hall of Mirrors)</i>
TALIESIN	Elemental Catalogues	<i>Le Toolkit (Theories Methods Tools) [§]</i>
TALIESIN	KerBabel Learning Resource Centre	<i>Brocéliande Forest</i>
TALIESIN	Teaching Activities & Programmes	<i>Yggdrasil</i>
TALIESIN	KQA	<i>HOT TOPICS [\$\$\$]</i>
TOUTATIS	ePLANETe Communities	<i>People Partners</i>
TOUTATIS	Showroom	<i>COLLABORATIVE ACTIVITIES NewsReel</i>
FAIRGROUND	Industrial & Territorial Metabolism (MIE)	<i>ECO-INNOVATION TERRAINS</i>
FAIRGROUND	<i>In the Dagda's Gardens</i>	<i>Sustainability Ideas & Actions</i>
FAIRGROUND & MERLIN	<i>In the Dagda's Gardens</i>	<i>* Cycles and Cascades * [§] {£}</i>
MERLIN	<i>In the Dagda's Gardens</i>	<i>Virtual Biodiversity Gardens Territorial Food Baskets</i>
MERLIN	IEA – Integrated Environmental Analysis	<i>PARC DE PATRIMOINES [\$\$\$]</i>
CAMELOT & TOUTATIS	Deliberation & Evaluation (INTEGRAAL)	<i>Worksites/Chantiers (= Uses of the Dagda's Cauldron)</i>
CAMELOT	<i>In the Dagda's Gardens</i>	<i>HOT SPOTS</i>
KERBABEL	Deliberation Support Tools	<i>KerDST Les K4U CogiTIX (The Universal Cauldron) [§]</i>
KERBABEL	Panoramix (Getting Around ePLANETe)	<i>The Gallery of Galleries...(Escher) [§] LES SMMAAD [§]</i>
KERBABEL	Elemental Catalogues	<i>Les KIKs (Indicator Bazaar) Les Grilles de Représentation</i>

Explanatory Notes: There are 6 Doorways, 12 Spaces and 24 Galleries. This structure is considered by the KerBabel design team to be “complete”. This means that no future additions are envisaged. On the other hand, as experience develops with use, some minor adjustments in Gallery organisation will continue to take place, notably concerning Types of objects in each Gallery, and the details of their profiles and cross-

linking conventions. At present (2019), two of the galleries (**Hot Topics** and **Parc de Patrimoines**, marked [\$\$\$]) are not yet operational in ePLANETe; and a few of the other galleries exist only in incomplete or ‘Alpha’ versions (marked [\$]).

The ePLANETe is not conceived in simple hierarchy and is not fully symmetric. For example, the “Elemental Catalogues” Space is linked with two Doorways (KERBABEL and TALIESIN); the “Deliberation & Evaluation” Space is linked with 2 Doorways (CAMELOT & TOUTATIS); and “The Dagda’s Gardens” Space is linked with three Doorways. In general, a Gallery is associated, through a Space, with only one Doorway; but there are three exceptions: (i) the “Cycles & Cascades” Gallery is associated, via “The Dagda’s Gardens” Space, with both the FAIRGROUND and MERLIN Doorways; (ii) the “Worksites” Gallery is associated, via the “Deliberation and Evaluation” Space, with both the TOUTATIS and CAMELOT Galleries; and (iii) the “Babel2Gardens” Gallery is associated, via the “Elemental Catalogues” Space, with both TALIESIN and KERBABEL Doorways. These anomalies cannot be resolved elegantly in a simple hierarchy table.

Finally, there exists at the centre of ePLANETe a singularity — a gallery-less Space, the **DAGDA’S CAULDRON** or “**MELTING POT**” — which in a sense belongs to all the Doorways. We do not put this in the table. **Sources:** Martin O’Connor & Philippe Lancelaur © KerBabel 2019.

Table 3. 2: General Features of ePLANETe, by Doorway (through into Galleries)

DOORWAY INTO EPLANETE	CHARACTER OF ASSOCIATED GALLERIES
<p>TOUTATIS (THE SOCIAL DIMENSION)</p> <p>Entry by introduction to the people and User Communities associated with ePLANETe.</p> <p><i>The nickname for this Doorway and collection of galleries is <u>TOUTATIS</u>, the Breton god who is the protector of the people.</i></p>	<p>The ePLANETe User Communities are organized and presented via Profiles in three cross-linked galleries, using complementary logics of identity: <u>PERSONS</u>; <u>PARTNERS</u> (institutions, or operational units within an institution); and the <u>USER COMMUNITIES</u> themselves.</p> <p>The past and ongoing activities in and around ePLANETe are presented in galleries of <u>COLLABORATIVE PROJECTS & PROGRAMMES</u>, including profiles of research, doctorates, networking and knowledge mediation actions.</p> <p>Current Events are presented through articles in the ePLANETe <u>NEWSREEL</u> gallery.</p>
<p>MERLIN — BEING-IN-NATURE</p> <p>Entry by introduction to the biophysical dimensions of our living world: THE ENVIRONMENTAL DIMENSION.</p> <p><i>‘MERLIN’ connotes the multi-language requirements of <u>KNOWLEDGE MEDIATION</u>.</i></p>	<p>Galleries presented through the MERLIN Doorway express different facets of our place in Nature. The <u>VIRTUAL BIODIVERSITY GARDENS</u> and the <u>TERRITORIAL FOOD BASKETS</u> link “informal” (vernacular) and formal (systemic) knowledge of our living environment and our food sources. The gallery of <u>CYCLES & CASCADES</u> exposes ecosystem functions and biosphere cycles (water, carbon, nitrogen...), opening out to green accounting and ecological ECONOMICS models. The <u>PARC DE PATRIMOINES</u> presents profiles of natural and historical wealth to be sustained.</p>
<p>VIRTUAL ECO-INNOVATION FAIRGROUND</p> <p>Entry by situating different facets of economic activity in their institutional and biosphere context: THE ECONOMIC DIMENSION.</p> <p><i>The term <u>FAIRGROUND</u> connotes ‘trade fair’ and also fun park, science park and so on.</i></p>	<p>Galleries in the ‘FAIRGROUND’ reveal the capacities of our societies for imagining and assessing innovations responding to the multiple performance challenges of sustainability (People, Planet, Process...). These include catalogues of Sustainability <u>IDEAS & ACTIONS</u>, of various <u>TERRAINS</u> of innovation action (e.g. rural development, higher education establishments, waste management), and of the <u>CYCLES & CASCADES</u> that underpin our vision of ecosystem functions biosphere services to be sustained. Eco-innovations are thus situated as</p>

	<p>projects anchored in their territories, relative to challenges of CSR (corporate social responsibility) and territorial governance towards a ‘greener’, inclusive or ‘circular’ economy.</p>
<p>CAMELOT — JUSTICE & ENVIRONMENT</p> <p>Entry by initiation to the “problem of social choice” in its practical and theoretical dimensions and, to the theme of ‘unequal ecological (as well as economic) distribution’:</p> <p>THE POLITICAL DIMENSION.</p> <p><i>CAMELOT is the gallantry of the Round Table, & French slang for money.</i></p>	<p>The gallery of ENVIRONMENTAL JUSTICE HOTSPOTS introduces the world of conflicts associated with inequitable access to environmental resources & services. The path through the INTEGRAAL Space offers access to WORKSITES exploiting deliberative and integrative analysis techniques, through which tacit, informal and formal knowledge is melded into collective wisdom. The KerBabel deliberation support tools mobilise objects from other ePLANETe galleries to express and inform judgements by ‘Actors’ who compare different situations or opportunities for action relative to multiple criteria. Results of evaluation actions are displayed in BENCHMARKING and INTEGRATIVE ASSESSMENT galleries.</p>
<p>TALIESIN — KNOWLEDGE AND LEARNING</p> <p>Entry by initiation to the teaching and learning programmes supported by ePLANETe: BUILDING KNOWLEDGE PARTNERSHIPS FOR SUSTAINABILITY.</p> <p><i>‘TALIESIN’ is the name of a Celtic historical and mythic figure, celebrated poet, druid and bard.</i></p>	<p>The ePLANETe as a whole is an on-line “Collaborative Learning Platform” that support a broad variety of forms of discovery and of sharing of resources for learning, with the accent on community and conviviality. Corresponding galleries through TALIESIN include the FOREST OF BROCÉLIANDE with thematically organised on-line teaching resources; the YGGDRASIL (World Tree) catalogue of Teaching Programmes, the TOOLKIT gallery of key concepts methods and analysis tools; and the transversal BABEL GARDENS meta-information system for comprehensive management of documents, videos, and website profiles. There is also access to the HOT TOPICS gallery of Knowledge Quality controversies.</p>
<p>KERBABEL — THE WORKSHOP</p> <p>Entry to the ePLANETe ‘ENGINE ROOM’, the spaces of conception, design, realisation & reflexion that animate and underpin the ePLANETe on-line system.</p> <p><i>KERBABEL is an oxymoron of ‘ker’ (Breton for hearth/locality) and ‘Babel’ as in cacophony.</i></p>	<p>The ‘KerBabel’ philosophy for knowledge mediation and deliberation support tools, is to establish ‘interfaces’ between “local” (vernacular) and more “formal” (systematised, scientific, technical) dimensions of knowledge. In the KerBabel Workshop are thus found a variety of “service” galleries — including the KERBABEL INDICATOR KIOSKS (KIK), the REPRESENTATION RACK (GRILLE), and the KerBabel Deliberation Support Tools (KerDST, K4U). Finally, the PANORAMIX gallery provides a reflexive overview of the ePLANETe itself.</p>

Sources: Martin O’Connor, © KerBabel & L’Association ePLANETe Blue (2015).

Table 3. 3: Time Line for Conception and Implementations of ePLANETe Functionalities — Retrospective, by Gallery

Doorway	Space	Gallery	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TALI & KER	Elemental Catalogues	<i>The Babel² Gardens</i>	KerB	GOUV	ViV	ALARM	IACA						REEDS	REEDS	✓✓✓
TALIESIN	Elemental Catalogues	<i>Le Toolkit</i>						ALARM				EURB	REEDS		✓
TALIESIN	Learning Centre	<i>Brocéliande Forest</i>	KerB					UVED	KerB		REEDS	KICE			✓✓✓
TALIESIN	Teaching Programmes	<i>Yggdrasil</i>									OVSQ	KICE			✓✓✓
TALIESIN	KQA	<i>HOT TOPICS</i>													CogITiX
TOUTATIS	User Communities	<i>People</i>					IACA				OVSQ	KICE	REEDS		✓✓✓
TOUTATIS	User Communities	<i>Partners</i>		FONDA					PRES		OVSQ	KICE			✓
TOUTATIS	Showroom	<i>COLLABORATIVE ACTIVITIES</i>					IACA		IACA			REEDS			✓✓✓
TOUTATIS	Showroom	<i>NewsReel</i>							IACA		OVSQ	KICE	REEDS		✓
FAIRGROUND	Metabolism	<i>ECO-INNOVATION TERRAINS</i>										EURB			✓
FAIRGROUND	Dagda's Gardens	<i>Sustainability Ideas & Actions</i>										EURB			✓✓✓
FAIR & MER	Dagda's Gardens	<i>Cycles and Cascades</i>											REEDS		✓
MERLIN	Dagda's Gardens	<i>Virtual Biodiversity Gardens</i>				ALARM							REEDS		✓✓✓
MERLIN	Dagda's Gardens	<i>Territorial Food Baskets</i>											REEDS		✓
MERLIN	IEA	<i>PARC DE PATRIMOINES</i>													AMORAD
CAMELOT	Dagda's Gardens	<i>HOT SPOTS</i>										EJOLT	EJOLT		✓
CAM & TOUT	INTEGRAAL	<i>Worksites/Chantiers</i>	GOUV	GOUV	KerViV			FONDA	ALARM	IACA	BN	EJOLT			✓✓
KERBABEL	DST	<i>KerDST</i>	GOUV	KerB	KerViV		KerDST							REEDS	✓✓✓
KERBABEL	DST	<i>Les K4U</i>										EURB		REEDS	✓✓
KERBABEL	DST	<i>CogITiX (Universal Cauldron)</i>													CogITiX
KERBABEL	Panoramix	<i>The Gallery of Galleries</i>												REEDS	✓
KERBABEL	Panoramix	<i>LES SMMAAD [§]</i>		(GOUV)	KerViV	ALARM						KICE		REEDS	✓✓✓
KERBABEL	Elemental Catalogues	<i>Les KIKs (Indicator Bazaar)</i>		(GOUV)	KerViV	ALARM						EURB			✓✓✓
KERBABEL	Elemental Catalogues	<i>Les Grilles de Représentation</i>											REEDS		✓✓✓

Status as of 2014/2015 (closure of the Centre international REEDS): ✓ = Alpha prototype ✓✓ = Beta prototype ✓✓✓ = Full integrated functioning.

Sources : Oral history (Martin O'Connor & Jean-Marc Douguet, based on supporting documents for each item)

3.4. ePLANETe as a pedagogic innovation

3.4.1. The Early Years of KerBabel: Brocéliande & the “Babel Gardens”.

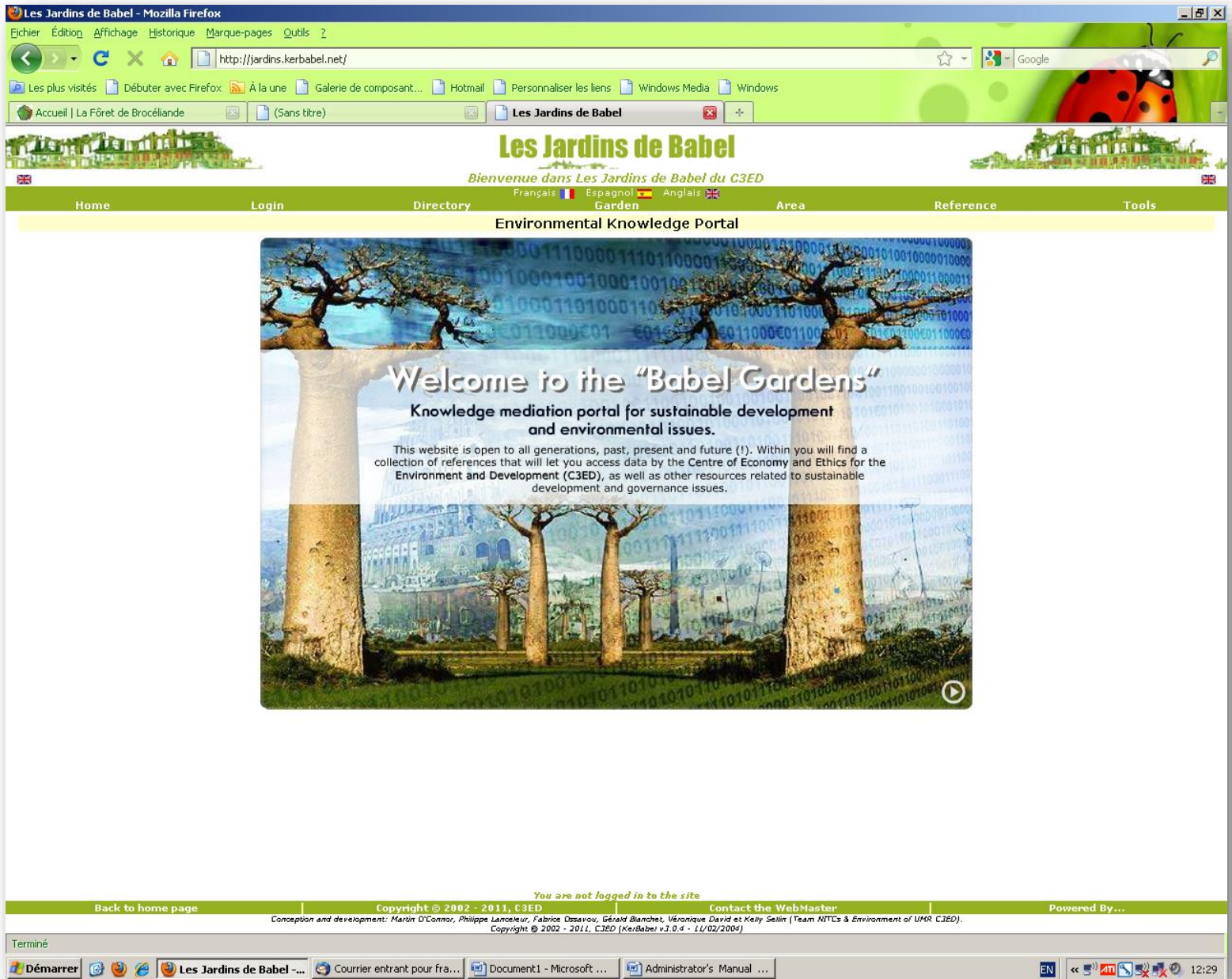
Since 2000, the KerBabel team (first established as a component part of the C3ED at the University of Versailles St-Quentin-en-Yvelines, UVSQ) has worked with partners worldwide in developing experimental tools, expertise and pedagogic support services for e-Learning in the interdisciplinary fields of ecological economics, eco-innovation, environmental governance and sustainability.

The “FORÊT DE BROCÉLIANDE” — referred to as the “Brocéliande Forest” or just “Brocéliande” — whose early prototypes date from 2001-2004, was a core component in the first generation of the KerBabel team’s forays into opportunities of the “Digital Transformation”.

The “Forest” was conceived from the outset, in 2001-2002, as a website with a modular structure for developing pedagogic resource materials on a progressive basis, around distinct themes, suitable for a diversity of teaching processes and environments. The system was conceptualised as a progressive discovery in a “virtual reality”, more particularly as a walk in a Forest. The top level of organisation was the opportunity to visit a “BOSQUET” or Wood Grove of the Forest, corresponding to a broad teaching domain or theme. A Bosquet was composed of several TREES, each of which corresponded to a block material addressing a specific topic or purpose of academic courses. Each tree could have several BRANCHES; and along the Branches it was possible to access “FRUITS” (meaning documents considered as useful reading or supplements to the material presented within the gallery itself).

These “Fruits” were managed in a separate catalogue, referred to as the “Babel Gardens”, for document and website meta-data management. The “Babel Gardens” was thus, from 2002, a complementary knowledge mediation tool developed by the KerBabel team, in support of both collaborative research and teaching activities in the ecological economics and sustainability fields. Indeed, in the early years of KerBabel (20001-2004), there was continuity in terminology and graphics style between the “Forest” and the “Gardens”, as shown by the image below presenting the “Babel Gardens” with boabob trees as a Knowledge Gateway.

Figure 3. 3: Knowledge Gateway of Babel Gardens



SOURCES: The original conception of the Brocéliande Forest, dating from 2001/2002, with its cross-linking to the Babel Gardens, was set out in an unpublished working paper by V erionique DAVID and Martin O’CONNOR(2002/ revised 2006), *La For et de Broc eliande » en 2002 : TRAME de PRESENTATION, STRUCTURE & GRAPHISME du SITE WEB*. This documentation is available as an Annex in the 2nd Edition of the Visitor’s Guide to The Forest of Broc eliande (O’Connor, Harrison & Douguet 2019), Cahier No.BB/2019-03, Collection Blue Bottles, L’Association ePLANETe Blue, France, May 2019, 68pp.

The first version of the “Babel Gardens” is documented in a variety of unpublished documents dating from 2002-2006. An overview, with a list of the available documentation, is provided (in French) in Marie-Sophie CLERC & Christelle HUE (2006), *Guide d’Utilisation de KerBabel*, Cahiers du C3ED No.2006-05B, C3ED, UVSQ, Guyancourt, 18pp.

Although the “Babel Gardens” has been a vital functional component in the initial vision and innovation path for the KerBabel suite of learning support tools, we will not focus directly on its technical specifications in this thesis. (See, however, the thesis by Philippe LANCELEUR, 2019, already mentioned). Rather, we will look particularly at the “**Broc eliande Forest**” with its ambition since 2001 for collaborative work in the development and use of on-line teaching resource materials, and at the “**Yggdrasil**” Gallery, created by the KerBabel team in 2011 in order to respond to the pressing need for a flexible tool for presentation of Teaching Programme in a context of inter-disciplinary and international partnerships (at the OVSQ-UVSQ and internationally).

3.4.2. From “Broc eliande” to ‘ePLANETE (2000-2015).

The **Forest of Broc eliande** has evolved considerably since the early experiments during 2001-2004. It has gone through various developmental versions, into a stable site integrated into ‘ePLANETE’, that fully expresses the functional features desired from the years of its conception.

The current version of the “**Forest**” is referred to as “**BROC ELIANDE7**”, in correspondence with the exploitation of the CMS Drupal version 7 in the ‘ePLANETE Platform. The main features of this current version were, however, first programmed in “**BROC ELIANDE 6**”, utilizing the CMS Drupal 6, initiated in 2009 and completed in 2011. In effect, the 2001 development was “future proofed” as much as feasible with the then-current technology, meaning that it was intended to be robust and flexible enough to accommodate Internet and operating system technology changes, including the updating with Drupal 7, during the ensuing years. We can note that this intention has been satisfied, to the extent that the “Broc eliande” gallery within ‘ePLANETE is still fully functional ten years on (that is, today in 2019).

The original idea, in 2001, was to create the capacity for production and management of a permanently evolving system of online teaching resources, as a support for university teachers and students. Research and partnership expertise at the then C3ED (Centre for Economics and Ethics for the Environment and Development) provided the incentive to envisage the creation of educational resources that could be used in a diversity of teaching environments — that is, at different universities, in programmes having distinct disciplinary or interdisciplinary character, and so on. The initial focus was at Master level, notably in support of the collaborative **Master EEE-SDP (European Ecological Economics and Sustainable Development Policy)** programme implemented during 1998-2000 as a multi-lateral partnership coordinated by Professor Martin O’Connor at the UVSQ. But the wider ambition, supported by the ESEE Secretariat and Presidency (European Society for Ecological Economics) based at the C3ED

during the initial years 1996-2000 of the ESEE, was to provide a shared resource for and with colleagues in Ecological Economics across the European space.

So, the accent was placed on “pedagogic resources” rather than the concept — quite trendy already at that time, but more restrictive — of “courses on-line”. The KerBabel team’s intention was to develop a system of production and management where content was easily added and modified, and where content could be accessed and exploited in a flexible way. In other words, “**Brocéliande**” was to be exploited on an ongoing basis for continuous development and updating of teaching resources, at the initiative of teachers and students, without day-to-day dependence on specialised IT personnel. It was to be readily accessible without any need for specialised training, and to give students and other visitors to the site a lot of autonomy in how they choose to study and what they choose to consult.

This ambition was expressed, as already mentioned, by the design vision of a system of teaching resources accessed as a *progressive discovery in a “virtual reality, more particularly as a walk in the Forest*. The top level of organisation was the opportunity to visit a “Bosquet” or Wood Grove of the Forest, corresponding to a broad teaching domain or theme (e.g., Integrated Environmental Assessment). A Wood was composed of several Trees, which corresponded to material addressing a specific topic of academic courses (e.g., the multi-criteria evaluation of sustainable agriculture strategies for a territory). Each tree could have several BRANCHES; and along the Branches it was possible to access “Fruit” (meaning individual documents considered as useful reading or supplements to the material presented within the gallery itself). These “Fruits” were managed in a separate cataloguing system, referred to as the “**Babel Gardens**”.

After several years of experimentation with website development and use, and scrutiny of other on-line teaching resource systems, and taking account of evolution in the ICT sector, a complete re-engineering of “**Brocéliande**” was carried out. Adopting the CMS (Content Management System) Drupal 6 as the core development tool, this redevelopment (undertaken during 2009-2011) retained the main original features of the hierarchical structure of Bosquets / Trees / Branches and Fruits, but now reframed more prosaically as MODULES/AREAS/GRAINS, and Fruits. But it also introduced two important new functionalities, in order to fulfil the teaching innovation objectives:

- (1) The opportunity for predefining multiple Learning Pathways within a Module; and
- (2) The opportunity for Grain-to-Grain “cross-links allowing “surfing both within a Module and also between Grains mobilised in distinct Modules.

These new functionalities provided, in a mature way, the flexibility for incremental content development and for autonomous navigation by users within the teaching resources gallery — thus catering to the diversity of teaching resource contexts and uses desired for the system.

During 2012-2013, in a final innovation phase, the “**Brocéliande Forest**” was embedded as a constituent gallery within the larger ‘ePLANETe’ structure. This multi-gallery system (already presented in the preceding section) in fact re-took and generalised the Brocéliande6 logic of “cross-links” between objects within a gallery, to provide the systematic opportunity for cross-linking of objects between and across Galleries.

In parallel with the re-engineering of Brocéliande, over the years a variety of other functionalities and platform components have been developed by the KerBabel team to support e-Learning goals and

initiatives. These various galleries with their distinctive contents and functionalities, which are all integrated within 'ePLANETe' since 2013, are in addition — and complementary — to the contents and functionalities of the **"Forest of Brocéliande"** itself. Today, therefore, in a fundamental sense we can consider the entire 'ePLANETe' system as the KerBabel prototype of a multi-functional on-line educational support tool.

3.4.3. Challenges of Partnership Diversity and Open Innovation

During the early years of KerBabel (2000-2004), there was ongoing discussion about the ways that the "Brocéliande" system of thematically organized teaching resources could, or should, be linked in with emerging institutional systems for (1) on-line presentations of University teaching programmes; (2) the provision of "on-line courses" (that is, Internet-based university education and examination); and (3) the associated needs for electronic document management.

For the KerBabel team, the priority remained to encourage and facilitate the production and exchange of educational resources between the sources (resource providers) and the readers (resource users), across an extended community. From 2003/2004, as a result of restructuring the French national degree structure into a 3-5-8 format (Bachelor-Master-PhD) to accommodate standardisation across European universities, the ambitious interdisciplinary Master SETE (Sciences of the Environment, Territory and the Economy) programme was created at the UVSQ. Development proposals for the **"Forest of Brocéliande"** at this time reflected a need to broaden the spectrum of envisaged educational fields from the initial EEE-SDP focus, to the much wider Master SETE spectrum. But uncertainties still remained about the ways in which, or the extent to which, the "Brocéliande/Babel Gardens" framework for collaborative development of pedagogic resources, could be put in synergy with institutional "e-Campus" initiatives aimed at providing digital collaborative learning environments (les ENT, *Espaces Numériques de Travail*) for students and university teachers.

The innovation perspectives and priorities of the KerBabel team during this time were, naturally, influenced by their vision of the needs and purposes of the reference user communities.

On the one hand, it was seen as necessary to maintain, and indeed diversify, a central role for the **"Babel Gardens"** as an omnibus document management system which, in addition to its role for managing the "Fruit" for "Brocéliande", also provided a permanent cataloguing and access service for the diversity of products generated in and around collaborative research projects.

This priority was reinforced by the diversity of partnership activities engaging colleagues at the C3ED. In addition to ongoing participation in European collaborative projects (such as GOUVERNe, VIRTUALIS and ALARM, all of which exploited the Babel Gardens for comprehensive and durable document management), the needs were expressed for electronic documentation of:

- Doctoral research (noting that PhD theses if readily available, were particularly high value educational resource materials);
- Partnerships at territorial level (e.g. with the members of FONDaTERRA established in 2003);
- Collaborative research, innovation and teaching activities associated with University-business partnerships (notably the industrial Chairs, the first of which was the Chair Econoving),

- ❑ and North-South cooperation programmes (the C3ED having evolved in 2001 to the status of a UMR — mixed research unit — in partnership with the French IRD).

On the other hand, members of the KerBabel team were engaged in collaborative research projects, exemplified by the European Commission funded project VIRTUALIS (2001-2004) for the design and development of prototypes of Internet-based “deliberation support tools” suitable for collaborative learning in education and in sustainability policy debates and decision-making. This work sensitized the team members to the radical innovation opportunities opened up by the new technologies, notably for capacity building through contributions of data, case study analyses and learning support basis on a collaborative “open innovation” basis involving extended peer communities.

The institutional “e-Campus” and e-Learning platform concepts prevailing in the early 2000s, did not yet respond to this pedagogic vision of open innovation in extended peer communities. So the KerBabel team was motivated to pursue its concept and prototype innovation work.

The period 2008-2010 at the UVSQ was marked by several facets of institutional change and internal restructuring. Versy briefly:

- ❑ At the territorial scale, during 2007-2010 the UVSQ together with the Université Paris Sud, was a core member of the “PRES UniverSud Paris” whose missions included the progressive mutualization of Master and Doctoral teaching programmes for the partner universities. The “PRES UniverSud Paris was, indeed, the umbrella structure for the establishment in 2008-2009 of the Econoving industrial Chair partnership, whose Chair-holder and related teaching and Phd programmes were housed at the UVSQ. This “PRES” structure was soon overtaken by parallel initiatives for the establishment of a mega-pole of research and high education at “Paris Saclay” but, the initiatives during 2008 for mutualization of Masters level teaching programmes and for international relations has nonetheless provided motivation for the development of flexible on-line tools for teaching and partnership programme presentation.
- ❑ With the UVSQ, the opening of a new building at Guyancourt for researchers of the IPSL, the establishment of the OVSQ with a triple research, teaching and observation mission at the UVSQ, and a new Four Year Plan providing for expansion of the Master SETE teaching programmes, created a concatenation of circumstances that saw the C3ED research centre phased out, and several distinct research structures established — these including the Centre international REEDS (operating during 2010-2015).
- ❑ At the European level, several major collaborative research and innovation network structures were established, including the “Climate KIC (Knowledge Innovation Community), providing for FONDaTERRA, REEDS and other environmental research laboratories (notably of the IPSL) with a new substantial terrain for collaboration in research, innovation partnerships and interdisciplinary teaching.

In this rapidly evolving institutional context, work by the KerBabel team continued, with the engagement of Drupal 6 specialist developer Ellis Hettinga to assure the re-engineering of the “**Forest of Brocéliande**” to provide for the desired functionalities of multiple Learning Pathways within a Module and a complementary “Grain-to-Grain” navigation opportunity. New navigational conventions were thus implemented to facilitate movement and connection between Areas and Grains. This work was

completed in 2011, and the new system was tested with the development of content in new Modules, including “AGRI-GNOSTICS” (Sustainable Agriculture), “BEST” (*Biodiversité comme un Enjeu de Stratégie Territoriale*) and “CxDD” (*Complexité et Développement Durable*).¹²⁷

More particularly, a parallel development project was initiated by KerBabel for the creation of the “**YGGDRASIL GALLERY**” designed for the presentation of Teaching Partnership Programmes, with profiles of the associated Partners and the component “Courses” (see sub-section 3.4.4 below).

his complementary gallery development made use of structural and navigation features in direct analogy with the Module/Area, Pathway, Grain-to-Grain cross-links”, and supplementary “Fruits” concepts already operational in “Brocéliande”. The **YGGDRASIL GALLERY**, in Beta-prototype, was completed in 2012 with immediate application to the spectrum of 1st and 2nd-year Master programmes in the OVSQ’s Master SETE, and, notably, with a view to deployment at wider partnership scales, notably for supporting the Education Programme of the Europe-wide Climate KIC (Knowledge Innovation Community).

With the Grain-to-Grain cross-linking functionality being generalised, during 2012, to permit linkages between objects belong to distinct galleries all compiled with the CMS Drupal 6, it was now possible to envisage not just the exploitation of the “**Babel Gardens**” for accessing Fruits as supplements to material managed on a website shc as Brocéliande, but also the “cross-linking” of contents from multiple galleries. This gave impetus for the completion of several prototype designs that had sat of the KerBabel table for several years, notably — as examples — the implementation of cross-linked CMS galleries for profiles of **People & Partners**, **Collaborative Activities** of all sorts (not only limited to Teaching Programmes already provided for with Yggdrasil) and **Sustainability Innovation Ideas**.

The conditions were thus satisfied for the implementation of a fully integrated platform of cross-linked galleries: this was the basis for the emergence of ‘ePLANETE’ as a unique structure during 2013.

¹²⁷ The 2011 paper and on-line editions of the *Visitor’s Guide to The Forest of Brocéliande* (Harrison Douguet & O’Connor 2012) were composed on the basis of this innovation cycle; and visual concepts for Brochures, Poster presentations and the website itself (<http://Broceliande.KerBabel.net>) were established at the Centre international REEDS.

3.4.4. The Yggdrasil Gallery for Presentation of Educational Programmes

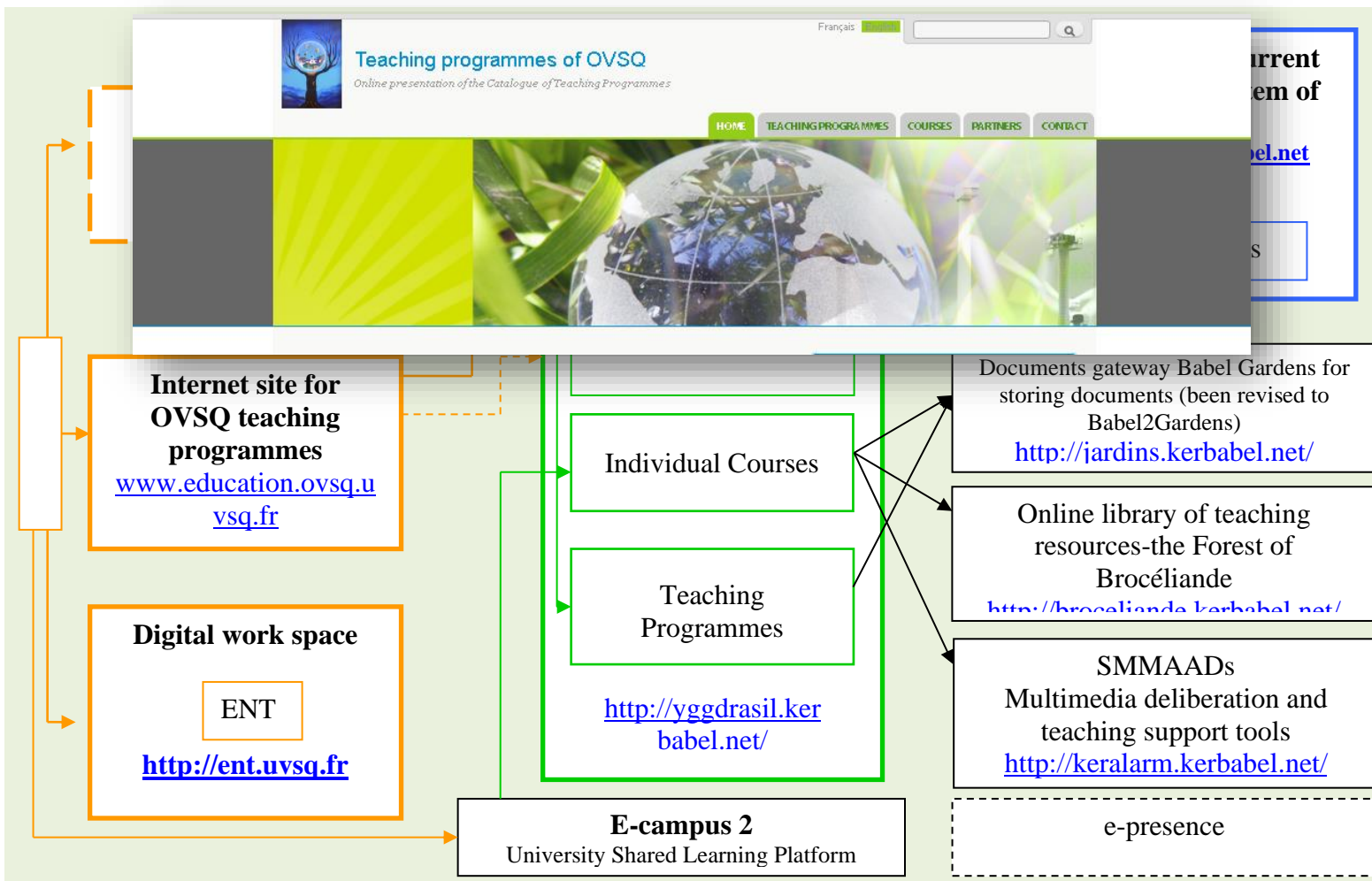
Because a significant part of this thesis is taken up with documenting applications of the Yggdrasil Gallery as an institutional innovation for the Internet-based management of interdisciplinary teaching partnership information, it is important to describe some key design features of this Gallery and to show how it fits within the larger 'ePLANETe' functionalities. For this purpose, we present the Yggdrasil Gallery as it was implemented, during 2012, for use at the OVSQ. The main source for this presentation is the documentation compiled at that time by members of the KerBabel team within the Centre international REEDS, notably in: Douguet J-M, Grall J, Harrison F (2013), **Yggdrasil: an online presentation of teaching programmes from the Observatoire de Versailles-Saint-Quentin en Yvelines**, Centre international REEDS, UVSQ, Rambouillet.

This documentation of Yggdrasil opens with the short text and diagram reproduced below, showing the vision at that time of the ways that Yggdrasil functionalities were linked in with other KerBabel tools and with other elements of OVSQ-UVSQ information. A comparison with the diagram dating from 2006, presented at the outset of this chapter, of the early KerBabel vision of e-Learning support functions, shows clearly the continuity with the 2002/2006 concepts, but also elements of institutional and technological evolution.

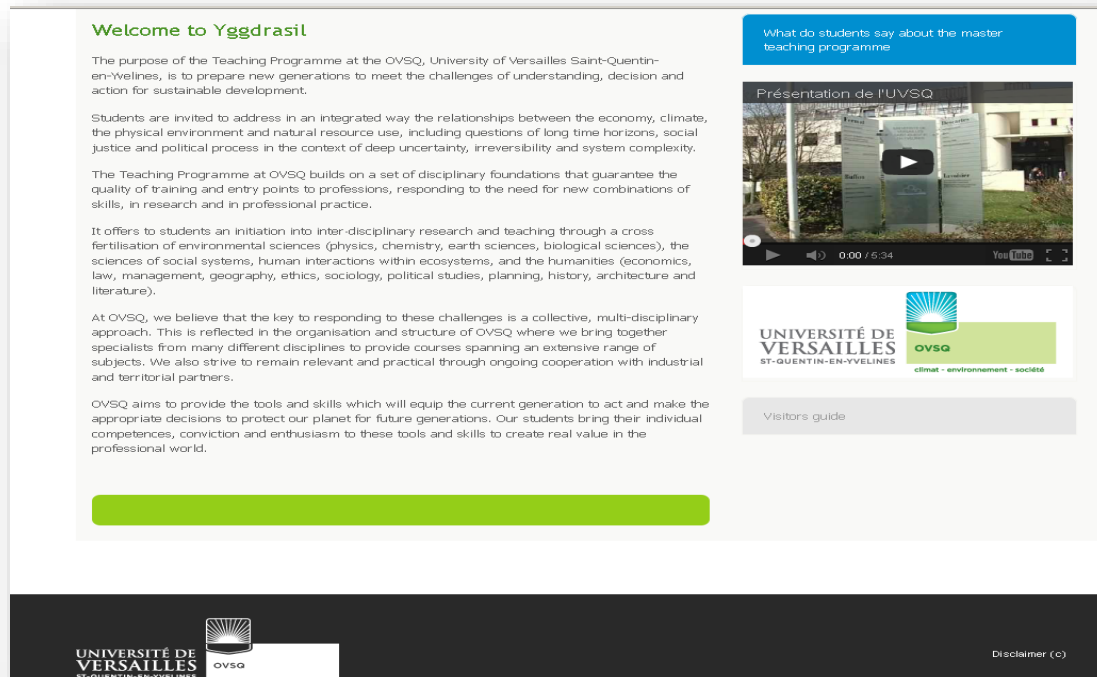
How the Yggdrasil Tree fits into the digital environment of the UVSQ

The UVSQ and its OVSQ have several online tools which are integrated so that visitors to these sites/tools can explore from various entry points. For example, a visitor to the *Yggdrasil* teaching programme and course catalogue can go directly to a *Current Events and Partners* site for more information on what that partner does; or to the online teaching resources library *The Forest of Brocéliande* to explore information on teaching topics of interest; or can go directly to an online collection of support documents/digital objects stored in the *Babel²Gardens*.

Table 3. 4: How the Yggdrasil Tree fits into the digital environment of the UVSQ



The Yggdrasil Home Page



The screenshot shows the Yggdrasil Home Page layout. On the left, there is a 'Welcome to Yggdrasil' section with several paragraphs of text. On the right, there is a blue header for a video titled 'What do students say about the master teaching programme'. Below this is a video player showing a presentation of the UVSQ. Under the video player is the logo for 'UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES' and 'OVSQ' with the tagline 'climat - environnement - société'. Below the logo is a 'Visitors guide' link. At the bottom of the page, there is a dark footer containing the university logo and a 'Disclaimer (c)' link.

Welcome to Yggdrasil

The purpose of the Teaching Programme at the OVSQ, University of Versailles Saint-Quentin-en-Yvelines, is to prepare new generations to meet the challenges of understanding, decision and action for sustainable development.

Students are invited to address in an integrated way the relationships between the economy, climate, the physical environment and natural resource use, including questions of long time horizons, social justice and political process in the context of deep uncertainty, irreversibility and system complexity.

The Teaching Programme at OVSQ builds on a set of disciplinary foundations that guarantee the quality of training and entry points to professions, responding to the need for new combinations of skills, in research and in professional practice.

It offers to students an initiation into inter-disciplinary research and teaching through a cross fertilisation of environmental sciences (physics, chemistry, earth sciences, biological sciences), the sciences of social systems, human interactions within ecosystems, and the humanities (economics, law, management, geography, ethics, sociology, political studies, planning, history, architecture and literature).

At OVSQ, we believe that the key to responding to these challenges is a collective, multi-disciplinary approach. This is reflected in the organisation and structure of OVSQ where we bring together specialists from many different disciplines to provide courses spanning an extensive range of subjects. We also strive to remain relevant and practical through ongoing cooperation with industrial and territorial partners.

OVSQ aims to provide the tools and skills which will equip the current generation to act and make the appropriate decisions to protect our planet for future generations. Our students bring their individual competences, conviction and enthusiasm to these tools and skills to create real value in the professional world.

What do students say about the master teaching programme

Présentation de l'UVSQ

UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES OVSQ climat - environnement - société

Visitors guide

UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES OVSQ

Disclaimer (c)

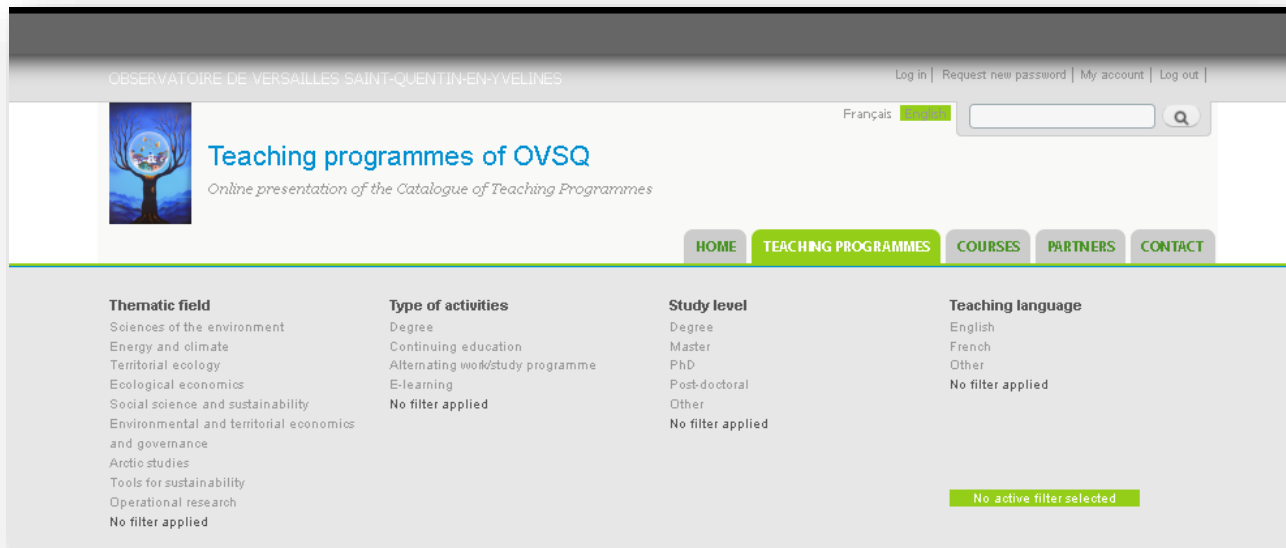
Prominent navigation tabs provide access from the Yggdrasil **Home** page to the key components of website content: **Teaching Programmes, Courses, Partnerships, Contact**.

A video embedded on the home page of Yggdrasil presented the UVSQ and OVSQ faculty based at the Guyancourt Campus. This video was in French but it highlights the principle of immediate access to visual as well as textual multi-media objects.

More substantively, the Home page contains a general introduction to the Teaching programmes and their courses, their objectives and orientations.

Presentation of Teaching Programmes in Yggdrasil

This part of the website is organized in two parts. First, there is a search engine at the top of the screen (see image below), which comprises a set of four filters to facilitate the search for or selection of a desired Programme. The filters are presented as a table of contents whereby you choose the *field of interest*, *the type of education*, *the study level* and *the teaching language* in order to target what you're



looking for.

Then, in the second section, there is displayed an alphabetical list of Teaching Programmes, for the full spectrum or a sub-set corresponding to the selection criteria applied. Each Teaching Programme is presented via four pieces of information:

- A photo associated with the programme may be present (but not always) to make it easier to identify the programme visually beside the title
- The level of qualification/degree such as bachelor, master...
- The teaching language (French and/or English),
- The study field which the programme relates to so that visitors can easily see if that interests them or not.

Clicking on a Programme title then gives access to the full profile.

- The main content describing the programmes is presented under **CHALLENGES, AIMS, STRENGTHS, CAREER PROSPECTS**.
- Documents such as a programme brochure can be attached with the option of printing it and a photo illustrating the programme theme or where it is conducted can be added.
- Additional information may also be available concerning teaching methods used by teachers, who is leading the programme etc.

Figure 3. 4: Presentation of a Teaching Programme: Elements on the page

The screenshot shows a web page for a teaching programme. A red circle highlights the 'Teaching programme:' section, which includes the title 'Environmental knowledge. Mediation, Partnerships for Sustainable Development (MEDIATION)', degree level 'Master', duration '1 semester', and location 'Rambouillet, Saint-Quentin-en-Yvelines'. A callout box labeled 'Message from the tutor' points to a green box containing a quote from Jean-Marc Douquet, the programme coordinator. Another red circle highlights a 'List of related programmes' section, which lists 'Biological Economics, Integrated Environmental Assessment' and 'Master 1 SETE - Ingénierie du Développement Durable'. A third red circle highlights a 'List of courses' sidebar on the left, listing various topics like 'Multimedia Tools', 'Participatory Methods', and 'Sustainable Development'. At the bottom, there is a 'Notes' section with bullet points about the programme's research-based and project-based nature, and contact information for the coordinator and secretarial support.

Structured discovery of the teaching courses

Starting from the Home Page, by selecting the tab '**Courses**' and applying search filters on courses, it is possible to search by **TEACHER, DISCIPLINE, LANGUAGE, COURSE CODE** (if you know it), **COURSE TITLE**. The courses page is divided into two sections:

- ❑ At the top of the page is a search function using filters (as just described);
- ❑ The second section shows a list of courses (papers) arranged in alphabetical order

As you can see, each course name is associated with a course code to clearly identify the course when enrolling, the teacher is identified as well as the teaching language(s) used.

OBSERVATOIRE DE VERSAILLES SAINT-QUENTIN-EN-YVELINES

Log in | Request new password | My account | Log out | Français

Teaching programmes of OVSQ

Online presentation of the Catalogue of Teaching Programmes

HOME TEACHING PROGRAMMES **COURSES** PARTNERS CONTACT

Teacher(s) - Any - Discipline - Any - Teaching language - Any -

Course code Title Search Reset

Courses

Title ▲	Course code	Teacher(s)	Teaching language:
Mise à niveau fondamentaux (CDEQ)	MPCDE30A	Bailly/Hoyet	French
Achats responsables	MSERS412		French
Achats responsables : supply chain, gestion risques, responsabilité élargie, éthique, chartes	MSERS408	M. Yacine	French
Acoustique	MSENB4	Philippe BOUSQUET	French
Acteurs, cadre institutionnel et territorial du tourisme	MSETQ303	Didier RAMOUSSE	French
Aérosols, pollution, climat	MRTEL???		French
Agenda 21 et aménagement (Territoires Durables)	MSEME411	Anaud Comolet, Martin O'Connor	French
Aménagement et mobilité	MSETE221	??	French
Analyse critique d'articles scientifique en anglais	MSSE106	Mathieu ROY-BARMAN	French
Analyse d'images et proj.informatique	MRTEL305	Gérard Caudal, Laurence Picon et Michel Roux	French
Analyse des données qualitatives et quantitatives	MSEEC114	SOUCARIS Arnaud	French
Analyse économique et gestion des risques urbains	MSEGR306	Denis LEVY (IGD)	French
Analyse économique et gestion du risque radiologique			French
Analyse économique et Maîtrise du Risque	MSEGR303	Jean-François VAUTIER (CEA)	French
Analyse et méthodes statistiques	MS2PHXXX	??	French
Analyse et traitement de l'information	MIEDD321		French
Analyse Prospective et Veille	MSEME303	Christelle HUE	French



Home » COURSES

This course is mobilised in teaching programmes:

- Sustainability studies: Theories-Tools-Terrains
- Sustainability studies: Theories-Tools-Terrains CERTIFICATE

Current programme

No teaching programme chosen yet

Course:

Introduction to Sustainability: Concepts and Challenges (Keynote seminars)

View Edit Revoke Translate

Teacher(s): Prof. Martin O'Connor, Prof Andrew French
ECTS credits: 2.5
Teaching language: English

Contact information
martin.oconnor@ovsq.fr

OBJECTIVE Presentation

Emergence of the concept of sustainable development. Historical antecedents in the classics and heterodox economic thought. Development and environment: écodeveloppement; alternatives to development. Indicators and norms for SD. System modelling perspectives. Key policy issues: energy; climate, water; biodiversity; sustainable consumption; governance.

Attached documents:

Brochure albion.doc



Course structure:

This course is taken in Year 1 of the Albion College students' B.A programme

Classes are held at Albion College USA

More

Education methods:

Classes are held at Albion College. Professor Andrew French is the day-to-day custodial tutor but twice a year Professor O'Connor is on site to give lectures and assist students. The remainder of classes are conducted online via video conferencing with tutors in France.

Individual and group work is expected for assignments.

Teaching programmes of OVSQ
Online presentation of the Catalogue of Teaching Programmes

HOME TEACHING PROGRAMMES COURSES PARTNERS CONTACT

Home » Teaching programmes » Current programmes » Sustainability studies: Theories-Tools-Terrains

This course is mobilised in teaching programmes:

- Sustainability studies: Theories-Tools-Terrains
- Sustainability studies: Theories-Tools-Terrains CERTIFICATE

Current programme

Sustainability studies: Theories-Tools-Terrains
» go to programme details

List of courses

- Introduction to Sustainability: Concepts and Challenges (keynote seminars)
- Long-term Radioactive Waste Stewardship
- Urban Systems & Territorial Ecology
- Fisheries and Marine Ecosystems
- Management & Governance of Coastal Zones
- Water Resources Stewardship
- Climate Change and the Carbon Economy
- Sustaining Biodiversity Values
- Sustainability Agriculture
- Topics in Eco-innovation: System performance & social acceptability (panel)
- NTICs and the Environment
- Valuation and Evaluation**
- Time and Uncertainty (System indeterminacy): Analysis and Governance of Risks
- Health & Environment

Course:
Valuation and Evaluation

View Edit Translate

Teacher(s): Martin O'Connor
ECTS credits: 7.5 pts
Teaching language: English

Objective Presentation

Nature & Value (theory of value, revisited): Introduction to philosophical and methodological perspectives on valuation of the environment. The spectrum of methods of evaluation (premises and purposes): Opportunity cost, substitutability and monetary valuation; Incommensurability and multi-criteria perspectives; Uncertainty and complexity; Deliberative processes; Social Choice and the roles of valuation in sustainability assessment. Applications of different approaches to local and global scale issues.

Attached documents:
Brochure albio.doc

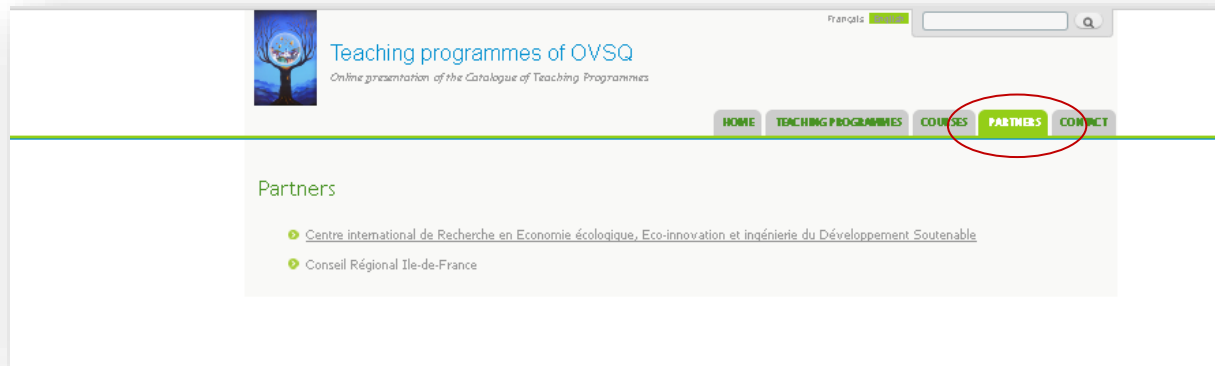
Course structure:
This course is taken in Year 2 of the Albion College students' B.A. programme

Classes are held at Albion College, Michigan, USA.

Access to the Gallery of Partner Profiles

Partner contributions to Teaching Programmes (or to individual Courses) can take different forms, such as lectures, collaboration for production of pedagogic resources, participation in conference cycles, supervision of students' projects or thesis studies. Increasingly, Master level programmes include provision for major blocks of work experience or internships for students, enabling them to test and deepen competences acquired in a practical context. Partners may also include institutions making financial contributions of any sort to the University, providing resources helping to improve courses and teaching programmes and to support initiative which help students in the first stages of their careers..

On the Yggdrasil Home Page, the '**Partners' Tab** gives access to a list of Partners involved in the Teaching



Programmes and those linked to its partners.

As developed in 2012, if a site visitor clicks on a Partner title in the list, they will discover which Teaching Programmes involve this partner.



Thus, the intention of the cross-linking of Yggdrasil Teaching Programme profiles and Partner information, is, on the one hand to provide visibility as to the collaboration activities in the teaching domain and, on the other hand to provide access to detailed information on each Partner organization.

By clicking on a **Partner** link, the visitor in YGGDRASIL is taken through to the corresponding Partner Profile information created and managed in a complementary KerBabel catalogue, for *PARTNERS & PEOPLE*. (The direct Internet access can be obtained at: <http://partners.kerbabel.net>).

A **Partner Profile** as composed in this KerBabel catalogue looks like this:

Figure 3. 5: A Partner Profile as composed the KerBabel catalogue

Partners
UVSQ



REEDS

Centre international de recherche en Economie écologique, Eco-innovation et ingénierie du Développement Sustainable

Identity

Address :

Bâtiment Aile Sud, 15 Bergerie Nationale
78120 Rambouillet France

Country :

France

Telephone :

+33(0)1 39 25 31 11

Fax :

+33 (0)1 39 25 31 21

Website :

www.reeds.uvsq.fr

Head of the organisation :

Martin O'Connor, *Director*

Contact details :

Martin O'Connor, *directeur scientifique*
Marie-Françoise Vanier *adjoite au directeur*

Centre international REEDS – OVSQ

Tel : 01 39 25 31 14 Ou 01 39 25 31 15

Fax : 01 39 25 31 21

Contact person :

Martin O'Connor

Contact details contact person :

Martin.O-Connor@reeds.uvsq.fr, Tel. +33 1 39253141

Google map:



Type of activity :

RES-Research

Status :

GOV : Governmental
Short presentation fFrench)

The example given is of the Centre international REEDS as of 2012. Partner Profile meta-information includes:

- Name, address, phone, website
- Senior manager(s)
- Key contact(s)
- Location via a Google map
- Type of activity
- Status
- A short and long presentation on the organisation in French and/or English
- General information on key activities, special strengths, national and international relationships
- Events and activities linked to the partner: a list of links classed by title and date which link to news articles relating to partner activities

3.4.4. Positioning Yggdrasil in 'ePLANETe' — The TALIESIN Doorway

Since 2012, the “**Brocéliande Forest**” has been embedded as a constituent gallery within the larger ‘ePLANETe’ structure which allows “cross-links” between objects within and across all constituent Galleries (including, but not limited to, the **Babel Gardens**). In the same way, the “**Yggdrasil**” Gallery for presentation of Teaching Programmes is an integral component of ‘ePLANETe’.

We have seen also, through the examples of the “**Babel Gardens**” for document and file management, and the “**Partners**” Gallery for the development and management of data about institutions implicated in collaborative activities of all sorts, that “**Brocéliande**” and “**Yggdrasil**” are fundamentally component parts of a greater whole. Today, therefore, in a fundamental sense, we should consider the entire ‘ePLANETe’ system as a multi-functional on-line educational support tool.

It becomes important, in this context, to position the character and uses of “**Brocéliande**” and “**Yggdrasil**” relative to other galleries of the ‘ePLANETe’ system. Recall that, in Section 3.3 above, we have presented in tabular formats, the complete set of Galleries found in ‘ePLANETe’ as of 2019, and their organisation relative to the six ‘Doorways’ of the platform. This allows us to “zoom in” to highlight the sub-set of galleries that are associated specifically with the interface of higher education, digital transformation and sustainability.

In general a Gallery is associated, through a Space, with only one Doorway of ePLANETe.¹²⁸ We retake, in the table below, the sub-set Galleries associated with the **TALIESIN Doorway**, and also those associated with the **TOUTATIS Doorway**. These are the Galleries of ‘ePLANETe’ that, individually and as components of the larger whole, provide “generic” services and functionalities directly in support of e-Learning and, more widely, higher education partnerships for sustainability.

We provide a paragraph of commentary for each of these Galleries (in the column on the right of the table), in order to situate their origins, roles and character in the emerging vision and functioning of ‘ePLANETe’.

¹²⁸ There are exceptions to this rule, but they do not impact on the present exposition. As the table shows, the “**Elemental Catalogues**” Space is linked with two Doorways (KERBABEL and TALIESIN); the “**Deliberation & Evaluation**” Space is linked with two Doorways (CAMELOT & TOUTATIS); and “**The Dagda’s Gardens**” Space is linked with three Doorways (MERLIN, FAIRGROUND & CAMELOT).

Table 3. 5: Commentary ‘ePLANETe’ Galleries

Doorway	Space	Gallery	Genealogy & Roles
KERBABEL & TALIESIN	Elemental Catalogues	THE BABEL² GARDENS <i>(Hall of Mirrors)</i>	<p><i>First Prototype by KerBabel in 2002, with catalogues of documents, videos, images and websites (etc.), organised by research project, institution or collaborative programme. Exploited for C3ED-UVSQ teaching support (with “Fruits” for Brocéliande) and for European project documentation 2002-2009.</i></p> <p><i>Revised meta-data structure in 2010-2012, to match international norms, with distinction between: Reference (for documents and other electronic objects stocked in the gallery); Notice (signalling on-line teaching resources); WebRef (profiling a website URL); and Record (for an Objet in ePLANETe itself).</i></p> <p><i>Re-engineered with El Fresco 2013 (as The Babel²Gardens), and fully articulated with all Galleries of ‘ePLANETe’.</i></p>
TALIESIN	Elemental Catalogues	Le Toolkit <i>(Theories Methods Tools)</i>	<p><i>A gallery of profiles of analysis frameworks and tools. Conceived during 2011-2012, as a component of ‘ePLANETe’, as a response to a pragmatic need for contextualisation of indicators and scenario profiles exploited in deliberation exercises.</i></p>
TALIESIN	The KerBabel Learning Resource Centre	The Forest of BROCELIANDE	<p><i>First Prototypes in 2001/2002 (Brocéliande 1 and 2), with a hierarchical structure (Bosquets / Trees / Branches), and with linkages to “Fruits” in the Babel Gardens. Re-engineered in 2003-2004 with Joomla; exploited in teaching (Masters) at C3ED-UVSQ.</i></p> <p><i>New design 2009 with multiple Pathways within a module, and with Grain-to-Grain cross-links across</i></p>

Doorway	Space	Gallery	Genealogy & Roles
			<i>the full forest. Re-engineered with Drupal 6 (Ellis Hettinga) in 2009-2011; integrated 2012-2013 into the multiple gallery structure of 'ePLANETe'.</i>
TALIESIN	Teaching Activities & Programmes	YGGDRASIL	<i>Conceived and implemented in 2010-2011 as a modular presentation of Profiles of Teaching Programmes and components (called 'Courses'), free from administrative and technical rigidities imposed by specific educational institutions or their hierarchies.</i>
TALIESIN	KQA	HOT TOPICS	<i>A gallery (under development 2016-2019) of profiles of situations of knowledge controversy, for KQA deliberation support.</i>
TOUTATIS	ePLANETe Communities	PEOPLE PARTNERS	<i>The Gallery of profiles of "Partners" has its origins in the compilation, during 2003, of an on-line database of institutions of relevance for the creation of the "Fondation européenne pour des Territoires Durables" (FETD, later named 'FONDaTERRA'), established as a vehicle for action-research and educational partnerships at the UVSQ during 2004-2014. The "Partners" meta-data structure was revised in 2007-2008 with a view to implementation for partner profiles of C3ED collaborative activities (Equipe IACA du C3ED) and, in parallel, in support of international relations partnerships for the PRES UniverSud Paris (2007-2009). Fully operational galleries of "Partners" and "People" were implemented during 2011-2013 (Centre international REEDS) and are integrated with full cross-link functionalities within 'ePLANETe' since 2013.</i>
TOUTATIS	Showroom	Gallery of	<i>The Gallery of Collaborative Activities, originally (2007-2009) conceived as an on-line catalogue of</i>

Doorway	Space	Gallery	Genealogy & Roles
		<p>COLLABORATIVE ACTIVITIES</p> <p>NEWSREELS</p>	<p>research activities in parallel with paper “Brochure” or Flyer presentations (Equipe IACA du C3ED, R2DS), was realised with Drupal 6 during 2011-2013 for use by the Centre international REEDS (EA 4456 UVSQ), incorporating full cross-link functionalities to other galleries of ‘ePLANETe’ (such as Partners, Yggdrasil, etc.) since 2013.</p> <p>The “NewsReels” gallery was conceived and implemented by KerBabel™ during 2011-2012 as a service functionality for dissemination of news items by members of research and teaching networks (e.g., the Master SETE OVSQ-UVSQ, the Climate KIC, the Greater Western Paris RCE). Created with Drupal 6, it presents short profiles of “Current Events” classified by various filters, and cross-linked to objects in other galleries (such as Teaching Programmes in Yggdrasil, Collaborative Activities, and Partner profiles). Although fully functional within ePLANETe, a rethink and re-engineering to take account of the sweep of generic “social network” systems is now on the agenda.</p>

This overview permits us to see how it is not just “Brocéliande” and “Yggdrasil”, but rather the complete sub-set of ‘ePLANETe’ galleries associated with TALIESIN and TOUTATIS, that provides a comprehensive innovation structure for support of e-Learning activities, in a collaborative partnership perspective. In this regard, two final points should be noted.

First, within ‘ePLANETe’, the generic e-Learning support tools are complemented by other KerBabel galleries and functionalities that provide more specifically for user engagement in multi-actor multi-criteria evaluation and deliberation activities. Key design features for these KerBabel tools for “deliberation support”, and their place in a vision of innovation in educational “ICT for Green”, are discussed in the following sections of this chapter.

Second, there is no attempt, within the KerBabel suite of e-Learning support tools, to substitute for generic tele-communication media (Internet, visio-conferencing, etc.). On the contrary, ‘ePLANETe’ provides web-services — content and tools — in support of certain sorts of collaborative learning and

work activities (notably addressing sustainability challenges) that, by design, can make use of prevailing digital communication technologies.

3.5. The KerBabel Deliberation Support Tools

3.5.1. The Birth of the KerBabel “SMMAAD” Concept

The purpose of this section is to show the genesis in work by the KerBabel team at the C3ED UVSQ during the years 2000-2005, of design concepts for **MM-DST** (multi-media deliberation support tools) with applications to environmental governance and sustainability.¹²⁹ For simplicity, we explain how these generic concepts emerged and were put to work in the **KerViViANE** MM-DST creation by the KerBabel team in the **VIRTUALIS** Project.¹³⁰ Then we show their generalisation, in the ALARM Project during 2005-2008. This provides the backdrop for the exposition, in the next section, of the “KICE” and “Fairground” SMMAAD concepts developed in 2010-2012 for deployment in the Climate KKIC Education and Innovation programmes.

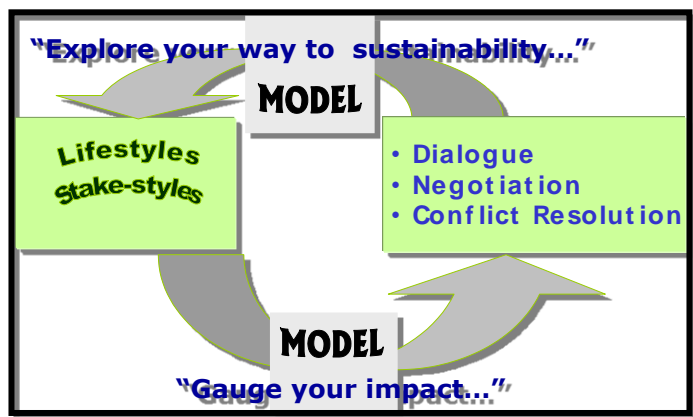
¹²⁹ The term for **MM-DST** (multi-media deliberation support tool) in English, was loosely translated by the KerBabel team as *Système MultiMedia d’Apprentissage & d’Aide à la Délibération*. The acronym SMMAAD has subsequently been retained by the KerBabel team for the general class of modular multi-function on-line collaborative learning and deliberation support systems (e.g., Ker-ALARM in the ALARM Project, and Ker-Becquerel in the AMORAD Project).

¹³⁰ This section is based mostly on material from a book chapter by Prof. Martin O’Connor (2006), entitled “Building Knowledge Partnerships with ICT? Social and Technological Conditions of Conviviality”. It focusses mostly on the ICT “DST” (Deliberation Support Tool) prototypes created in the context of two European Commission funded multi-partner projects coordinated by Professor O’Connor at the C3ED, the GOUVERNe Project (1999-2003) and the VIRTUALIS Project (2001-2004).

3.5.2. Origins of the Ker-ViViANE MM-DST

The **VIRTUALIS** project funded by the European Commission during 2001–2004,¹³¹ set out to develop computer-based learning tools exploiting state-of-the-art ICT, that would test new opportunities for organising and communicating scientific knowledge about risks and challenges in the field of environmental management for non-scientific audiences. It brought together a consortium of specialists in information technology, sustainable development, environmental modelling, public policy and governance, learning psychology and open learning, to develop computer-based learning tools on ecosystems and natural resources. Four environmental domains were selected: agricultural pollution, greenhouse gas emissions contributing to climate change, freshwater resources and marine capture fisheries. Taking these four domains as exemplary, **VIRTUALIS** created a suite of novel learning tools for improving citizens' awareness of environmental management and risks.

The project was not focused on technical sophistication primarily (even though state-of-the-art visualisation, navigation and knowledge management technologies were used), rather it was with the effectiveness of the products — multi-function interfaces as outlined below — in collaborative learning contexts such as school and university education programmes, with citizens groups, and with business and territorial administration interests as “stakeholders” in



sustainability education, policy and resource management. **VIRTUALIS** produced demonstrations of ICT tools that facilitate the learning by non-specialist members of society through the “translation” of technical and scientific expertise into formats accessible to and pertinent to interested non-specialists.

The key design concept was of learning as an inter-subjective “voyage of discovery”, taking place partly in a virtual space, in this case a voyage of the individual in society “towards sustainability”. This is suggested schematically in the diagram (taken from Guimarães Pereira, 1999).

The idea was to create *ICTs* that permit users, individually and collectively, to explore and reflect on their personal actions, in social, economic, institutional and ecological contexts.

As suggested in the schema, there are two main components of such a learning opportunity. First, the user can gauge how their personal way of living impacts on the environmental feature or resource in question. Second, the user can explore alternative possibilities for social and economic changes towards sustainability.

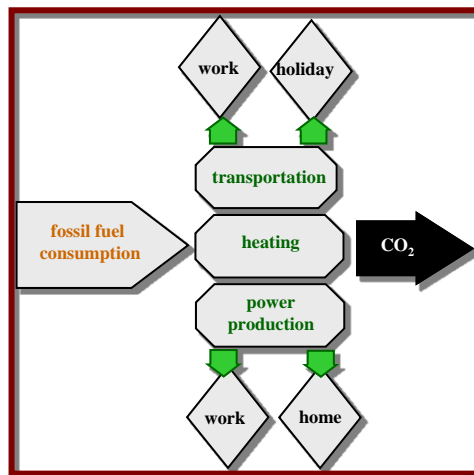
¹³¹ VIRTUALIS was the acronym adopted for the multi-partner project *Social Learning on Environmental Issues with Interactive Information & Communication Technologies* (Contract No. IST–2000–28121, European Commission 5th Framework Programme 1998–2002 Information Society Technologies (IST) Key Action 1: Systems & Services for the Citizen), coordinated by Martin O’Connor at the C3ED, from September 2001 to April 2004.

In VIRTUALIS, these were referred to, respectively, as:

- ❑ **Personal Barometers**, allowing quantification of environmental "pressure" impacts of individual production and consumption activities (viz., lifestyles, stakestyles);
- ❑ **Scenario Generators**, allowing personal lifestyles to be put in the context of possible future trends and changes in patterns of economic activity.

The Personal Barometer and Scenario Generator concepts were not inventions of **VIRTUALIS**. Their seeds can be seen in antecedent ICT developments, notably (1) the GAS "personal calculator" concept (from the Ispra JRC team) and the Phyt'Amibe concept (from the C3ED team) and (2) the use of multimedia visualisation techniques for the development and communication of scenario analyses in environmental governance domains.

During the *ULYSSES* research conducted in the late 1990s by the JRC Ispra-based team, a prototype "PERSONAL CALCULATOR" had been developed which accounted for personal CO₂ emissions on the basis of data provided interactively by an individual person, the "user" (see schema). This tool permitted an intuitive framing and quantitative response to the question 'how does my lifestyle relate to the global problem'. It produced an indication of the yearly carbon dioxide emissions derived from personal consumption of electricity and transportation fuel, following the framework of connections illustrated in the Figure (Guimarães Pereira, 1999).



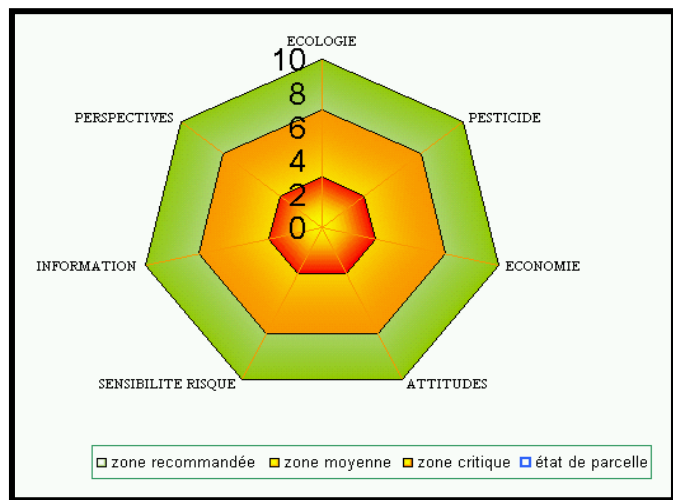
The **PERSONAL CALCULATOR** allowed people to evaluate directly their personal contribution to greenhouse gas production in relation to their country per capita average, and also in comparison to per capita averages for other countries. Then, through exploring scenarios of different "lifestyle" profiles, there can be an appreciation of margins of manoeuvre for reduction of greenhouse gas emissions. From this sort of exercise, it was envisaged, social processes may emerge into dialogues, negotiations, self-reflections and — perhaps — eventually agreed alternatives.

This is the first prototype that, four years later in an interactive 3-D virtual reality format, became transformed into the 'VGAS' of the **VIRTUALIS** Project. Also during the late 1990s, the C3ED began experimentations with an interactive ICT device, called the "PHYT'AMIBE", that combined a questionnaire designed to explore the dimensions of individual agricultural activity (at the farm, family and local community level), with a visual multi-criteria "amoeba" presentation. The tool was composed to run on

any PC computer with Windows and a Pentium chip, based on a few lines of instructions to load and operate the software. The questionnaire is filled out by clicking with the mouse on menus illustrated by more-or-less well-judged photo or other images; all this in 20 minutes, more or less. At the end of the questionnaire process, an “amoeba” (or kite diagram) was produced that summarised the performance of the respondent along 7 dimensions covering economic performance, environmental quality, social context, views and practices of pesticide use health, information and knowledge sources, and outlook for the future.¹³²

The “PHYT’AMIBE” was an elementary multi-criteria evaluation tool that could, in principle, be exploited as a self-evaluation tool by a farmer, or in an interactive context in dialogue with researchers or other stakeholders. These were the beginnings of what became, through cross-linkages of the farmer questionnaire format with a calibrated model of agricultural production and chemical emissions and a spatial visualisation of rural land-uses, the much richer ‘VIVIANE’ system in VIRTUALIS.¹³³

In parallel with the “personal calculator” type experiments, several of the research teams were also collaborating in the field of integrated environmental analysis, exploring notably the use of scenario studies with multimedia visualisations and multi-criteria



evaluation frameworks for assessment of resource and territorial management options. The **GOVERNE** project had addressed the challenge of interactive ICT applications for the integrated management of underground resources in a perspective of ‘stakeholder concertation’. This was the context for the emergence of the terms **Deliberation Support Tools (DST)** and **Tools for Informing Discussions, Debates and Deliberation (TIDDD)**.¹³⁴ One of the primary goals of **GOVERNE** was to demonstrate feasibility of

¹³² Documentation of the PHYT’AMIBE (first version created by V. Bourget, R. Lahrech, and J-M. Douguet) can be found in Douguet, O’Connor & Girardin (1999).

¹³³ The PHYT’AMIBE developments leading to integration within the full ViViANE (further discussed below) passed through an intermediate step, in the context of the PEGASE project (*Pesticides in European Groundwaters: detailed study of representative Aquifers and Simulation of possible Evolution scenarios*, Project No.EESD-ENV-99-1, EC 5th Framework Programme, co-ordinated by Christophe Mouvet, BRGM, Orléans, France, 2000–2003), being of the linkage of the farm-scale questionnaire to an empirically calibrated agricultural production model for a set of farm units making up a rural territory. See Douguet & O’Connor (2003) ; Douguet et al. (2000, 2003).

¹³⁴ The multi-partner project GOVERNe (*Guidelines for the Organisation, Use and Validation of information systems for Evaluating aquifer Resources and Needs*) was funded under Contract No. EVK1-CT-1999-00043, European Commission 5th Framework Programme 1998–2002 Thematic Programme: Environment and Sustainable Development (March 2000 to February 2003) and coordinated by Martin O’Connor (C3ED, UVSQ, France). The two terms DST and TIDDD are fairly interchangeable; however their respective pedigrees are different. The former (DST) was introduced by the KerBabel team at the C3ED and sought, in the context of policy and programme evaluation, to displace the traditional DSS (decision support system) concept. Deliberation is a richer concept and is more pertinent

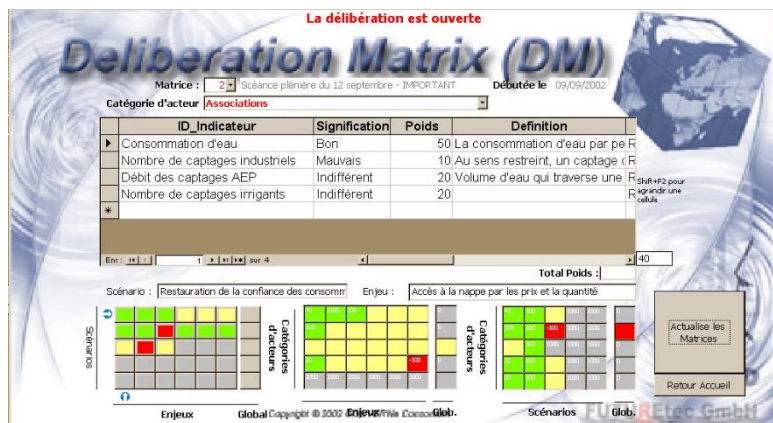
new ICT for user-friendly interactive stakeholder-based decision support. The work programme resulted in the development of two fully functional tools, a 'TIDDD' for both the Hérault (southern France) and the Argolid (southern Greece) watersheds; and a 'DST' for the Champigny aquifer (greater Paris region in France). These developments combined spatial representation, scenario simulation, multiple criteria evaluation and interactive user-friendly computer interfaces.

The **CHAMPIGNY** case study led by the KerBabel team at the C3ED, addressed risks and management options for a major rain-fed aquifer district in the greater Paris region that serves rural as well as metropolitan uses and that is diffusely vulnerable to chemical contamination and to quantitative depletion. On the basis of extensive consultation with stakeholders and other analysis, a workshop exercise was undertaken of “composing” scenarios through a free association of propositions of actions and outcomes. The result was a group of five distinct scenario narratives. These scenarios constituted one dimension of the multi-stakeholder, multi-criteria deliberation framework that was developed via the AQUI'Brie Association made up of various resource user representatives, public administration and other stakeholders.

The idea of a comparative evaluation of scenarios undertaken simultaneously with respect to several *different criteria* (or performance categories), and from the several *different points of view* (corresponding to distinct stakeholder preoccupations), then led to the concept of the three-dimensional *Deliberation Matrix*.

than 'decision' because (according to the underlying social theory) it is the inter-subjective process of argument and dialoguing with its affective as well as informative dimensions, that engenders new insights (learning) and, more particularly, builds (or undoes and rebuilds) alliances, modifies motivations and thus permits the exploration of contradictions and emergence of new solidarities. The latter (TIDDD) was introduced by the knowledge quality assessment and multimedia development team led by Silvio Funtowicz and Angela Pereira at the European Commission's Joint Research Centre (Guimarães Pereira & Corral Quintana, 2002; Corral Quintana et al., 2002) and makes explicit the notion of a “cognition pathway” allowing a user to make a “progressive discovery of information”.

Figure 3. 6: Dimensional view of *Deliberation Matrix*



The KerBabel Deliberation Matrix (see Figure 3.6 showing a screen for the CHAMPIGNY DST) organises information, judgements, methods and communications at several levels in an integrated way. For a policy problem, each stakeholder class offers a judgement (e.g., satisfactory, poor, intolerable, etc.) of each scenario in relation to each of the key governance or decision issues. The participatory ‘evaluation’ activity

proceeds through a step-by-step phase, which can be undertaken on an individual or a collective basis within the group, of the filling out of cells of the 3-D Deliberation Matrix. Individual reflection and/or exchanges of views between protagonists in a deliberation/negotiation process may lead to modifications at any or all or the steps of the choices and judgements.

- On the one hand, the Matrix, presenting an array of judgements, gives a momentary profile in a given time in a process of negotiation.
- On the other hand, in a dynamic perspective such as a policy exploration or review process where users of the DST may reassess the choices and assumptions leading up to the judgement put into each cell, the Matrix becomes a support for negotiation and a framework for documentation of the negotiation.

So, the KerBabel DST makes explicit the structure of a political process, that is, as a multi-stakeholder, multi-actor, multi-criteria deliberation. The deliberation support process is centred on the Deliberation Matrix, and complemented, through a progressive disclosure, by virtual reality spaces that provide information on the territory and the key stakeholders, and on the issues to be addressed through comparative scenario evaluation.

3.5.3. Progressive Discovery in Virtual Environments

The specificity of **VIRTUALIS** was the emphasis on design of ICT supported “learning opportunities” inviting the users to explore features of environmental change and human action across a spectrum of scales and exploiting a spectrum of interaction modes within a virtual space. Four environmental domains were selected — greenhouse gas emissions; chemical pollution from agriculture, freshwater water resources at river basin scale,

THE VIRTUALIS PERSONAL BAROMETERS

VGAS offers a cognitive bridge between knowledge and action domains of everyday life (home, travel, recreation, and so on) and climate change at a planetary scale. It allows individual citizens to gauge their ‘contribution’ to greenhouse gas emissions and also to gauge their possibilities for contributing to reduction of these emissions.

The FISHUALIS system offers bridges between individual consumption actions (buying and eating fish) and scientific analyses of the exploitation of fisheries at national and international scales.

A “Water Shadow” calculator within VWATER allows users to estimate the volume of water used annually in an individual lifestyle, and relating this to the number of m² (or km²) needed to “capture” this amount of water through rainfall at the prevailing precipitation levels for the region.

The “Phyt’Amibe” in VIVIANE allows a user to adopt the role of a farmer and to construct a multi-criteria profile of his or her activity centred on the use of chemical inputs (fertilisers and pesticides) posing pollution risks for health and the environment.

and marine fisheries. For each domain, user-interactions were proposed that embedded “Personal Barometers” and “Scenario Generators” within interactive digital environments, thus proposing a “Virtual Visit” within which the learning may take place. Finally, the most ambitious aspect of the project, it was proposed to create “Multi-player Games” within the virtual environments that would allow individuals to learn about the problems of collective action, conflict resolution and governance in complex environmental domains.

A generic design principle enunciated by **VIRTUALIS** was the principle of ‘**PROGRESSIVE DISCOVERY**’. In each of the prototypes, users are offered, on screen, navigation “pathways” that start from concepts and images that are the very accessible or ‘intuitive’, and then move on (through clicks of the mouse, choices in a menu, etc.) towards forms of information, representation and analysis that are less readily accessible.

So, a privileged starting point for **VIRTUALIS** prototypes is the personal scale with, notably, the use of ‘**PERSONAL BAROMETERS**’ for getting a feel for the environmental pressures such as water use, energy use, food consumption, or the “impact” of fishing or farming activity (see textbox).

A second key generic feature is to provide opportunities for dialogue and debates around the scientifically based images and information encountered by the visitor in the virtual world. For example, the **VIVIANE** system responded to stakeholder learning and dialogue challenges for integrated water resource management encouraged under the new EU Water Framework Directive (WFD), whereby *“Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans.”*

As multi-media products, the **VIRTUALIS** prototypes demonstrated a range of different distinct navigation modes — or ways of “getting around” in a virtual world. These included:

- A “Wheel Chair Initiation” with a video on automatic pilot;
- A “Guided Visit” with a pre-determined itinerary which can be activated step-by-step by the visitor;
- A “Free Visit” allowing exploration of the various ‘functionalities’ without, however, modifying the world;
- A “Participating Visit” in which, as an ‘actor’ in the virtual world, contributions can be made to information sets and to dialogues/interactions with other ‘actors’.

Overall, the ‘learning tools’ function to take the visitor ‘through’ the virtual world and replace her or him back in the ‘real world’. Various mechanisms can be effective for this:

- Pedagogic Modules & Links to Educational Resources — The ‘Virtual Library’ functionality is an open-ended feature, and so a virtual world can be a doorway to an indefinite spectrum of contextual information in and about the real world, e.g., the integration of the **VIVIANE** and **VGAS** systems within teaching programmes and pedagogic resources in relevant domains; catalogues of documents, websites, institutions and persons of interest.
- Simultaneous Use and Interaction of Multiple Users — Each of the prototypes (in the four domains: greenhouse gas emissions; freshwater resources; chemical residues from agriculture;

marine fisheries) offers, in one way or another, opportunities for simultaneous interaction of several users, as ‘participants’ in the virtual world, who are thus — by design or by circumstances — engaged in a real collective learning process together.

- The Social Setting of ICT Learning — Access to the ‘virtual’ learning opportunities can be provided in appropriate real situations, e.g., the **FISHUALIS** system could be installed in a fish shop or at a fish market.
- Mobile ICT gadgets as information, social networking and learning opportunities.

Finally, as the **VIRTUALIS** prototypes matured, it became clear that a defining feature is the definition within each virtual world of a plurality of “discovery spaces” and “learning pathways” that are interpenetrating and in confounded hierarchies with each other. People learn from different ‘starting points’ having different domains of knowledge, widely contrasting preoccupations, and so on. Design of multimedia frameworks for learning, documentation and communication should not envisage only one pathway of “progressive disclosure” but rather, a variety of ‘learning pathways’ that are interesting and accessible for different user contexts and classes of users. An insight that emerges for one user (e.g., a farmer or a consumer) as the end-point of a long “voyage of discovery”, might be the natural starting point for a different class of user (e.g., a water system engineer, an elected politician, a climate modeller) whose personal and professional competences prepare them differently.

This means that it is desirable that **several alternative pathways** should be possible for the “entry” into and the progressive discovery of a virtual world. So the KerBabel team decided that they should engage in the design of a **multimedia deliberation support tool (MM-DST)** made as a network with many alternative starting points and pathways of disclosure — users passing from screen to screen, encountering one after the other a sequence of objects, images, texts and interaction opportunities — giving to the virtual world the character of a labyrinth or a maze.

LINKED DISCOVERY SPACES IN MM-DST

Any particular MM-DST is constructed in terms of a set of ‘spaces of discovery’ that can be considered as so many nodes/crossroads in a maze. We may characterise the possible pathways as the set of *sequences of passages between these spaces or nodes*.

An analogy can be made with moving around in a house. Suppose that there are N rooms, these rooms being denoted $R_1, R_2, \dots, R_i, \dots, R_N$ with the doorways between two rooms (the i^{th} and the k^{th} rooms) being denoted D_{ik} . (For simplicity we suppose that there is only one doorway connecting directly from the i^{th} to the k^{th} room).

An example of a cyclical pathway of discovery of the house is the sequence $D_{31} \rightarrow D_{14} \rightarrow D_{42} \rightarrow D_{23}$. This describes a cycle, starting in the 3rd room, moving to the 1st, next to the 4th, from there to the 2nd, and back to the 3rd room.

To portray the complete set of links or doorways, it is sufficient to use an $N \times N$ matrix array where the i^{th} row signifies the room of departure and the k^{th} column signals the room of arrival, the link (or doorway) then being designated by the cell D_{ik} . The rooms themselves are designated by the diagonal elements in the matrix (viz., $R_k = D_{kk}$).

This was the challenge that led to the integrated virtual world of **VIVIANE** constructed by the KerBabel team as part of the **VIRTUALIS** project.¹³⁵

¹³⁵ Depending on the context, the designers used the language VIVIANE DST or Ker-VIVIANE. The name VIVIANE is an acronym for *Visite Virtuelle à Notre Environnement* and is, of course, the name from Celtic tradition of the young woman who bewitched Merlin (who, notwithstanding, could speak and understand all languages of the

3.5.4. Virtual Visit to Our Environment: KerViViANE

The problem situation presented in the *KerViViANE* virtual world is based on a real-life case of the commune of Montreuil-sur-Epte, in north-western France. A crisis had emerged, due to the cumulative contamination of local groundwater by chemicals deriving from agricultural fertiliser and pesticide applications, meaning that this water source could no longer be used for municipal supply.

The **ViViANE** DST focuses on the problem of chemical pollution of the environment caused by agricultural production. The chemical pollution of soil and water interferes with the *functioning of* the local environmental systems in themselves and, more particularly, interferes with the services or *functions provided for* economic activity and human well-being by the natural systems (in this case, available of high-quality drinking water for municipal supply). Resolving the question of goals and strategies for water use and water quality emerges here as a key challenge for sustainability policy.

natural world...). We use *KerViViANE* to refer to the virtual world (village and rural territory) that is a creation of the KerBabel team at the C3ED; the Breton word *ker* (which has very old roots) means a place, as in hearth or home. A detailed exposition of the structure and functionalities of the *VIVIANE* system is found in the comprehensive *ViViANE Users' Manual* (Douguet et al., 2004). French and English versions co-exist.

Table 3. 6: Short description of the discovery space (dm)

ACRONYM	SHORT DESCRIPTION OF THE DISCOVERY SPACE
§1 HOME	The point of arrival from the 'outside', introducing the purposes, structure and navigation possibilities of the KerViViANE system.
§2 KERVIVIANE	The KerViViANE 3-D Virtual World = the composite space that, as a landscape with active objects, allows navigation to and from the various functionalities and that, as a function of choices made by users, manifests a range of scenario features.
§3 PHYT'AMIBE	The principal 'Personal Barometer' of the KerViViANE system, which establishes a personalised profile of farming activity on the basis of data inputs to a questionnaire.
§4 FUTURES	The 'Scenario Generator', which organises the presentation and exploration of a spectrum of possibilities for the evolution of farming practices, land use and water quality at the scales of the commune (county) and wider territory;
§5 CUBE	DELIBERATION MATRIX = the KerViViANE 'Multi-Actor Game' offering the opportunity to engage in a multi-stakeholder multi-criteria evaluation of scenarios, introducing the user (or users) to the challenges of governance and conflict resolution;
§6 IDBox	The prototype (Version 2.0) KerBabel Indicator Dialogue Box (or KIK) for the KerViViANE system;
§7 DOCU	The 'Virtual Library' components (in the C3ED's KerBabel Gardens) that present documentation of the virtual and real worlds (including pedagogic materials).

The **VIVIANE** system has seven major components (see tabular presentation below). Pathways in VIVIANE can be identified as sequences of passages between these seven components referred to as "discovery spaces". We can use an 7x7 matrix array where the i^{th} row signifies the "discovery space" of departure and the k^{th} column signals the "discovery space" of arrival, the link (or doorway) then being designated by the cell D_{ik} . The "spaces" themselves are designated by the diagonal elements in the matrix (viz., D_{kk}). The cross-tabular presentation "**GETTING AROUND VIVIANE**" shows the 'pathways matrix' obtained in this way for the seven main components of the 'VIVIANE' prototype.

Getting Around VIVIANE:
 Structural Chart of the (Piecewise)
 Navigation Pathways
 for the Deliberation Support Tool 'VIVIANE'
 © KerBabel / VIRTUALIS 2004

Key to Table	
(Key link enabling user inputs
(Signposted (motivated) link
(Re-entry from KERBABEL
—	Link not emphasised
(Contextual HELP

	To	1	2	3	4	5	6	7	
From	!?! ?HELP?								From
1		HOME	★	★	★	★	★	★	1
2		—	KerViViANE 3-D Virtual World	★	—	—	—	★	2
3		—	✿	Personal Barometer (farmer)	✿	—	✿	★	3
4		—	✿	—	FUTURES Scenarios	✿	✿	★	4
5		—	✿	—	★	CUBE (Deliberation Matrix)	✿	★	5
6		—	✿	—	★	✿	ID-Box	★	6
7		□	□	□	□	□	□	Docu (KerBabel Jardins)	7
	To	1	2	3	4	5	6	7	

Within **KerViViANE**, societal options are framed in a *comparative scenario context* for the exploration of the “space of opportunities” into the future. The **FEASIBILITY** question is explored along the systems science axis, through integrated modelling combining ecological and economic dimensions. The **DESIRABILITY** question is explored along the social significance axis, highlighting the governance problem of institutional arrangements for coordination of the actors in society with their disparate interests and preoccupations. (See inset box.)

As in most environmental problems, we find contrasting perspectives in the **KerViViANE** world with regard to the significance of the changes (or anticipated future changes) in environmental systems. Setting environmental pressure policy targets is usually a conflictual process. With this in mind, the **KerViViANE** world offered to the visitor a **SCENARIO GENERATOR** as an opportunity to explore and evaluate options for action.

Based on the real-world analyses, several possible courses of action could offer elements of response to the degradation of local groundwater water quality.

Five scenario themes were retained, each of which expresses in a systematic yet simple manner the reasoning associated with a distinct political choice. In order to give the DST users insight into the key features and significance of each scenario for the stakeholders concerned, a on-screen questionnaire — called “The Reflection Grid” — was developed which, progressively, lead the user towards one or other of the five scenarios. These questions are relative to:

- The abandonment of agriculture in the community (scenario 1);
- The abandonment of the aquifer (scenario 2);
- Use of water purification (scenario 3);
- Using technical solutions to limit the impact of agriculture on the environment, such as integrated agriculture (scenario 4);
- Using structural solutions to help the evolution of agriculture and for management of the aquifer (scenario 5).

Scenarios as ‘Interface’ Representations

SYSTEMS SCIENCE portrays the contributions, and potential contributions, of the water resource in terms of “Environmental functions” — that is, the capacities and performances of natural processes and components that satisfy human needs.

The SCENARIOS portray the « working out » through time of Governance Issues characterised as « Conflicts for the Appropriation of Scarce Environmental Functions »

SOCIAL SIGNIFICANCE is revealed by the Criteria and Justification Forms that people advocate for resolving Governance Issues, viz., in what terms are these “governance issues” portrayed and judged by the actors concerned (categories of interests, political principles, ethical outlooks, collective identity (etc.), obtainable via social sciences techniques of Stakeholder Mapping » (interview, institutional, documentary analyses).

As a function of the responses given to this questionnaire, all alternatives are accessible. It reposes on a binary logic, as presented in the table to the right. For the first question, if, for example, the user answers “Yes,” a second question appears in the reflection grid, question n°2. If the response is negative, there is a presentation of Scenario 1 in the 3D world, as well as a narrative presentation of it in the 2D window. And so on.

QUESTIONS	RESPONSE	QUESTIONS/SCENARIOS
1	Yes	➔ Question 2
	No	■ Scenario 1
2	Yes	➔ Question 3
	No	■ Scenario 2
3	Yes	➔ Question 4
	No	■ Scenario 3
4	Yes	■ Scenario 4
	No	■ Scenario 5

Once the scenarios are described, visitors to **KerViViANE** were invited to adopt roles as stakeholders in a **GOVERNANCE GAME**. The social

choice problem was to decide what might be desirable within the bounds of different scenarios considered to be feasible.

Institutional analysis in the real-world case study distinguished six major stakeholder categories: *Local farmers; the Municipality; Domestic water consumers; Territorial administrations at region, national and EU scales; Water distribution companies; Citizens’ associations.*

The same empirical analysis highlighted the pertinence of six major types of governance issues; these are presented in tabular form below.

	ECONOMIC	SOCIAL	ENVIRONMENTAL
ECONOMIC	Price & Quantity of Water		
SOCIAL	Social Status & Prestige	Stakeholder participation in Political Processes	
ENVIRONMENTAL	Segregation of Water Qualities	Artificialisation of Nature	Landscape & Ecosystem Quality

The **KerViViANE** stakeholder categories span, in a parsimonious way, the worlds of business, public administration and civil society. Similarly, the six governance issues span the gamut of these three spheres and their interfaces.

The idea then was that participants can engage, via the **Deliberation Matrix** as already described, in a multi-criteria, multi-stakeholder evaluation exercise. This exercise is structured along three dimensions: a list of stakeholder categories, a list of the governance or performance themes, and a list of the

alternatives or scenarios to be considered. Within the Matrix (accessed via the Ker-ViViANE virtual reality), each stakeholder class offers a judgement (e.g., satisfactory, poor, intolerable, etc.) of each scenario in relation to each of the key governance or decision issues. The participatory evaluation activity proceeds through a step-by-step phase, which can be undertaken on an individual or a collective basis within the group, of the filling out of cells of the 3-D Deliberation Matrix with qualitative signals motivated by indicators. The overall political dimension of the situation is thus portrayed as an “argumentative” process in which each interest group is confronted by the challenge to set their own priorities in relation to the concerns of others.

3.3.5. The SMMAAD “Ker-ALARM” — Proof of Concept

The virtual world **KerViViANE** was an early example of the opportunity for a new generation of interactive on-line **deliberation support tools (DST)** for discovery and analysis of the sustainability challenges facing public policy makers, the business world, scientists and civil society. **VIRTUALIS** was a pioneering project for the demonstration of the potentials of the new technology.

As seen in the **KerViViANE** example given above, the emphasis is on active participation of the user. The KerBabel team had sought, through this prototype, to demonstrate ways of creating learning opportunities through a user’s (or users’) interactions within a virtual world proposed by the **MM-DST**. In the context of governance and scientific analyses and stakeholder dialogues, it is important to highlight not just the learning opportunity but also the wide scope for users’ inputs or contributions to the knowledge mediation system.

So, for example, in addition to pronouncing judgements (via the DELIBERATION MATRIX) about policy options or scenarios, the **MM-DST** users could also provide suggestions for information categories that might be used as Indicators or Arguments for description or evaluation of scenarios and policy measures. They could also provide opinions about the pertinence (or not) of indicators and information categories already suggested by other system users. Within **KerViViANE**, the key information categories for characterising the scenario profiles and for informing the multi-criteria evaluation process are catalogued by a CMS tool called the KerBabel™ INDICATOR KIOSK (or ‘KIK’, which at the time of **Ker-ViViANE** was called an Indicator Dialogue Box). THE KIK is an interactive meta-information system for documenting “profiles” of all information categories and variables (etc.) that are or might be used as “indicators” in the description and evaluation of system change. **Ker-ViViANE** users on-line can provide contributions to the bank of data within the **KIK** as an authentic forum for ongoing dialogue between producers and users of information.

The usefulness of these MM-DST or “SMMAAD” design concepts has since been demonstrated in numerous action-research projects carried out over the years by the KerBabel team. To round off this section, we will give a quick overview of the Ker-ALARM system which, benefiting from the experience of the preceding **GOUVERNe** and **VIRTUALIS** Projects, was designed and implemented as a modular multi-functional tool for collaborative learning and deliberation support during 2005-2008, as part of the EC funded **ALARM** Project

The **ALARM** Project, with more than 50 scientific partners, addressed the issue of biodiversity risks and losses in Europe. As described in the Ker-ALARM Brochure composed in 2005 by the KerBabel team at the C3ED, the creation **Ker-ALARM Biodiversity Europe** was “...an interactive on-line deliberation support

tool (DST) for discovery and analysis of the biodiversity challenges facing public policy makers, the business world, scientists and civil society.” Ker-ALARM. In other words, using the French denomination, a SMMAAD (Système MultiMedia d’Apprentissage et d’Aide à la Délibération).

Ker-ALARM was conceived with twelve functional spaces, each one providing access to specific learning, analysis and information sharing opportunities. These are listed in tabular form on a separate page (below). A key design feature was the conception of an indefinite variety of “learning pathways” that are inter-penetrating or in confounded hierarchies with each other. Application of the principle of ‘*Progressive Discovery*’, or *Progressive Disclosure of Information*, means here that Ker-ALARM users can be offered, on screen, a navigation “pathway” that starts from concepts and images that are the very accessible or ‘intuitive’, and then moves on (through “clicks of the mouse, choices in a menu, etc.), towards forms of information, representation and analysis that are less and less readily accessible. Applying this principle, it might for example be proposed that the accessing of scientific information via on-screen multimedia navigation can start with symbols and images of objects that are ‘popularly’ recognised and interpreted — e.g., easy-to-interpret maps, and so on — moving towards more complicated analytical models and explanations of the data transformations, and finally towards presentation and discussion of underlying hypotheses, uncertainties, controversies about the scientific knowledge. But, people learn from different ‘starting points’ having different domains of knowledge, widely contrasting preoccupations, and so on. This leads us to propose that, in any multimedia framework for learning, documentation and communication, there will not be one pathway of “progressive disclosure” but rather a variety of ‘learning pathways’ should be offered that are adapted for different classes of users. In fact, any of the 12 Ker-ALARM Areas can be a pertinent starting point, depending on a user’s interests and background.

Table 3. 7: Discovery Spaces of “Ker-ALARM”

Area	Acronym	The 12 Discovery Spaces of “Ker-ALARM”
1	HOME	This area introduces the entire Ker-ALARM system. It outlines the evaluation and knowledge management tools offered within “Biodiversity Europe” as an interactive on-line DELIBERATION SUPPORT TOOL (DST), and highlights the opportunities for discovery of the biodiversity challenges facing public policy makers, the business world, scientists and civil society.
2	GARDEN	The VIRTUAL GARDEN introduces the visitor to the variety and significance for human society of European biodiversity, and the reasons for being concerned about biodiversity loss and change. This is a space of free discovery in a visually pleasing format. The GARDEN presents eight main types of ecosystem — inland waters; wetlands; forests; grasslands and dry scrub; agroecosystems; mountains; polar habitats and urban ecosystems. For each ecosystem type, examples are given of significant environmental services (natural resource; waste assimilation; scenery, site of production and consumption; life-support) and of damage to these functions (relating to the ALARM Project’s four change vectors: chemicals, invasive species, pollinators, and climate).
3	METHOD	This area outlines the METHODOLOGY and design features of the “Biodiversity Europe” DST. Ker-ALARM is an interactive multimedia DELIBERATION SUPPORT TOOL allying science and stakeholder dialogue processes for European biodiversity management and risk governance. It introduces visitors to the state-of-the-art of integrated environmental assessment (IEA) and participatory evaluation practices, and explains the mobilisation of ALARM’s multi-disciplinary scientific results in the comparative appraisal of policy scenarios through multi-stakeholder multi-criteria deliberation.
4	ALARM	This area links to the “Home Page” of the ALARM Project’s web-site which presents the integrated project’s goals and programme of work, the scientific partners, progress to date, network activities and notes on the European policy scene.
5	ISSUES	ALARM brings together science and social science to observe, interpret and anticipate the “risks” associated with European biodiversity change. Here, ten facets of governance concern are highlighted — Maintenance of Biological Richness; Ecosystem Services to the Economy; Economic Performance; Social Cohesion; Power Structures & Political Models; Economic Regulation; Environmental Governance; Community & Local Identity; Perceived Quality of Landscape; Status of Nature. Through an interactive forum, DST users are invited to explore the full spectrum of issues and to discuss the importance of policy action in each field.
6	ACTORS	This area introduces the users of the DST to themselves as participants in a Europe-wide science-policy dialogue. According to our underlying deliberative theory, it is through dialogue processes of discovery and multi-stakeholder debate that shared understandings are established as the basis for robust and legitimate public policy. Who are the key players and classes of “stakeholders” in the governance of biodiversity change? Who might be interested in learning from the results of ALARM? What are the communication challenges — the “gaps” to be bridged — to link the actors in the scientific world with those in public policy and administration, the business world and civil society?
7	CUBE	This area offers access to the Deliberation Matrix (also known as “The Cube”), which is a multi-stakeholder multi-criteria framework permitting an exploration and comparative assessment of biodiversity futures. It provides an interactive framework allowing users, as members of a stakeholder class, to signal their judgements (satisfactory, poor, intolerable, etc.) of each scenario for the spectrum of governance considerations being addressed.
8	KIK	The KerBabel™ INDICATOR KIOSK is an interactive meta-information system for managing all information used as “indicators” in the description and evaluation of system change. It provides a forum for dialogue between producers and users of information, highlighting: the SCALES at which observation, analysis and/or measurement takes place; the geographical place or SITES; the decision making, management, evaluation or governance ISSUES that are in mind; the STAKEHOLDERS that might have something to contribute; and time-path within SCENARIOS for which the information may play a descriptive or evaluative role. It thus organises the interface between scientific description (data, maps, scenarios) and socio-economic evaluation (multicriteria

		analysis).
9	FUTURES	The visitor is invited to explore a set of scenarios of possible futures for European Biodiversity. A "SCENARIO GENERATOR" introduces the visitor to hypotheses about the key factors determining current and possible future biodiversity loss and change. Images, maps, graphs and texts from the ALARM scientific community are used to profile the scenarios, setting the scene for the key question: What governance can, and should, be influenced over European biodiversity change?
10	MAPS&DATA	This area links to the "DATA WAREHOUSE" component of the ALARM Project's web-site which, rigorously cross-referenced with the KIK, manages the scientific data produced and made available by the ALARM scientific community. These data (in various formats of time series, graphs and maps, etc.) are also resources for profiling the SCENARIOS policy analysis.
11	KQA	All policy formulation and evaluation requires judgements about the scientific quality and pertinence of information. This area gives a state-of-the-art presentation of practical tools and procedures for Knowledge Quality Assessment "from the point of view of complexity". These tools address standard scientific considerations (such as data sources, model specifications and incertitude) and also highlight societal dimensions in the "framing" of science-policy issues (value systems, power relations, acceptability of risks).
12	DOCU	The confounded hierarchy features offered by digital hyperlink technologies allow us to provide, embedded within the virtual world, a comprehensive documentation of the Ker-ALARM system itself and of the "outside" world. This "DOCUMENTATION" area is composed of electronic library facilities, referenced within the C3ED's BABEL GARDENS knowledge management tool, with "Search" functions and cross-referencing to the rest of the Ker-ALARM DST.
Area	Acronym	Ker-ALARM - The "Biodiversity Europe" Deliberation Support Tool

The text box (below) reproduces the explanations and invitations provided in the KerBabel team's Brochure offered to potential **Ker-ALARM** users. This information, when read in conjunction with the functional descriptions of the 12 **Ker-ALARM** Areas, allows an appreciation of the ICT innovation ambitions of the KerBabel team in the fields of scientific knowledge mediation and collaborative learning in the sustainability field.

THE TOOLS	Allying science and stakeholder dialogue processes for risk governance, Ker-ALARM introduces visitors to state-of-the-art integrated environmental assessment and participatory evaluation practices.
	◆ Participate, via the Deliberation Matrix (The Cube), in a multi-stakeholder multi-criteria scenario evaluation as a framework for the appraisal of the risks of biodiversity loss and of options for policy.
	◆ Familiarise yourself with, and contribute to, the Indicator Kiosk — an interactive meta-information system for the information sets used in description and evaluation of system change, and a forum for dialogue between producers and users of information.
	◆ Discover an array of procedures for Knowledge Quality Assessment that address data sources, model specifications and incertitude, and also societal dimensions such as value systems, power relations and acceptability of risks in the framing of science-policy issues.

DISCOVERY AND LEARNING	<p>Learn about the reasons for being concerned about biodiversity loss and change.</p> <ul style="list-style-type: none"> ◆ Enter the “Biodiversity Europe” VIRTUAL GARDEN to appreciate the variety and significance for human society of European biodiversity. Discover the fauna and flora of inland waters, wetlands, forests, grasslands and dry scrub, agroecosystems, mountains, polar habitats and urban ecosystems. ◆ Explore the spectrum of GOVERNANCE ISSUES and the importance of policy action in each field:— Maintenance of Biological Richness; Ecosystem Services to the Economy; Economic Performance; Social Cohesion; Power Structures & Political Models; Economic Regulation; Environmental Governance; Community & Local Identity; Perceived Quality of Landscape; Status of Nature. ◆ Build bridges between different points of views on biodiversity and what needs to be done.
THE POLICY CHALLENGES	<p>Become a participant in a Europe-wide science-policy dialogue.</p> <ul style="list-style-type: none"> ◆ What are the factors determining current and possible future biodiversity loss and change? ◆ What governance can, and should, be influenced over European biodiversity change? ◆ Who are the key players and classes of stakeholders in the governance of biodiversity change? ◆ Who might be interested in learning from the results of ALARM? ◆ What are the communication challenges — the “gaps” to be bridged — to link the actors in the scientific world with those in public policy and administration, the business world and civil society?
CONTRIBUTIONS FROM SCIENCE	<p>Travel in a virtual world in order to gain new insights about our real one. Walk through the doorway to the ALARM Project’s multi-disciplinary scientific results.</p> <ul style="list-style-type: none"> ◆ Explore SCENARIOS of possible futures for European Biodiversity with the help of models, Images, maps, graphs and texts from the ALARM scientific community. ◆ Link to the ALARM Project’s “DATA WAREHOUSE” for the complete spectrum of scientific data produced and made available by the ALARM scientific community. ◆ Exploit hyperlink access to a comprehensive DOCUMENTATION of the Ker-ALARM system itself and to information about the “outside” world.

Source: Various versions of the Ker-ALARM “Biodiversity Europe DST” Brochure, produced by the KerBabel team at the C3ED in 2005, notably Martin O’Connor, Laura Maxim, Philippe Lancelleur and Jean-Marc Douguet.

3.6. KICE & the Fairground – Towards integration

3.6.1. The Climate KIC Education Programme 2011-2013

The Climate KIC (Knowledge Innovation Community) funded by the European Commission, was set up in 2010, including the ambition for a comprehensive set of Education Programme activities including inter-university reciprocity in Masters programmes, a Doctoral programme and (although less well defined initially) professional & executive education.

The eLearning/Open Source portfolio of the Climate KIC Education Programme was initiated in 2011 as a cross-cutting action in support of the complete set of education activities. A vision was developed, in 2011, for a modular system of support services, nicknamed the "KICE" system (for KIC Education), which would become the electronic gateway for the "Academy of Climate Innovation" (ACI) envisaged by the Education Programme Management Team (MT) as the vehicle for development and visibility of Climate KIC education services. This "KICE" system was intended to provide for direct services to other Education Programme activities and also, interfaces with the Innovation/Pathfinder and Entrepreneurship programmes of the Climate KIC. These latter interfaces were, furthermore, to be designed and exploited in dialogue about concepts for the Climate KIC "Community hub", that is, a KIC-wide knowledge gateway on climate innovations.

Responsibility for piloting the eLearning/Open Source portfolio of the Climate KIC Education Programme was delegated to Professor Martin O'Connor and the KerBabel team at the Centre international REEDS (UVSQ). Core team members included Ms. Lisa Bozek (education officer) and Mr. Philippe Lancelier (information systems and software services to the user) who, with the help and inputs of other members of REEDS (including Frances Harrison, Virginia Branco, Julie Grall, and Jean-Marc Douguet) worked during 2012 and 2013 on the design and development of KICE platforms and functional modules.

An executive decision was made by the Climate KIC management in September 2013, that platform developments within the Education Programme were to be curtailed in favour of generic 'Community hub' structure of services.¹³⁶ Nonetheless, the key functionalities of the envisaged "KICE" internet-based structures were in place in their Alpha- or Beta-prototype versions, and available for collaborative use in early 2013. A short summary of the key functions is provided in the inset box (as below).

¹³⁶ By late 2011, the Education group management team had established its concept of an "Academy of Climate Innovation (ACI)". The different facets of this 'Academy' were to be made available as online modules. The "Climate Café" was conceived, at this time, to be one of these modules, that is, convivial exchange space for students, Alumni and other KIC associates, within a collaborative learning environment. However, in early January 2012, the Climate-KIC Executive Team (ET) confirmed that a web tool that enables cross-community interaction and community building was required. A task force with representatives from each Pillar and the RIC chaired by the Director of Operations was set up. This development, while positive for the Climate KIC Community as a whole, created uncertainty for the Education Open Source team, as to whether and in what directions proceed with "Climate Café" conception and prototype developments. Nonetheless, the "KICE" system in its 'Beta' prototype (delivery March 2013) offered a set of education and knowledge mediation services that could potentially be incorporated into or made complementary with, the "Community hub" as it was developed during 2013-2014. These opportunities are documented in several unpublished working documents including the [Community Hub Project Brief](#) (prepared by Lisa Bozek in late 2012) and the [Correspondence Table for discussion of Design Options for the Climate KIC's "Hub"](#) (prepared by Martin O'Connor in September 2012 to show KICE/Hub interfacing).

OVERVIEW OF THE "KICE" INTEGRATED MODULAR SYSTEM OF SUPPORT SERVICES

Development steps were taken during 2012 to implement a first version of the integrated modular system of support services, nicknamed "KICE" (for KIC Education), envisaged as the electronic portail for the "Academy of Climate Innovation" (ACI) as conceived by the Education Programme Management Team (MT). This "KICE" system is intended to provide for direct services to other Education Programme activities and also, interfaces with the Innovation/Pathfinder and Entrepreneurship programmes of the Climate KIC. These latter interfaces were to be designed and exploited in dialogue about concepts for the Climate KIC "Community hub", that is, a KIC-wide knowledge gateway on climate innovations. Among the principal features of the modular system, are included:

- Welcome Spaces (Home page, presentation of ACI mission, cross-links to other Climate KIC pages);
- Gallery of Climate KIC Education Programme activities (theJourney, Masters, Doctorate...)
- Galleries of People and Partners (with integration of social networking fonctions);
- The "Climate Café" including various galleries for News, Announcements, Innovations Ideas...
- Links to Terrains and Projects of selected Innovation/Pathfinder and Entrepreneurship Programmes
- Services for creation and mobilisation of on-line Teaching Resources;
- Access to ePresence services (Climate KIC Polycom and others) and Guide to good practice;

- Comprehensive Documentation and Search/Find functions.

Outputs of T1.5.3/c: As of December 2012, the architecture and design principles for an integrated system of cross-linked Galleries and interactive information spaces is complete, and an 'Alpha' prototype programmed in the Open Source CMS 'Drupal' is implemented. The 'Beta' version, for experimental use by Climate KIC partners, will be made available in March 2013.

Source: Overview of Task 1.5.3(c) in: O'Connor & Bozek (2013), *Climate KIC Education Programme eLearning / OpenSource Activities 2012*, Rapport de Recherche REEDS RRR 2013-01 (January 2013), REEDS, UVSQ, Rambouillet.

A complete list of the functional "spaces" as envisaged in 2012 for the KICE system, is provided in the table 3.6. in the next page. It can be seen how it is already a precursor to the modular structure of Spaces and Galleries now exploited by "ePLANETe".

Subsequently, some but not all of these KICE functionalities were exploited in planning for the needs of ongoing Climate KIC collaborative projects, including "EURBANLAB" financed by the Climate KIC. This provided a context for the completion of design work, on the one hand of the "KICE" platform already determined, with, on the other hand, the conception of the "Virtual Eco-innovation Fairground" as a thematic discovery pathway within 'ePLANETe' (as explained below).

Finally, these design, development and demonstration activities provided the springboard for the full integration of "KICE" and "Virtual Eco-innovation Fairground" features into a single modular platform, the "ePLANETe". So this is an important phase in the emergence of the "ePLANETe" system.

- The Sub-section 6.3.1.1 provides a detailed view of the planned "KICE" functionalities. This incorporates, via Table 3.8., an overview of the functionalities intended specifically as components of the "Virtual Eco-innovation Fairground", showing how this experimental process led to the idea of thematic "Doorways" that would come to characterize the future "ePLANETe Blue".¹³⁷
- Finally, in table 3.8. , we summarise in a schematic way (with a table extending over several pages) the transition from "KICE" and "Fairground" as incompletely cross-linked systems, to the integrated vision of "ePLANETe" currently available

¹³⁷ As mentioned, during 2012-2013, the design process for the "KICE" system was in interface with other Climate KIC teams looking at concepts and functionalities of the "Community hub". These included, for example, ideas for an on-line "Climate Café" envisaged as a convivial e-space of interaction for members of the Climate KIC Education community, and also a facility for accessing and development of "serious games" as specialised on-line educational resources. Not all of these "Community hub" related features were incorporated into the final "ePLANETe" framework as it currently exists, although it would be quite possible to incorporate such features if wanted by a user community.

Table 3. 8 : LIST OF THE “KICE” FUNCTIONAL SPACES (as of 2012)

<p>LIST OF THE “KICE” FUNCTIONAL SPACES (as of 2012) <i>(Virtual Academy of Climate Education)</i> KICE-000 — WELCOME/Reception (Welcome to The Virtual Academy of Climate Innovation)</p>
<p>KICE-00 — GUIDED TOURS GETTING AROUND THE ACADEMY — A Visitor's Guide to the on-line Academy (Your Gateway to Educational resources and Activities in Climate Innovation)</p>
<p>KICE-01. The Climate KIC Introducing the EDUCATION Programme: Climate, Sustainability, Knowledge Partnerships & Innovation) (Including presentation of The Academy of Climate Innovation’s Mission)</p>
<p>KICE-02. EDUCATION PROGRAMMES <u>Gallery</u> of "EDUCATIONAL ACTIVITIES at the ACADEMY" Gallery of the Academy's Education Programmes and Components/Modules (<i>The Journey; Doctoral studies; Inter-university Master's programmes, etc...; and components of each Programme</i>)</p>
<p>KICE 03. — The Climate KIC Community <u>Galleries</u> of PEOPLE and Partners: The CLC's & the RICs; Member institutions; Governance & Admin Preqsentations of the Collaborative Programmes: Education, Innov & Pathfinder, Entrepreneurship Profiles of individual Projects and People</p>
<p>KICE 04. "NoticeBoard" A Gallery of Announcements or "OPPORTUNITIES" — In the KICE Current Events “ NewsReel on line...</p>
<p>KICE-05. "CURRENT EVENTS" A Gallery of News Articles — in the KICE Current Events “ NewsReel on line...</p>
<p>FAIR/KICE-06 — Innov'Ideas "IDEAS-TO-MARKET" — <u>Gallery</u> of INNOVATION CONCEPTS</p>
<p>FAIR/KICE-07 — TERRAINS <u>Gallery</u> of Eco-innovation TERRAINS (or, "Innovation Cases" / Cas d'Ecole)</p>
<p>FAIR/KICE-08 — T&T <u>Gallery</u> of profiles of "THEORIES, ANALYSIS TOOLS & METHODS"</p>
<p>KICE-09. PEDAGOGIC RESOURCES <u>Gallery</u> of Thematically Organised Dedicated Teaching and Learning Resources</p>
<p>KICE-10. GAMES ROOM Gallery of Educational 'Games" and on-line simulation/interactive learning systems</p>
<p>KICE-11. DOCU — The Academy’s LIBRARY Document Galleries, Catalogues of Pedagogic Resources, and Catalogues of Gallery Collections</p>
<p>KICE-12. — SEARCH & FIND The Academy’s Search & Find Facility</p>
<p>KICE-13. Communications Room ePRESENCE & Collaborative Learning Platforms (including the <i>future "DIGISCOPE"</i>)</p>
<p>KICE-15a. The Climate Café <i>A Convivial Place to Chat</i></p>
<p>KICE-15b. The Academy On-line Shop <i>Souvenirs, Education resources, Services...</i></p>

Source: Adapted from Martin O'Connor & Lisa Bozek, unpublished documents (2012).

3.6.1.1. The "Expo Spaces" of the "KICE" System

The Climate KIC Education eLearning/Open Source team conceived the "Virtual Academy of Climate Innovation" (KICE for short) as a multimedia collaborative learning and deliberation support tool offering many alternative starting points and pathways of disclosure. Users would be able to pass from Space to Space, from screen to screen, encountering one after the other a sequence of objects, images, texts and interaction opportunities — giving to the virtual world the character of a labyrinth or a maze.

The KICE system was constructed, in its first (2012/2013) version, principally with the Drupal CMS (Content Management System), on a modular basis allowing 'Progressive Discovery' of the wealth of materials housed within the site. Conceived as an inter-related whole, it had five main facets: exposition of Climate KIC Community; Information Sharing; Collaborative Activities within and around Innovation Projects/Terrains; the Academy Education Support Services; Communication & Commerce:

- A "static" presentation (Who we are, what we do, how to find us, etc.), with a tree-structure of pages plus dynamic catalogue facilities for Partners and People.
- Moderated systems of "Current Events", of "Announcements", and of "Innov'Ideas" — short Articles or Notices, that can be contributed by any member of the Climate KIC community, that present information about a single event or item of current interest, or job opportunity, or innovation idea on its road towards the marketplace..., and whose accumulation through time will generate a Living Archive.
- A "Virtual Eco-innovation Fairground", composed as a system of cross-referenced modules, each module being composed for presentation of a distinct class of objects, each of which can, potentially, open towards more in-depth information.
- Educational resources and on-line support services;
- Collaborative Learning Platforms and diverse facilities for ePresence, Interactive tele-working, Social Networking and so on.

For the modules presenting data from the innovation community and its "knowledge market" process, a dynamic Contents Management framework was put in place so as to allow new elements to be inserted (and existing material to be updated) as members of distinct Classes of objects in Galleries.

This "modular" conception of the KICE Website based on functional groupings is outlined in more detail in the sequence of tables on the pages that follow. It was intended as a precursor for a 2D+ "Virtual Reality" that was programmed for development in experimental form during 2013 and 2014. Anticipation of this Virtual Reality was indeed the basis of the "Academy" and "Fairground" concepts introduced into the language and design, such as:

- ... the language of an expo space/landscape/campus with many « expo rooms » or « spaces »;
- ... each offering specific DISPLAYS, ACTIVITIES, SERVICES, TOOLS, GALLERIES of information; and
- ... all being OPPORTUNITIES for discovery, learning, knowledge sharing, partnerships.

The modular organization of the KICE System, grouped into 15 main thematic areas or "KICE Expo Spaces", is presented in tabular form in Table 8.

To introduce this exposition, recall first, the Table 3.6 on the preceding page, that gives a list of the “Spaces” with a very brief indication of their roles.

Of course, these KICE Expo Spaces are not isolated from each other. On the contrary, each of the “Spaces” has cross-links to other spaces. This logic of cross-references between Expo Spaces is shown in the Table 3.7 below. In the physical world or that of book references, it would be necessary to move from place to place or to pick up another book in order to follow the link. In the "Virtual" Academy, the link from one Space to another can be provided instantaneously by a "click", allowing teleportation into the new learning/discovery Space.

The extended Table 3.8 (spilling over several pages), which gives a more detailed description of the functions to be provided by each “Expo Space”. Importantly, in the column on the right of this table, there are notes about how the functionalities have (or not) subsequently been integrated into “ePLANETe”. These notes explain key points about the evolution from KICE/Fairground to ePLANETe, as subsequently took place in REEDS during 2013-2015

Table 3. 9— Schematic Expression of the Functional Cross-linking of KICE Galleries

<i>From</i>	<i>To</i>	01 KIC EDU	G/02 Prog-Proj	G/03 PEOPLE	G/04 Notices	G/05 News	G/06 Innov Ideas	G/07 Terrains	G/08 Tools	DST & Kiosks	G/09 Pedag	G/10 Games	G/11 Docu
00 Home			By Menu	By Menu	By Menu	By Menu	By Menu	By Menu	By Menu		By Menu	By Menu	By Menu
01 KIC EDU	ACADEMY KICE		By Menu	By Menu	By Menu	By Menu	By Menu	By Menu	By Menu		By Menu	By Menu	By Menu
02 Prog-Proj	(By Menu)		Programmes & PROJECTS	→→	→	→	→	→→	→→		→	→	→→→→
03 PEOPLE	By Menu		→→	PEOPLE & Partners	→→	→→	→→	→→	→→		→→	→→	→→
04 Notices	By Menu		→→	→	NoticeBoard (Opportunities)	→??→	→??→	→→	→		→	→	→
05 News	By Menu				→??→	NEWS (Current Events)	→??→	→→	→		→→	→→	→→
06 Ideas	By Menu		→	→	→??→	→??→	INNOVATIONS Ideas-to- Market	→→	→→	[→]	→	→	→
07 Terrains	By Menu		→→→→	→→→→	→	→	→→	TERRAINS	→→	→→	→→	→	→→
08 TOOLS	By Menu		→→	→→	→	→	→→	→→	TOOLS	→→	→→	→	→→
Indic Kiosks								→→	→→	Catalogues of INDICATORS	[→→]	[→→]	[→→]
09 Pedag	By Menu		→	→	—	—	—	→→	→→	[→→]	PEDAGOGIC RESOURCES	→→	→→→→
10 Games	By Menu		→??→	→??→	→??→	→??→	→??→	→??→	→??→		→→	Serious GAMES	→
11 Library	By Menu		Dossier/ Tree	Dossier/ Tree	—	—	—	Dossier/ Tree	—	—	—	—	Libraries DOCU
<i>Correspondence to Galleries in ePLANETe</i>	(SMMAADs)		YGGDRASIL (& COLLABORATIVE ACTIVITIES)	PEOPLE & PARTNERS	(NEWSREEL)	NEWSREEL	IDEAS & ACTIONS	TERRAINS	TOOLS	(LES KIK, B4U, KERDST)	BROCELIANDE	—	THE BABEL-2- GARDENS

Note: This table privileges the inter-relations of functional Expo Spaces or Galleries as envisaged in 2012 for the “KICE”. For completeness it signals the presence of Indicator Kiosks and Deliberation Support Tools (KIK, KerDST, B4U) as required for the interface with the Virtual Eco-innovation Fairground. But it does not include reference to other ‘ePLANETe’ galleries that have no functional analogues within the 2012 KICE design. **Source:** © O’Connor 2012/2013.

Table 3. 10: From KICE and the Fairground towards the Unified ePLANETe(Function Considerations / Design Elements for the Climate KIC’s Virtual Academy of Climate Innovation (KICE) as envisaged by the Climate KIC Education Programme 2011/2012) with reference to the “Virtual Eco-innovation FairGround”

The KICE Expo Spaces (Academy of Climate Education)	Short Functional Description by “Expo Space” for The Virtual Academy of Climate Innovation	Correlations with the future ‘ePLANETe’ (including KerBabel and “FAIRGROUND” concepts)
KICE-000 WELCOME/Reception (Welcome to The Virtual Academy of Climate Innovation)	Introduction to the on-line Gateway to the Climate KIC Education Programme's “Academy of Climate Innovation”. Direct access to the various Galleries of information, educational opportunities and expositions..., ... including the NoticeBoard of Opportunities in the climate innovation education field, and the system of “ Current Events ” that tell of Climate KIC Education Programme activities...	The “ePLANETe” offers entry via the TOUTATIS Doorway to profiles of User Communities and, through that Doorway, access to profiles of Communities (in the Gallery PARTNERS AND PEOPLE), to Current Events in the NEWSREELS GALLERY , and profiles of COLLABORATIVE ACTIVITIES of these User Communities.
KICE-00 Introducing the on-line system: GETTING AROUND THE ACADEMY A Visitor's Guide to the on-line Academy: Your Gateway to Educational resources and Activities in Climate Innovation	“How to Get Around” in the Climate KIC Education Programme's Virtual ACADEMY of Climate Innovation: A Visitor's Guide to the Introducing the Education Programme — who we are and what we do... <ul style="list-style-type: none"> • Presentation of the different functional areas or “spaces” of the KICE system. • Guided Tour/Virtual Visit to the VACI (Virtual Academy of Climate Innovation). • How to Contact Us; Contextual Help, Feedback and Suggestion Box... <p><u>Note:</u> This Space also gives access to information on the KICE Website's design and methodology and, on this basis, explains the variety of tools and techniques accessing information, services, people and activity zones within the Academy.</p>	This Expo Space was intended include information on the “sub-worlds” found within or accessed from the Academy. For example: <ul style="list-style-type: none"> ● The Virtual Ecoinnovation Fairground (corresponding now to the FAIRGROUND Doorway of ePLANETe); ● Projects or Programmes exploiting KerBabel on-line collaborative learning and deliberation support tools (now accessed through the KERBABEL Doorway to the Gallery of SMMAADs [modular multi-media deliberation support systems] and to the Gallery of Evaluation Worksites); ● The KerBabel “Brocéliande Forest” system of on-line teaching resources in Sustainability Studies, Ecological Economics, Environment and Climate Change (now accessed through the TALIESIN Doorway).
KICE-01. The Climate KIC Introducing the EDUCATION Programme Climate, Sustainability, Knowledge Partnerships & Innovation: The Education Programme and, the Academy of Climate Innovation	<p style="text-align: center;">The Climate KIC: Introducing the EDUCATION Programme — who we are ... / ➔ People and Partners in Climate KIC Education ... and what we do... / ➔ Education Programmes (KICE-01 The Academy) How to contact us...</p> <p style="text-align: center;"><i>Climate, Sustainability, Knowledge Partnerships & Innovation: The Education Programme and, the Academy of Climate Innovation's Mission...</i></p>	The “ePLANETe” offers entry via the TOUTATIS Doorway to profiles of User Communities and, through that Doorway, access to profiles of Communities (PARTNERS AND PEOPLE), to Current Events (NEWSREELS), and profiles of COLLABORATIVE ACTIVITIES of these User Communities. The “ePLANETe” offers entry via the TALIESIN Doorway to presentations of User Communities' teaching/education programmes (via the YGGDRASIL GALLERY), and to pedagogical resources (in THE FOREST OF BROCELIANDE). See below.

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<p>KICE-02 "EDUCATIONAL ACTIVITIES at the ACADEMY" Gallery of the Academy's Education Programmes and Components/Modules</p>	<p>As originally conceived (2011), the Gallery of Climate KIC Educational Activities, would provide profiles, using a standard template for each type of activity (Module of Journey; inter-university Master programme or Course within a Master Programme; PhD study programme, Short professional training course, etc., etc.)</p> <p>The Gallery of EDUCATIONAL PROGRAMMES and MODULES allows the profile of each EDUCATIONAL PROGRAMME and of each individual MODULE (e.g., a course within a Master's Programme) to be cross-referenced to entries in other galleries — notably including PEOPLE & PARTNERS, IDEAS, TERRAINS, and TOOLS associated with the pedagogic activity in question. Within this Gallery, the Educational Programmes and their components (modules, etc.), are classified along various axes, including language employed, education level or type, thematic domain. It was envisaged that this cross-referencing could also be opened towards "PROJECTS" if a KIC-wide Gallery of Project Profiles were to be implemented and if the innovation networks and knowledge products of Projects are considered systematically as potential pedagogic resources.</p>	<p>At the initiative of the KerBabel/REEDS team, the OVSQ faculty at the UVSQ (France) implemented during 2011-2013 an on-line catalogue of its teaching programmes, called YGGDRASIL, which was cross-referenced to a Catalogue of People & Partners and to Galleries of COLLABORATIVE ACTIVITIES and of OVSQ Current Events (NEWSREEL).</p> <p>This Drupal CMS system was considered a 'prototype' whose methods could be adapted and extended to the Climate KIC wide partnership in Education. All of these functional spaces, galleries and cross-link features are carried over into the future “ePLANETe.</p>
<p>KICE 02./b — Climate KIC Gallery of PROGRAMMES & PROJECTS Introducing the Climate KIC's Programmes of Activity and its CHALLENGE PLATFORMS</p>	<p>The Gallery of Climate KIC PROJECTS was intended to provide profiles, using a standard template to be decided at the level of the Climate KIC management, of each PROJECT benefiting from KIC financial support or other recognition. This Gallery could be introduced by a general overview of the challenges addressed by the Climate KIC as a whole, that is, "the Dimensions of the Climate Innovation Challenge", and would then be structured by, among other classification axes, the Climate KIC's Programmes (the Innovation and Pathfinder Programme, the Education Programme, etc.) and the Climate KIC's Challenge Platforms which (as of July 2012) were:</p> <p>▣ TRANSFORMING THE BUILT ENVIRONMENT ▣ SUSTAINABLE CITY SYSTEMS ▣ MAKING TRANSITIONS HAPPEN ▣ INDUSTRIAL SYMBIOSIS ▣ GREENHOUSE GAS MONITORING ▣ BIOECONOMY ▣ LAND & WATER ENGINEERING FOR ADAPTATION ▣ CLIMATE SERVICES ▣</p>	<p>The KICE Gallery of PROJECTS would, if implemented in this way, have allow the profile of each individual PROJECT to be cross-referenced to entries in other galleries — notably including PEOPLE & PARTNERS, IDEAS, TERRAINS, and TOOLS associated with the Project in question.</p> <p>This purpose is satisfied in the ePLANETe system, via the Gallery of COLLABORATIVE ACTIVITIES (already mentioned) which, itself, provides one of the pathways to presentations of Gallery of projects developing or contributing to on-line SMMAADs [modular multi-media deliberation support systems] which, having their prototypes in 'ViViANE and Ker-ALARM, are a unique feature of the ePLANETe.</p>

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<p>KICE 03. The Climate KIC Community (Galleries of PEOPLE and Partners)</p> <ul style="list-style-type: none"> • The CLC's & the RICs • Member institutions • Governance & Admin • The Programmes: Education, Innov & Pathfinder, Entrepreneurship • The Climate KIC Alumni • Individuals (including those employed by Members institutions/Partners, those associated with a project or Programme (e.g., Coaches or mentors?), individual Alumni...) 	<p>A system of Catalogues, that can be accessed at different levels and with various filters, with "PARTNER" profiles of the various Organisations, and Profiles of the individual PEOPLE associated in the Climate KIC consortium.</p> <p>The PEOPLE & PARTNERS Gallery system was conceived (in 2011) and given a first implementation (during 2012), at the level of the Education Programme, with the hypothesis that it could be generalised to cover the entire Climate KIC community, that is, the Innovation & Pathfinder Programme, the Entrepreneurship Programme, the RICs and the Management activities of the Climate KIC. In this case:</p> <ul style="list-style-type: none"> • A first hierarchical structure is that of Consortium / CLCs & RICs / Members & Associates / Individuals. • A second, complementary organisation is that of the Internal Structure, viz., the mobilisation of individuals in structures of Governance and of each of the 3 Programmes. <p>These two logics of presentation can be proposed to coexist, simultaneously, by analogy with the 'Table of Contents' and the 'Pathway' navigation functions of the KerBabel systems Brocéliande and Yggdrasil (already mentioned).</p> <ul style="list-style-type: none"> • Within the PEOPLE Gallery, a different type of relation, non-hierarchical, can be proposed by analogy with "Linked-in" or "Facebook", providing for an Individual-to-Individual relation of proximity. <p>Within the PARTNERS & PEOPLE Gallery, Individual profiles can be cross-referenced to entries in other galleries, including: TERRAINS, IDEAS-TO-MARKET, TOOLS, PROJECTS, and finally the Education-specific galleries of PEDAGOGIC RESOURCES and EDUCATIONAL PROGRAMMES.</p>	<p>In view of the hierarchies and cross-links, this was the most complex 'gallery' structure within the KICE system. Trials were envisaged of different functionalities with small sub-populations of KIC community members. It was agreed that the Catalogue of Partners needed to be complemented cross-linked with the "Tombinoscope" or Directory of People. It was also proposed for the KICE that consideration could be given to providing for a fourth category of organization within the PARTNERS & PEOPLE Gallery, that of the individuals linked together in a PROJECT. (The question of quality control for data implementation at the KIC-wide level remained to be resolved.)</p> <p>The KerBabel team at the OVSQ-UVSQ had already implemented an on-line Catalogue of Partners & People which was cross-linked to the Catalogues of teaching programmes (Yggdrasil), of educational resources (Brocéliande), of Collaborative Activities, and of Current Events (the OVSQ NewsReel). So the KerBabel Drupal CMS system was already proven as a 'prototype' whose methods could be adapted and extended to presentation of the entire KICE. All of these functional spaces, galleries and cross-link features are carried over into the future "ePLANETe.</p>
<p>KICE 04. "NoticeBoard" A Gallery of Announcements or "OPPORTUNITIES" The KICE Current Events “NewsReel” on line...</p>	<p>This Gallery is a "NOTICEBOARD" for the posting of "OPPORTUNITIES" of interest to members of the Climate KIC community and, more widely, to the innovation community at large (if this Gallery is open to the wider public). A standard template will be provided which will allow any registered member of the Climate KIC community to compose an Announcement (whose acceptability must then be checked by a NoticeBoard Moderator before being published on-line). The Announcements will appear in reverse chronological order (the most recent at the top) and, various filters can be applied by the NoticeBoard reader. In the first version (late 2012), the Classification Axes included:</p> <p><input type="checkbox"/> Language of the Announcement, <input type="checkbox"/> The list of CLCs and RICs, plus Alumni, <input type="checkbox"/> The list of Climate KIC Challenge Platforms, <input type="checkbox"/> The Climate KIC Programmes (Education, Innovation & Pathfinder, Entrepreneurship, Governance), <input type="checkbox"/> The Type of Opportunity (Job, Partnership, Investment, Training, Product or Service...)</p> <p>Individual Announcements on the NOTICEBOARD can be cross-referenced to related items in other Galleries, for example to TERRAINS, to PEOPLE (& Partners), to Innov/IDEAS, to TOOLS, and also to Climate KIC PROJECTS.</p>	<p>The envisaged "NoticeBoard" structure is closely analogous to a "Current Events" Gallery — cf. the REEDS and OVSQ 'NewsReel' Galleries, which were each cross-linked to other Galleries of Objects — including, but not limited to: the Catalogue of teaching programmes (Yggdrasil), the Catalogue of Partners & People, the Gallery of Pedagogic Resources (Brocéliande).</p> <p>All of these functional spaces, galleries and (generalized) cross-link features are carried over into the future "ePLANETe. A specific "NoticeBoard" feature can be obtained as a sub-set of the general "NewsReel" functionality.</p>

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<p>KICE-05. "CURRENT EVENTS" A Gallery of News Articles The KICE Current Events “ NewsReel on line...</p>	<p>This Gallery is a "NewsReel" of "Current Events", made up of short articles that tell of Climate KIC Education Programme activities. A standard template is provided, which will allow any registered member of the Climate KIC community to compose an News Article (whose acceptability must then be checked by the NewsReel Moderator before being published on-line). A <u>News Article</u> can include text, images, Website links and videos etc., up to certain technical limits. The News Articles appeared in reverse chronological order (the most recent at the top) and, various filters can be applied by the reader. In the first version (2012), the Classification Axes included:</p> <ul style="list-style-type: none"> ☐ Language of the Announcement, ☐ The list of CLCs and RICs, plus Alumni, ☐ Climate KIC Challenge Platforms, ☐ The Climate KIC Programmes (Education, Innovation & Pathfinder, Entrepreneurship, Governance), ☐ The Type/Level of Educational Activity (Doctorate, Master, 'The Journey', Professional/Executive, ...) ☐ Types of media and technologies involved (e-Learning, ePresence...). 	<p>In the “KICE”, the Gallery of “Current Events” was conceived as separate from the “NoticeBoard”. But the functionalities are almost identical, and so the two sorts of announcements can easily be melded within a single “NewsReel” with several classes of announcements.</p> <p>Individual <u>News Articles</u> on the KICE Current Events NEWSREEL could be cross-referenced to related items in other Galleries, for example to TERRAINS, to PEOPLE (& Partners), to Innov'IDEAS, to TOOLS, to Climate KIC PROJECTS. In this way, a visitor to the Current Events Gallery can be "initiated" via a specific news item, into other Expo Spaces. These cross-link features are carried over into the future ePLANETe.</p>
<p>FAIR/KICE-06. Innov'Ideas "IDEAS-TO-MARKET" <u>Gallery of INNOVATIONS</u></p>	<p>Eco-innovation partnerships may engage Innovations in technology, and also in methods of analysis and evaluation, communications, commercialisation strategies, and partnerships. The purpose of this Gallery, as first implemented for the “Virtual Innovation Fairground” in 2012, was to allow innovative IDEAS, of whatever sort, to be posted for visibility to others, using a standard template. Individual IDEAS can then be cross-referenced to entries in other galleries (notably including PEOPLE & PARTNERS, TERRAINS associated with these innovation ideas).</p>	<p>The IDEAS Gallery was structured by several axes for the typology of eco-innovations, including <u>type</u> (e.g., institutional, educational, technology, etc.) and <u>distance to market</u> (reflecting the EURBANLAB Project's “ideas-to-market” preoccupations). The classification fields were subsequently modified so as to provide for a wider scope, in a Gallery of Sustainability Actions & Ideas. This gallery is retained in ePLANETe, where it is accessed through the FAIRGROUND Doorway.</p>
<p>FAIR/KICE-07. <u>Gallery of Eco-innovation</u> TERRAINS (or, "Innovation Cases" / Cas d'Ecole)</p>	<p>A key part of the visibility of the Climate KIC (Knowledge Innovation Community is the identification of specific Terrains of experimentation. The Gallery of TERRAINS presents, using a standard template (adapted from inputs by, e.g., FONDaTERRA within EURBANLAB) profiles of "Case Studies", "Demonstration Projects" or other activities of territorial development falling within the Climate KIC's orbit of interest. Individual TERRAINS profiles can then be cross-referenced to entries in other galleries (including PEOPLE & PARTNERS, IDEAS, TOOLS associated with a specific terrain).</p> <p>In this context, the 'EURBANLAB' project had the status of providing a “demonstrator” for the description of Terrains of eco-innovation activity, permitting the demonstration of the "IDEAS-TO-MARKET" Gallery with reference to their respective Challenge Platforms. (The List of Climate KIC Challenge Platforms was one of the Classifications within this Gallery.)</p>	<p>The Gallery of TERRAINS is fundamental to the “Virtual Eco-Innovation Fairground” implemented in the context of the EURBANLAB Project.</p> <p>The term 'TERRAIN' was used in order to make explicit the focus on activities taking place in a specific territorial context, as distinct from 'Project' in the sense of activities financially supported by the Climate KIC through its various programmes. This raised into focus the question of a Gallery of 'Projects' as part of the “KICE” and/or the “FairGround”.</p> <p>Such a Gallery could, evidently, be implemented using the same principles of classification and cross-gallery linkages applied in other KICE Galleries. In the subsequent ePLANETe, this function is served by classes of objects in the Gallery of Collaborative Activities.</p>

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<p>FAIR/KICE-08 Gallery of "ANALYSIS TOOLS & METHODS"</p>	<p>This concept was initially incorporated in EUBANLAB's "Virtual Innovations Fairground", where it was described as The EURBANLAB Reference Benchmarking Tool (RBT) Catalogue of Analysis METHODS & TOOLS. The purpose of this Gallery was to present, on the basis of typologies, a spectrum of methods and analysis tools engaged by EURBANLAB partners/associates for the description and evaluation of eco-innovations in their terrains of demonstration and implementation.</p> <p>This gallery as implemented during 2013 but was not systematically exploited during the short lifetime of the EURBANLAB Project itself.</p>	<p>The concept of a Catalogue of Analysis METHODS & TOOLS has been retained in the ePLANETe, where a Gallery of Paradigms, Methods & Tools is accessed through the TALIESIN Doorway. This gallery is (1) mobilized as a teaching & learning resource, and (2) exploited as a resource base in the 'KerBabel Representation Rack' for the methodological classification of Arguments and Indicators mobilized by the KerBabel suite of Deliberation Support Tools (see below).</p>
<p>The Climate KIC Eco-innovation Indicator Kiosk (KICIK) (A Gallery of Indicators)</p> <p><i>[Not Incorporated within “KICE” in the 2012 design.]</i></p>	<p>A "Catalogue of Indicators" was not initially envisaged as a generic component of the “KICE” system. However, in the EURBANLAB RBT (Reference Benchmarking Tool), the Climate KIC Eco-innovation Indicator Kiosk (KICIK) provided a meta-information system for characterising each type of information retained for use as an Indicator for description and normative appraisal of a Technology or Terrain. Indicators may then be cross-linked to Objects in the other Catalogues.</p> <p>The KIC Eco-innovation Indicator Kiosk was thus implemented as a Gallery within the “Virtual Innovations Fairground”, which provided for the cross-linking of Indicator profiles (or of entire ‘Kiosks’ of Indicators) systematically to other Galleries such as TERRAINS and TOOLS. It was also recognized that Galleries of Indicators (like other tools), are likely to be important teaching resources., and that cross-links to Indicator profiles, or references to whole sets of Indicators, were likely to be features of Educational Resources developed and managed in the on-line Libraries/Galleries of teaching resources.</p>	<p>Versions of the KerBabel™ Indicator Kiosk (or KIK) had been developed and exploited since 2004 in multi-criteria multi-stakeholder evaluation exercises with the KerBabel “Deliberation Matrix” (KerDST).</p> <p>In the 2012 “KICE” design, the view was first adopted that, given the contextual nature of user-oriented information, Indicator catalogues were best implemented at the level of a Programme or Project or family of closely associated projects. They were to be accessed in the context of specific deliberation support exercises (e.g., with KerDST and K4U on line) or in modular systems of integrated analysis (SMMAAD: <i>Système MultiMedia d’Apprentissage et d’Aide à la Délégation</i>).</p> <p>After 2013, with generalization of the “cross-linking” and confounded hierarchy features of ePLANETe, this argument became redundant and was abandoned. The gallery “Les KIK”, accessed through the KERBABEL Doorway, becomes a fully-fledged part of the platform.</p>

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<p>KICE-09. PEDAGOGIC RESOURCES Gallery of Thematically Organised, Dedicated Teaching and Learning Resources</p>	<p>This Expo Space provides, as a core functionality of the Virtual Academy of Climate Education, a Gallery of Modules of on-line Teaching Resources, organised thematically. In the 2012 design, it was envisaged that these pedagogic resources would include didactic presentations of Eco-innovation Case Studies, , drawn from Climate KIC Innovation & Pathfinder Projects.</p> <p>The interface with the “Virtual Eco-innovation Fairground” was provided by the “URBANLAB Roadshows” — that is, documentations of URBANLAB Case Studies including description, analysis methods and performance evaluation results, made available progressively in a standard didactic format for use in teaching, decision support and communication.</p> <p>The design prototype for this KICE gallery was the modular ‘Brocéliande Forest’ system already developed by the KerBabel team. At the levels of MODULES, their Chapters and their constituent Grains, the Gallery of Pedagogic Resources may exploit cross-links to other Modules, and also to objects in other KICE Galleries — such as TERRAINS, TOOLS, IDEAS-TO-MARKET and PEOPLE & PARTNERS. At all levels, these Pedagogic Resources may exploit or make reference to ‘external’ objects and website material.</p>	<p>The design prototype for this KICE gallery was the ‘Brocéliande Forest’ system already developed in 2009-2011 by the KerBabel team (with precursors dating from 2002). The originality of ‘Brocéliande’ was its fluid navigation structure, with thematic Modules organised by Chapters/Grains, multiple Learning Pathways defined within a Module, and systematic Grain-to-Grain links (cf., Wikipedia page-to-page links) allowing ‘surfing’ within and between Modules of the Gallery.</p> <p>At all levels in ‘Brocéliande’, the dedicated Pedagogic Resources may exploit or make reference to ‘external’ objects and website material, called “Fruits”, that are catalogued in one or more Libraries (including the Babel2Gardens) or simply accessed through hyperlinks. These galleries and functionalities, accessed through the TALIESIN Doorway, remain at the heart of the mature ePLANETe system.</p>

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<p>"Build Your Problem"</p> <p>A Gallery of Tools and Cases of Multi-Criteria EVALUATION</p> <p><i>[Not Incorporated within “KICE” in the 2012 design.]</i></p>	<p>The "Virtual Eco-innovation Fairground" offers to the visitor an initiation to the evaluation of eco-innovation opportunities as multi-faceted social choice problems. In particular, it proposes (1) access to presentations of case studies already evaluated; and, (2) initiation to the steps for conducting one's own multi-criteria appraisal.</p> <p>Two main evaluation tools are privileged: (1) the EURBANLAB Project's Reference Benchmarking Tool (RBT), known as B4U (Benchmarking for You), dedicated for territorial eco-innovation; and (2) the KerBabel Deliberation Matrix providing for multi-stakeholder as well as multi-criteria perspectives in evaluation.</p> <p>Access to evaluation case studies can, in principle, be ad hoc or via pre-existing catalogues on-line. It was, for example, possible for the Fairground to exploit the pre-existing "Consult the Cube" gallery created by KerBabel which since 2006 presents, with a standard template, applications of the KerBabel™ Deliberation Matrix permitting indicator-based multi-criteria multi-stakeholder evaluations of options for action. In the context of EURBANLAB, a complementary on-line cataloguing system was envisaged for the Reference Benchmarking Tool (RBT, or B4U) applications.</p> <p>Such tools and case study materials, whether coming from Climate KIC funded projects or other sources, were recognized to constitute valuable teaching and learning resources for the KICE Education Programme. Although not having the status of galleries in their own right within the ACADEMY, it was thus expected that they could be found and accessed through various Expo Spaces of the Virtual Academy of Climate Innovation, notably the gallery of TOOLS and the gallery of PEDAGOGIC RESOURCES.</p>	<p>Versions of the KerBabel™ Deliberation Matrix had been developed and exploited by the KerBabel team since 2002, in their experimentation of on-line participatory tools for multi-criteria multi-stakeholder evaluation exercises. Historically, they were accessed in the context of specific deliberation support exercises (e.g., with KerDST on line) or in SMMAAD modular systems of integrated analysis (notably the demonstrations ViViANE 2004 and Ker-ALARM 2006).</p> <p>In the 2012 “KICE” design, the view was first adopted that these tools and examples of their uses were best offered at the level of a Programme or Project. So, the presentation and use of KerDST and B4U was assigned to the “Virtual Eco-innovation Fairground”. After 2013, with the fusion of the ‘KICE’ and ‘FAIRGROUND’ concepts in the confounded hierarchies of ePLANETe, this separation no longer applied.</p> <p>The Deliberation Matrix concept and its implementations (KerDST = the KerBabel on-line deliberation support tool) permitting indicator-based multi-criteria multi-stakeholder evaluations of options for action, is at the heart of the mature ePLANETe system. The gallery of Worksites (including terrains of eco-innovation evaluation) is accessed through the TOUTATIS and CAMELOT Doorways; and the gallery presenting the Deliberation Support Tools themselves (including B4U and variations) is accessed through the KERBABEL Doorway.</p>

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<p>KICE-10. GAMES ROOM Gallery of Educational 'Games' and on-line simulation/interactive learning systems</p>	<p>The pertinence of "SERIOUS GAMES" for Climate KIC Education Programme activities was identified early in 2011 and, it was agreed that on-line games and interactive simulation/learning systems relevant to climate innovation should be documented (or even created!) and, access to them should be facilitated. "Serious Games" could validly be considered as a class of TOOLS, or as a sub-set of PEDAGOGIC RESOURCES. But, in view of their distinctive features, for KICE design purposes we separated them into a Gallery of their own.</p> <p>The "Games Room" or "Games Arcade" would use a standard template to provide a list of the catalogued "games", with a short description of their character, their sources and requirements/conditions for their use, and links towards the relevant site or interface. Games would be classified by "type" (these typologies yet to be determined), and also with reference to Climate KIC categories:</p> <p><input type="checkbox"/> The list of Climate KIC Challenge Platforms, <input type="checkbox"/> Pertinence to different Types/Levels of Education activity, Innovation & Pathfinder, Entrepreneurship, Governance), <input type="checkbox"/> ... / ...</p> <p>As of 2012, proposals for the development and adaptation of "serious games" had been made within the Climate KIC's Education programme and also to the Innovation & Pathfinder programme. It was envisaged that these projects would feed directly into this Gallery.</p>	<p>In the 2012 KICE design, the "Games Room" or "Games Arcade" was only at an embryonic stage of development. It was intended to use a standard template to provide a list of the catalogued "games", but the appropriate template and typologies had yet to be determined.</p> <p>In the fusion of the KICE with the FAIRGROUND leading to 'ePLANETe', the concept of a separate "Games Arcade" has not been retained. The KerBabel team's view is that such a feature could, if wanted, be provided as a Module within the 'Brocéliande' gallery of teaching resources.</p> <p>It is also noted that, in a certain sense, deliberative multi-criteria multi-actor evaluations can be interpreted as "serious games". In ePLANETe, these are either catalogued as stand-alone applications of KerDST (in the WorkSites Gallery) or presented in an integrative context (such as ViViANE) within the Gallery of SMMAADs.</p>
<p>KICE-11. DOCU The Academy's LIBRARY</p> <ul style="list-style-type: none"> • Document Galleries, • Catalogues of Pedagogic Resources, and • Catalogues of Gallery Collections... 	<p>The ACADEMY offers to its members, users and visitors, a set of Virtual Libraries that provide, through a variety of referencing conventions, access to bibliographical information and to various sorts of documents, files and media (including videos, data sets, etc.) relating to all aspects of the Climate KIC Education Programme. Within the KICE Library on line, these materials should be organised according to several complementary logics: Classification by Source/Place/Conditions of production (e.g., research projects, educational institutions...); Classification by Type (PDF, PowerPoint, Image, video, Music, other...); Classification by Places of Use in the Academy.</p> <p>The emphasis of the ACADEMY system is on managing resources for Educational uses/purposes. Thus, for example, entries in the GALLERY OF PEDAGOGIC RESOURCES can exploit or make reference to 'external' objects and website material that are catalogued in the Academy's LIBRARY. But this feature is extended as a "service" to all Galleries within the ACADEMY. For example, profiles of PEOPLE (and Partners), of TERRAINS, of TOOLS, etc., can all signal complementary documents as "annexes" and these objects are catalogued and managed in the Academy's Library. Finally, the ACADEMY's Library services can, in principle, be made available to PROJECTS within the Climate KIC User Community, permitting the cataloguing and management of a PROJECT's production</p>	<p>The prototype for the envisaged Academy Library was the KerBabel on-line file management and document management system known as the "Babel?Gardens", with precursors dating back to 2002 (the first 'Babel Gardens / Jardins de Babel').</p> <p>In the current ePLANETe, this system [exploiting in its current incarnation the specialized software El Fresco], is like a "mirror" of the different functional spaces. It provides a service function for the management of supplementary teaching resources, and for the documentation of research projects and other collaborative activities expressed through the corresponding ePLANETe galleries. Also, although less obviously, it acts as a storage place for the entire contents of the 'ePLANETe'.</p>
<p>KICE-12. — SEARCH & FIND The Academy's Search & Find Facility</p>	<p>Any visitor to the ACADEMY will have specific interests and needs, and so may wish to search directly for a specific object or for information on a specific topic. This is provided for, by a comprehensive "SEARCH & FIND" functionality. An adaptation of state-of-the-art Search engines was implemented, which provided for the following:</p> <ul style="list-style-type: none"> • Find all "objects" in Academy Galleries or in ordinary pages of the website, containing a specific string of text; • Select by fields, for the three major categories of objects managed by Academy Galleries, namely (i) Documents referenced according to classical publication conventions; (ii) on-line Pedagogic Resources including Serious Games; and (iii) Other objects in Galleries. 	<p>The SEARCH & FIND functionality/service is fully deployed in the current ePLANETe, and is available to Users by default as one of the modalities for "Getting Around ePLANETe".</p> <p>Documentation of this, and other technical functionalities, is provided in the PhD thesis by Philippe Lancelleur (2019) titled <u>The KerBabel Experience</u>.</p>

The KICE Expo Spaces (Academy of Climate Education)	Short Functional Description by “Expo Space” for The Virtual Academy of Climate Innovation	Correlations with the future ‘ePLANETE’ (including KerBabel and “FAIRGROUND” concepts)
<p>KICE-13. Communications Room ePRESENCE & Collaborative Learning Platforms</p>	<p>During 2012, the Climate KIC engaged the implementation of a state-of-the-art tele-conferencing network, designated ePRESENCE, exploiting PolyCom services and technology. In this context, it was envisaged that the Academy's Communication Room would give Climate KIC user community members “virtual” access to TeleConferencing facilities. This specialized function could then be opened out to, or complemented by sign-up opportunities to more “generic” services, such as participation in dedicated Climate KIC Social Networking Services (Facebook, Linked-in, etc.), exploitation of Collaborative Learning Platforms (notably the KICE) and other support services for the Academy of Climate Innovation's User Communities.</p>	<p>Since 2011, in the context of the <i>EquipEx 'DIGISCOPE'</i>, the KerBabel team has been engaged in design and ergonomic experimentation of opportunities for multi-screen exploitations — within a single physical workspace (such as 'MIRE' at the OVSQ) or at a distance — of on-line collaborative learning and deliberation support environments. Experience with students shows the power of multi-screen interfaces, for both individual and collective use, in physical presence or at-a-distance.</p>
<p>KICE-14. The Climate Café A Convivial Place to Chat</p>	<p>The general idea (from the KIC Education team in 2011) was that, in addition to opportunities to develop "Chat" threads etc., the Virtual Climate Café could open out to the Gallery of PEOPLE (and Partners), and to various other Galleries providing for rapid posting of information, for example: the NewsReel of Current Events, the Gallery of Innov'IDEAS, the NoticeBoard of Announcements/Opportunities. Alternatively, it would be possible to consider the "NoticeBoard," "NewsReel", etc., as part of the Climate Café. This is a design matter of navigation and visualization.</p>	<p><i>As of the time of writing (2019), the KerBabel team has not implemented any social networking functionalities specifically associated with the 'ePLANETE'.</i></p>
<p>KICE-15. The Academy Shop Souvenirs, Education resources, Services...</p>	<p>An ACADEMY SHOP was suggested, which would — as on any self-respecting campus — provide an opportunity for the purchase of Alumni Souvenirs, of different sorts of Education resources, of access to Services. Analogously, it was suggested that the Virtual Eco-innovation Fairground could, in due course, contain an On-Line Shopping Arcade: Boutiques for Souvenirs, Products & Services available on-line; Contacts for information on specialised tools & consulting services including partnership building.</p>	<p><i>Neither the “Academy Shop” as a KICE Gallery nor the “Shopping Arcade” for the FAIRGROUND progressed beyond the initial 2012 concepts. As of the time of writing (2019), the KerBabel team has not implemented any on-line shopping or professional service provision specifically associated with the 'ePLANETE'.</i></p>

3.7. “ICT for Green” - Knowledge Partnerships for Sustainability

3.7.1. *ePLANETe — Structuring the ‘Virtual’ as a force for Real Change*

This chapter has presented some of the history and key design features of the ePLANETe platform, as designed, built and maintained by REEDS International at the UVSQ in collaboration with technical, scientific and educational partners around the world. Through the successive sections, we have considered the ePLANETe system:

- ❑ First, in Section , as an experimentation in the design and implementation of an Internet-Based “Knowledge Gateway” in support of knowledge and learning partnerships for sustainability;
- ❑ Second, in Section , via the core of KerDST (KerBabel Deliberation Support Tools) and the synergistic concept of the SMMAAD, as an innovative approach to the “integrative” and participatory modeling of eco-socio-economic systems;

These different facets of the ePLANETe system are complementary. Each type of use or experience can be considered as primary for different purposes and user communities. We can consider ePLANETe as, in an emergent sense, an experiment for a digital ‘social networking’ concept that centres not only on sharing knowledge resources and collaborative learning, but also on building processes of collective deliberation and choice — and that, in this regard, goes beyond the simple gestures “I like” characteristic of the generation FaceBook, Instagram, Linked-in...

3.7.2. *ePLANETe as a Knowledge/Learning Gateway*

Considering ePLANETe as a “Sustainability Knowledge/Learning Gateway” available through the Internet, we can put the accent first on the TOUTATIS and TALIESIN Doorways, with the identification of different Learning Communities (whose members may, of course, sometimes overlap) and on the spectrum of knowledge/learning resources offered to the users.

This was the ambition that, as discussed in Section Previous, was carried in the early KerBabel years by the “Brocéliande Forest” in tandem with the “Babel Gardens”. However we have seen how, over the years, there has been enrichment in the spectrum of functional spaces and galleries, and a deepening of the procedures for “cross-linking”. The core of ePLANETe as a mature Knowledge Gateway is the offer of a set of cross-linked “galleries”, each of which offers a catalogue of digital objects and each of which can be exploited as “knowledge partnership” resources in collective deliberation. So, the specificity of ePLANETe resides as an innovation « ICT for Green” resides in its systemic features:

- ❑ the spectrum of catalogues (the galleries);
- ❑ the systematic use of filters for selecting within a gallery;
- ❑ the multi-layered procedures of cross-linking of objects in different galleries;
- ❑ the opportunity for decentralized contributions by User Communities to many of the Galleries;
- ❑ the opportunities, via the KerBabel deliberation support tools, for the mobilization of diverse arrays of knowledge contributions and judgements, in a diversity of collaborative evaluation and deliberation exercises.

In the bullet points below, we try to summarise the innovative framework offered by ePLANETe as a collaborative learning support technology:

- ❑ First, the platform provides, in flexible ways, for a great diversity of “User Communities”, via the complementary galleries of the **People** and **Partners** engaged in the activities supported and documented by the Knowledge Gateway. These functionalities are in many ways analogous to digital “social networking” application that have colonized the world during the past decade. Importantly, however, the individual ‘People’ profiles are very succinct, with the accent being placed on the opportunity for cross-linking to other components of the system. The ‘avatars’ of ePLANETe system users become visible by their contributions to and engagement with elements found elsewhere in the system.¹³⁸
- ❑ Second, the platform provides, in ways that are far more flexible than most institutional websites and digital work spaces, for the presentation and exploitation of a great diversity of pedagogic information. This provision for diversity is expressed, notably, by the capacities of the galleries “**Brocéliande**” (for teaching resources), “**Yggdrasil**” (for Teaching Programmes and individual courses offered by Partners), and the “Babel Gardens” (for the contextual integration of any supplementary digital materials available locally or worldwide).
- ❑ Third, the platform provides, in ways that are systematic but again more flexible than most institutional websites, opportunities for contributions of members of user communities to the presentation — on an ongoing basis — of the full diversity of activities and events. This is provided for in a set of complementary “service” galleries, whose gestation in the KerBabel gallery suite has been marked by numerous hesitations, now including: the gallery of **Collaborative Activities** which presents short profiles of different types of activity (*Multi-partner projects; Doctoral studies; Collaboration on Knowledge Mediation Tools; Networks, Consulting-Expertise*); and the **NewsReel** galleries for publication of Current Events articles.¹³⁹

3.7.3. ePLANETe as a novel approach to participatory modelling

As outlined in Section 3.5, a core feature of the ePLANETe system, which built directly on the sustainability assessment and multicriteria evaluation expertise of the C3ED and its European partners (and then REEDS) during 1995-2015, is a collaborative learning outlook that builds around **multi-stakeholder multi-criteria evaluation methodology**. With this standpoint, ePLANETe can be considered as a new experimental approach to “immersive”, participatory and integrative eco-socio-economic modeling — the array of cross-linked galleries providing, in both structural and transactional terms, an evolving “mosaic” of situations/processes of collective choice.

In the deliberative evaluation approach, learning about sustainability and environmental governance challenges is proposed through (individual and collective) participation in procedures (real or simulated) of:

¹³⁸ It is perhaps important to note, also, the ePLANETe Users are not blitzed and bombarded by advertising, solicitations and traps seeking to induce them into involuntary network participation. But this point would require a separate discussion.

¹³⁹ Each NewsReel has its own internal classification system. Provision of ‘NewsReels’ can be considered a generic service to ePLANETe User communities; and the articles of a NewsReel can be cross-linked to objects in all other galleries. In the 2013-2015 architecture there is not one overarching Current Events gallery for ePLANETe, but rather, several “NewsReels” for distinct institutional contexts and themes. The recent evolution of the GAFA social networks suggests that, if this functionality is retained within a future ePLANETe, there should be a unique NewsReel gallery.

- (1) Selection and deployment of Arguments and Indicator systems for
- (2a) evaluation (ex ante) of strategic options, and/or
- (2b) evaluation (ex post) of performance relative to specified targets or criteria.

More specifically, the ePLANETe system provides for:

- ❑ Definition, within the gallery of **Evaluation Worksites**, of specific problems or tasks of multi-criteria multi-stakeholder evaluation and, the presentation of the outcomes of these exercises with a classification of the objects presented as a function of the evaluation tool or procedure employed.
- ❑ Composition and exploitation of catalogues of **Performance Indicators** (including the opportunity for the construction of a *KerBabel Indicator Kiosk* (KIK) for a given Evaluation Worksite);
- ❑ The creation, through exploitation of the evaluation tools and a selection of ePLANETe “service” functions outlined above, of a modular on-line discovery space devoted to the specific Worksite or collection of worksites that is the focus of Partners’ collaborative attention. Such a discovery space can, for example, be a customized Module within the **Brocéliande Forest** gallery of teaching resources. Or it can be more complex, up to the scale of a full-blown “**SMMAAD**” engaging several galleries of ePLANETe.¹⁴⁰

These **Worksites** can be specified for widely varying situations, having in common the identification of multiple stakeholders as “protagonists” in a situation of consultation, negotiation or conflict over the path of action for or against different sustainability challenges. Depending on the nature of the sustainability challenges, different types of objects within ePLANETe galleries be mobilized as carrier of judgements in the multi-criteria multi-stakeholder evaluations.

The classic approach to evaluation is, of course, the mobilization of Indicators. This is provided for, in ePLANETe, by the Gallery of KerBabel Indicator Kiosks, or “KIK”, whose first prototypes date from the GOUVERne and VIRTUALIS projects in 2002-2004. However, the “knowledge resources” for collaborative evaluation exercises can be conceived in a richer way.

The different phases of the KerBabel Experience have seen the implementation, initially in an ad hoc way, of a spectrum of galleries that respond in methodologically precise ways to substantive knowledge requirements of user communities for addressing sustainability challenges. The first prototype of this subset is the Gallery of **BIODIVERSITY VIRTUAL GARDENS**, initiated in 2005 within the ALARM Project, and now considered as methodologically situated close to the MERLIN Doorway. More recently, prototypes have been designed and implemented for **ECO-INNOVATION TERRAINS** and **SUSTAINABILITY IDEAS AND ACTIONS** (close to the FAIRGROUND Doorway), the **TERRITORIAL FOOD BASKETS** and the **PARC DE PATRIMOINES** (close to MERLIN but looking also towards the FAIRGROUND), the Gallery of Environmental Justice **HOT SPOTS** (close to the CAMELOT Doorway), and the planning for a Gallery of **HOT TOPICS KQA** (close to the TALIESIN Doorway).

¹⁴⁰ There are several galleries that we have not explicitly mentioned in our discussions in this chapter, most of which are positioned close to the KERBABEL Doorway. These include the Toolkit, the Representation Rack (for the classification of Indicators and Arguments), and the DST galleries (for the presentation of ongoing and completed deliberations with KerDST, K4U, etc.). It is not within the scope of this thesis to make a full methodological exposition of these components, although some features are illustrated in applications in later chapters.

Specificities of this group of galleries include (1) the use of interactive scalable maps for positioning the objects of a Gallery in their geographical context; and (2) the mobilization of these objects as either targets of evaluation exercises or carriers of judgements contributing to an evaluation exercise.¹⁴¹

Thus, the effect of the ePLANETe gallery structures with their cross-linking not just at an object-to-object level but also by the richness of mobilization of “knowledge resources” in collaborative deliberation activity, is to provide for the creation, evolution, and observation of a **mosaic of “HOT SPOTS” of collaborative social choice activity** that, as a composite structure, can be seen as a novel type of evolutive participatory modeling of eco-socio-economic activity.

What is the social value of this innovation? As already said several times, the ePLANETe system is highly experimental. It has exploited state-of-the art content management (CMS) and internet navigation techniques (including relatively high levels of data and user security). Underlying the gallery and evaluation tool designs there are various hypotheses and normative positionings about deliberation, inter-subjectivity, learning processes, reciprocity (etc.) relative to politics and sustainability challenges. The ePLANETe development and exploitation process explores, in a participatory action-research mode, various hypotheses about the possibilities for (virtual) conviviality and (real) knowledge partnerships via the Internet technologies. All these speculations about collaborative learning potentialities through “digital” technologies must themselves be made the object of ongoing scrutiny.

¹⁴¹ For completeness, in this methodological context, it is appropriate also to consider the Gallery of COLLABORATIVE ACTIVITIES, close to the TOUTATIS Doorway. As will briefly be discussed later in the thesis, it is possible to consider *Activities* as carriers of quality in the context of a performance evaluation for an institution, strategy or sector at a higher level (e.g., a University or other Higher Education Institution). This logic can further be extended to a consideration of the *Teaching Programmes* in the YGGDRASIL Gallery as carriers of quality in the context of a performance evaluation for an institution, strategy or sector. The KerBabel team at REEDS during 2013-2015 carried out a number of experimental exercises in this sense, conducting an auto-evaluation of the performance of the REEDS research centre relative to multiple criteria of teaching and research quality, partnership, innovation...

CHAPTER 4: THE TALIESIN DOORWAY, BUILDING KNOWLEDGE PARTNERSHIPS FOR SUSTAINABILITY

The ePLANETe is an on-line “Collaborative Platform” that seeks to support a broad variety of forms of learning, and of sharing of resources for learning, always with the accent on community and conviviality. In a local/global perspective, it seeks, to incite new experiments in collaborative learning, social networking and knowledge sharing concerning the biosphere and sustainability, and to offer tools supporting debate and deliberation addressing social, political, technological, economic and environmental dimensions of sustainability. The nickname ‘Taliesin’ is the name of a Celtic historical and mythic figure, poet, druid and bard.

The construction of the Taliesin Doorway finds these roots at the end of the 90s, through precursory activities. Two complementary learning activities were followed: (1) Development of tools to build a knowledge partnership for sustainable development (see Chapter 5 and Chapter 6) and (2) training materials (see Chapter 4, and their exploitation in innovative pedagogic activities, in Chapter 7). Each of these two approaches, each in their own way, has a strong pedagogical innovation character.

4.1 Precursory activities in building partnership for sustainability

Activities prior to the creation of partnerships for sustainability have been developed within the UMR C3ED and within REEDS.

4.1.1 NTIC & Environment (2003-2005)

The operation EGER 07 of the C3ED Research Centre, "NTIC & Environment", aimed at harnessing the radical potential of new information and communication technologies (ICTs) for research and teaching, in the areas of environmental governance and sustainable development. ICTs are used as a medium both for the representation of ecological-economic systems and processes and for the organization of knowledge for pedagogical purposes (valorisation of research, environmental education, computer support in processes of consultation and deliberative governance). This operation had five components, which are closely complementary:

- A research and demonstration program (the DICTUM program);
- The development of multimedia tools as a medium for knowledge sharing and the provision of educational resources (notably the KerBabel portal);
- South / North partnership activities for the exchange and exploitation of environmental knowledge ;
- The training and production of educational resources (the Broceliande and Fangorn virtual libraries)
- Academic activities (scientific publications, internships, doctoral theses ...)

Operation EGER 07 envisaged NICTs for the creation, organization and exploitation of spatial data (for example, geological and ecological classifications, land use, climatology, etc.) - potentialities that has reinforced and renewed the practices of cartography and allow the integration of the latter in dynamic analysis approaches (scenario modelling and representation techniques of possible futures ...). In the DICTUM research program, we were committed to creating new multimedia interfaces between science, policymakers, industry and citizens.

Multimedia ICTs proposed new ways of promoting scientific research - dissemination and popularization through electronic media and animated visual presentations, etc. In particular, this operation considered a

revolution in the possibilities of interactive multimedia communication and representation and uses in environmental education and as interactive decision aids.

Finally, through all of these research and service activities (valorisation, teaching aids, etc.), the team had constantly a reflexion on the significance of the penetration of digital technologies in our societies, as in the South. North. Openness to the world of information was therefore considered both methodological and empirical. It was done according to the following four main axes:

4.1.2 Using ICT for Promoting Sustainable Human Relationships with Ecosystems and Living Resources – The DICTUM project

The DICTUM project, meaning “Democratic Information and Communication Technologies for promoting sustainable Use and Management of ecosystems and living resources”, has been developed within the l’UMR C3ED n°063 IRD-UVSQ research centre in the University of Versailles Saint-Quentin-en-Yvelines (1999-2009). The key idea was that an emergent dimension of the new information and communication technology (ICT) was related to the range of interactive advanced modelling tools, simulation and networking which allowed new interfaces between science and citizens or NGO’s to aid negotiation and conflict resolution. These tools can empower non-scientific audiences in the context of issues that, directly or diffusely, impact on their lives. The DICTUM Project was an ongoing interdisciplinary programme of research, innovative teaching and technology development based at the C3ED of the University de Versailles St-Quentin-en-Yvelines, in close cooperation with research, public policy and educational institutions throughout Europe and overseas. It centres on the design and realisation of a set of computer-based learning tools, interactive virtual spaces, that supply current scientific knowledge about a number of environmental domains to non-scientific audiences, showing the links between individual lifestyles and global sustainable futures for a number of environmental problematiques. Such tools can be used in a variety of classroom and open learning modes and the context of participatory governance processes, to better illustrate complex issues and to achieve social learning:

- the salience of the various economic and environmental phenomena;
- the effects of individual and collective actions over various scales;
- uncertainty and ignorance about environmental consequences and about opportunities of remediation;
- constraints on policy and action and individual responsibility (as a function of increasing scale and more inclusive scope).

Clearly, such tools need to be adequately adjusted to the audiences of concern and also customised for the regions and social settings where they might be used. Therefore, the work we are engaged in relates not just to the scientific and software components of design, but also to the testing and fine-tuning of the virtual environments in the form of computer tools to be used in a variety of learning contexts and in participatory processes about relevant environmental problematiques.

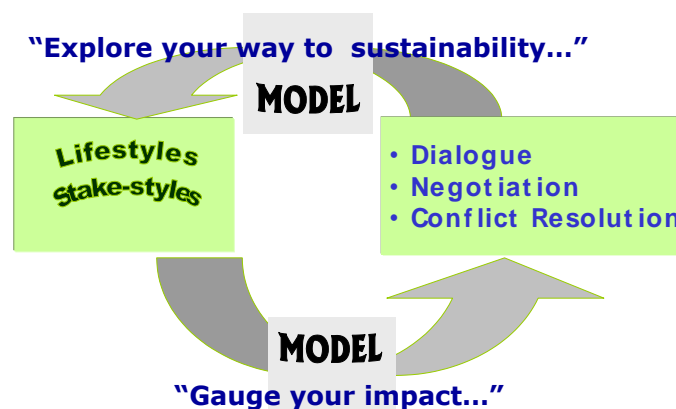
The DICTUM Project thus envisages a suite of innovative ICT designs and implementations for classical classroom based learning in schools and universities, for Internet based distance learning (including open university programmes) and for life-long and citizen learning, in several important domains of environmental education, policy and governance. The four selected domains at this stage are:

- the emission of greenhouse gases;
- the depleting or sustaining of fisheries

- pressures on underground and surface water resources through exploitation and waste disposal
- pesticides, fertiliser residues and other chemical pollutants into soil and water originating from agricultural activity

As well as the specific ICT learning products in the environmental and sustainable development field, the Project will create and diffuse new knowledge for learning system design for managing sustainable development, and specifications of key design variables for web-based self-organizing learning systems.

Two main components of an individual or collective learning opportunity have been identified. First, the user(s) can gauge how their personal way of living impacts on the environmental feature or resource in question. Second, the user(s) can explore alternative possibilities for social and economic changes towards sustainability. From this sort of exercise, social processes emerge into dialogues, negotiations, self-reflections and eventually agreed alternatives. The figure below illustrates the general logic being applied :



Building on this initial concept, the types of ICT being developed in The *DICTUM* Project fall into four major categories:

- Personal Barometers, allowing quantification of environmental impacts of individual lifestyles;
- Scenario Generators, allowing personal lifestyles to be put in the context of possible future trends and changes in patterns of economic activity, in particular movements towards sustainable resource use;
- Multi-player Games, which will allow an individual to learn about problems and processes of coordination and their impacts on resource exploitation, governance, equity of access.
- Virtual Visits, which provide an interactive digital environment within which the learning may take place.

The last of these categories, the "Virtual Visit", is a virtual reality "setting" (or theatrical set) within which the Personal Barometer, Scenario Generator and Multi-Agent Models are encountered. It is envisaged that this can be a dynamic interactive environment, reflecting an underlying notion of learning as a Voyage of Discovery.

The Virtual Visit may also be the setting for a "Virtual Library" which provides keys and state-of-the-art tools for Information Search across the Internet.

The key design concept is to move from video interfaces based on the "life-worlds" and « lifestyles » of citizens — in their homes, in the work situations, at school or on holiday (etc.) — into the presentation of

systematic, structured information about environmental problems. The ICT products thus are interactive model-backed *ICT* tools.

In scientific terms, a Personal Barometer and a Scenario Generator consist of a family of models that allow the quantification of environmental impacts linked (directly or indirectly) to personal consumption and lifestyle, and also the specification of scenarios developing different perspectives of "what is sustainable". The algorithms that relate lifestyles to, for example, emissions of the greenhouse gases, CO₂, CH₄ and N₂O are designed and calibrated by reference to « integrated » scientific and economic analyses. The personal-level *ICT* is coupled-back to relevant modules of integrated economy-environment models at appropriate regional, national, and global levels. This implies a concern with scientific integrity and validation.

The passage between scales of data definition and organisation is not necessarily one of simple aggregation or disaggregation, it often involves changing the "way of looking at the problem". This property can be exemplified through exploitation of the ICT "window" and "virtual environment" capacities. What is important about the *DICTUM* concept is to organise scientific, economic and institutional information in a distinctive way starting from the "local" knowledge and perspective of an individual citizen.

4.1.3 Prototypes of deliberation support tool (DST)

The DST developed by the KerBabel Team at REEDS exploits ICT to represent and help structure collective environmental governance problems. The specificity of DST is to access different functions according to a "virtual world", with its own structure and navigability, while opening up to additional educational resources located outside this virtual world.

VIVIANE: Virtual Visit to Our Environment

The VIVIANE prototype v. 1.2.1 was developed as a part of the VIRTU@LIS project (Social Learning on EnVIRonmental Issues with the InTeraCTive Information and CommUnicAtion TechnoLogLeS), financed by the Information Society Technologies programme (1998-2000), within the fifth Framework Programme of the European Commission, and coordinated by Prof. Martin O'Connor (C3ED, University of Versailles Saint-Quentin-en-Yvelines, France). This project grouped together specialists in information technologies, sustainable development, environmental modelling, public policy and governance, and the psychology of learning and distance learning, in order to develop computerized tools for education on the topics of ecosystems and natural resources. The four domains focused on are agricultural pollution, climate change, water resources and fisheries. For each of these four domains, ViRTU@LiS developed learning tools to improve the awareness of citizens regarding management and environmental risks.

This project has allowed the development of innovative multimedia tools for learning, using Information and Communication Technologies (ICT). It involves the organization of scientific knowledge regarding stakes and risks of environmental management, for non-scientific communities. Four types of tools are developed: (1) Personal Barometers, which allow the measurement of environmental impacts of individual lifestyles; (2) Scenario Generators, which target the exploration of changes in economic activity through the durable use of resources; (3) Virtual Visits, or interactive digital environments within which learning can take place; and (4) Multi-Actor Games, which allow individuals to learn about the issues and stakes of governance and access to resources. All these tools have been tested and evaluated by user groups.

VIRTU@LIS has this been a pioneering project for the elaboration and demonstration of generic concepts for the organisation of ICT interfaces for environmental education. The scientific analysis and communication based on (1) key notions of systems sciences in terms of environmental pressures and environmental functions, and (2) the philosophical, political and economic concepts concerning the equitable use and management of commonly owned resources. For each of the four environmental domains, specific architectures and programming of the corresponding ICT's are tested and evaluated, for the integration of the four types of ICT concepts (Personal Barometer, Scenario Generator, Multi-Actor Game Play and Virtual Visit) within a virtual reality structure. Interactions with students and with 'outside' stakeholders (businesses, public administration, civil society) have permitted a rigorous evaluation of the effectiveness, and limitations of the whole set of the ICT tools during the knowledge evaluation. The demonstration versions are available for a potential use as : (1) interfaces distributed free of charge on the internet, (2) as a product available, within the scope of agreements, for exploitation in educational contexts and for the education of citizens, in institutions such as schools, universities and territorial administrations, and (3) as communicational concepts and products that may be developed on a commercial and professional basis, for research institutes, for companies, and clients of the public sector interested in the communication between citizens and institutions, and by the dialogues of stakeholders in relation to environmental stakes.

KerALARM: Challenges for biodiversity in Europe: <http://keralarm.kerbabel.net>

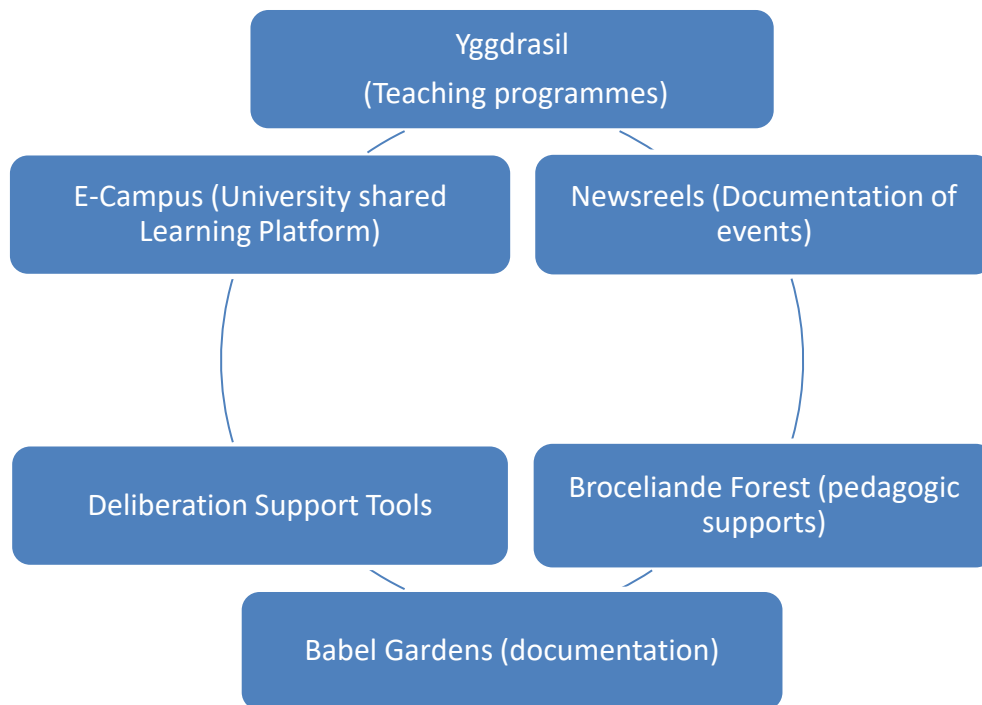
Ker-ALARM "Biodiversity Europe" is a Deliberative Learning and Deliberation Support System (DAMMS) available online for the discovery and analysis of biodiversity challenges facing policy makers, the world business, scientists and civil society. This DST is built around an integrated analysis on a large scale, risks to biodiversity. This involves studying the risks of combining the effects of climate change, chemicals, pollinator loss and biological invasions. Ker-Alarm presents a range of tools and methods for assessing specific risk factors and tools for communicating risks to biodiversity to end-users.

KerTECHNO: Ethical Challenges of the Digital Worlds - <http://body.kertechno.net>

Technolife's approach is to use the Kerbabel™ suite of deliberation tools as an entry point for the operational management of a set of narratives that draws on the imaginaries expressed by different communities sharing a point of view. with respect to a given technology. The Deliberation Matrix allows not only the organization of these narratives concerning the technological modifications of the human body, but also allows to associate the identification of the community expressing itself on this subject.

4.1.4 Digital Environment of the OVSQ in the UVSQ

The UVSQ and OVSQ had several online tools which are integrated so that users/learners to these tools from various entry points. For example, a user/learner to the Yggdrasil teaching programme and course catalogue can do directly to a current Events and Partners Galleries for more information on what that partner does or to the online teaching resources library "Broceliande Forest" to explore information on teaching topics of interest or can go directly to an online collection of support documents/digital objects stored in Babel Gardens. The access to the variety of ePLANETe galleries can be done using UVSQ online teaching plateforme E-Campus (ent.uvsq.fr)



4.1.5 Towards an open campus: "Territories and Sustainable Development" of the PRES "UPGO"

The principle of our OPEN CAMPUS is to offer students an experience, a dynamic, a quality framework that incorporates (i) the opportunities of « virtual community "offered by the new generation of ICT with (ii) the benefits of" colloquium "and physical community. Indeed, a "hybrid" welcome and support is offered, which will ensure the continuity of student support through new communication technologies (videoconferencing, various Internet, social networking ...) in addition to welcoming practices, framing and face-to-face but periodically (for short periods in groups).

This strategy is based on a clever use of ICT (Information and Communication Technologies for Education) and, more broadly, ICT. It is based on several years of research and experimentation with "ICT" within the UVSQ and UCP (University of Cergy-Pontoise) institutions and in partnership (PRES UPGO). We can summarize the many facets of this reflection in four parts, considering new technologies sometimes as a tool sometimes as a target for teaching and research activities.

The changes brought about by the "digital" lead to questions about the evolutions of the new ICT-based economy and, more broadly, the new forms of conviviality from smart phones and social networks (Facebook, Twitter, etc.) to share immersive virtual realities. Thus, the TICE strategy is, in itself, a fruit of research, learning and evaluation activities. To consider the forms and institutions of higher education for the first decades of the 21st century, new opportunities should be invented, experimented, demonstrated and gradually validated concepts, models and methods of teaching and coaching that exploit these new forms of proximity (virtual community) and friendliness.

- Multimedia and information processing as pedagogical tools
 - Collaborative learning environments (CLE), examples: eCampus (UVSQ); ELGG (Climate KIC);

MOODLE, etc.

- On-line Presentations of Institutional and Consortia Education Programs (example: OVSQ-UVSQ's Yggdrasil [CMS Drupal])
- Profiles of institutions of higher education and research, presentations (on static or dynamic websites) of the Activities and News of the institutions and their partners, eg the NewsReels (KerBabel™) of REEDS, OVSQ, kerDST, KIC-Education at UVSQ.
- On-line libraries of dedicated educational resources (for example, the Brocéliande system developed by REEDS UVSQ and, more broadly, the sharing of educational resources through the UVED Foundation, the Virtual University in Environment and Sustainable Development).
- Catalogs of all kinds of objects and information of educational value (PDF, video, PowerPoint, websites, images, etc.), including partner institutions but also from all over the world (Qwam, Econext ..., up to Google itself). still ...).
- Distance viewing technologies: Tele-presence, videoconferencing (Skype, Adobe Connect, Webex, PolyCom, etc.).
- Multimedia, information processing and NICTs as an object of pedagogical training
 - Example of the Master SETE specialties on "Mediation of Environmental Knowledge".
- The treatment of information and the NICT as tools of research and valorisation of research
 - The laptop becomes commonplace as a tool for work and communication. Also, remote visualization technologies are to be considered as tools for research and collaboration (see also DIGISCOPE / MIRE).
 - There are also specialized operations of interactive multimedia technologies, for example: online deliberation support tools (such as kerDST developed by REEDS OVSQ-UVSQ)) and multimedia learning and support systems. deliberation (the DSTs of the KerBabel™ team at the UVSQ).
- ICTs as an object of research in economics and management.
 - EquipEx "DIGISCOPE/MIRE", for the exploration of the potentials of the new generation of network touch screens, for interactive visualization around problems and complex systems, with educational applications and decision support provided by the UVSQ.
 - Evaluation mechanisms for the quality and effectiveness of multimedia tools in educational applications and others, developed by the UVSQ teams in the framework of European projects (VIRTUALIS, etc.) and the Education Group of the "Climate KIC".

Finally, the Open Campus would have developed thanks to an amalgam of techniques and uses, in synergy to ensure on one hand the support of the "virtual" learning communities and, on the other hand, to ensure a wealth of educational resources and teaching practices. Examples:

- Multimedia Libraries and Learning Centers (Multimedia Learning Centers) linked to University Libraries;
- "Multimedia Workshop" rooms for interactive group work with simultaneous access to online educational resources and tele-presence activities (meeting of project partners, exchanges between professors, remote conferences, etc.).

- Virtual Worlds designed for knowledge mediation purposes to communicate research results and provide educational opportunities for more or less specialized audiences (eg VGAS, Viviane, kerALARM and other UVSQ DSTs and its partners European).

Online training (e-learning or e-learning) is a training method that uses new multimedia technologies of the Internet (ICT) to overcome the physical presence of a teacher nearby. Different types of e-learning projects exist, from simple to complex: tool to help trainers; place to provide knowledge and access to educational materials; learner's guide with definition of educational pathways; integrated training in skills and knowledge management. In the same way, the means of online training are multiple, complementary and independent: access to resources (syllabus, exercises, e-learning courses, video, cd-rom ...); access to services (tutoring communication tools, resolution of exercises, support, ...); exchanges and remote collaboration (via forums, chat, email, phone ...).

It is therefore necessary to propose a methodology for evaluating ICTs that meet the needs of the user (individual and collective). In Section 5.10, we propose an ex-post evaluation program of the ePLANETe.Blue deployed to determine if and to what extent a tool meets the requirements of a community of users wishing to perform an activity. For this purpose, we use the Deliberation Matrix to formulate evaluation tasks with three axes.

- Teaching Programmes in UVSQ and University Paris Saclay.
- Performance issues (determinants of quality, acceptability, satisfaction, etc.)
- The ePLANETe.Blue uses for research and for education as a mean and as an object.

In the following section, we explore the exploitation of ePLANETe.blue platform as collaborative learning environments for virtual learning communities.

4.2 ePLANETe.Blue, Virtual Learning Communities and Collaborative Learning Environments

4.2.1 Collaborative learning issues

Considered as a whole, ePLANETe is an on-line “Collaborative Platform” that seeks to support a broad variety of forms of learning, always with the accent on community and conviviality. It is oriented towards knowledge sharing, social learning and deliberation support addressing social, political, technological, economic and environmental dimensions of sustainability challenges.

Ewing & Douguet (2007) attempt to establish a basic framework which permit an examination of the principles of learning where appear to be relevant to understanding learning and its practical application to ICT. There are several beliefs which been advanced about how learning takes place. One of these beliefs is that learning is largely not instantaneous but is a process, possibly involving several elements or stages.

Another one is the cognitive processing approach to learning. A key feature of cognitive learning is how new material is associated with existing knowledge or the learner’s past experience. Learning involves making links with existing events (or awareness) and the manner in which this might take place has been the subject of a very substantial field of research. Central to categorising, therefore, is the phenomenon of making links between what is new and what is known.

- Additionally, learning has many social dimensions where the development of new knowledge, insights and awareness is associated with personal interactions with others in the learning environment. This is a central idea of social learning and there is now substantial acceptance that much learning (and arguably all learning) starts at the interpersonal level before developing into a more intrapersonal learning
- It should be easy to see that collaborative learning is one form of social learning. Collaborative learning undoubtedly helps to promote communication and the sharing of ideas which in turn lead to more effective 'sense making' by the individual.

The approach adopted in collaborative learning involves the participation of a group of learners who will work together rather than individually. Different ways of approaching collaborative learning and its use within ICT have also been proposed. For example, the traditional view of educational computing as a means of communication by transmitting knowledge is replaced by a more transformative approach which is of greater benefit both to the learner and to the teacher. When communication functions in a transformative manner, it is two-way, interactive and dynamic, with the emphasis on construction of knowledge rather than on the receipt of information. Exchange of information and knowledge therefore takes place through discussion and through sharing. For active knowledge construction to take place within a group, the meanings and understandings that have to be taken-as-shared are therefore the core of collaborative learning. The interaction between learners will function more successfully if there is also an open and accepted sharing of social standards, cognitive awareness and even of personal interests. This includes the establishment of trust and empathy between those preparing a learning environment (that is, the teacher or the designer of learning material) and the users. In collaborative learning, all partners are expected to demonstrate both accountability and responsibility.

When collaborative learning is designed to be part of a computer-based learning environment, the programme designer does more than simply make the material accessible via a computer. The use of ICT to present curricular information requires that the information provided will be reformulated such that it much

better meets the needs of the learner than it might have been in a traditional learning environment. To achieve this, the designer has to understand the learners for whom the material is relevant (referred to as the stakeholders) and the designer has to know how to support them in the building of their own knowledge. This can become a complex task when the learners come from different backgrounds and may have different needs. This approach has been likened to 'collective' learning. Others have suggested that collaborative learning promotes "knowledge-building communities" where didactic approaches and learner-centred approaches to teaching and learning are replaced with a more dynamic learning environment based on a "community of learners" who work collectively in gaining knowledge.

A key outcome of designing a collaborative learning opportunity is the provision of a learning environment which will support users in becoming informed and self-regulating learners. The context and the learning medium used, such as through the use of ICT, must therefore be carefully designed to make learning possible, supportable and relevant. This provides opportunities for learners to engage meaningfully in a learning event, to be able verify their understanding of new material, and to extend their learning to match their personal needs.

4.2.2 Learning communities

Considering ePLANETe as a "Knowledge Gateway", we put the accent on the identification of different Learning Communities and, their role in the production of knowledge and the uses of learning resources. These Learning Communities are organized in the PEOPLE / COMMUNITIES Gallery and PARTNERS Gallery, and presented via Profiles in three cross-linked galleries, using complementary logics of identity that are cross-linked:

- **Profiles of Persons** (see picture below): It is the profile of each member of ePLANETe communities. The profile is composed of three parts:
 - On the right part of the screen, there are different information about communities Jean-Marc DOUGUET is part of
 - In the centre of the screen, the description of the profile of Jean-Marc DOUGUET (Given Name, Surname, Profile, email, favourite links).
 - On the left part of the screen, three mains access to objects in or outside eplanete.blue
 - "GALLERIES IN RELATION" allows you to navigate horizontally from the current Gallery to one of those connected to it. This is the list of Direct Link Galleries. The icon to the left of the name of each linked gallery indicates a link to the home page of the target gallery.
 - "OBJECTS IN RELATIONS", opens an access to objects that already exist in ePLANETe.Blue. Under each Object Class, the list of Linked Objects appears. It provides access to the Crosslinks page as shown below. For example, "Broceliande" represents the pedagogic supports that have been developed by Jean-Marc DOUGUET. In "Yggdrasil", it shows the course he is responsible for.
 - Fruits: downloadable documents, image, URL related to the profile of the user.

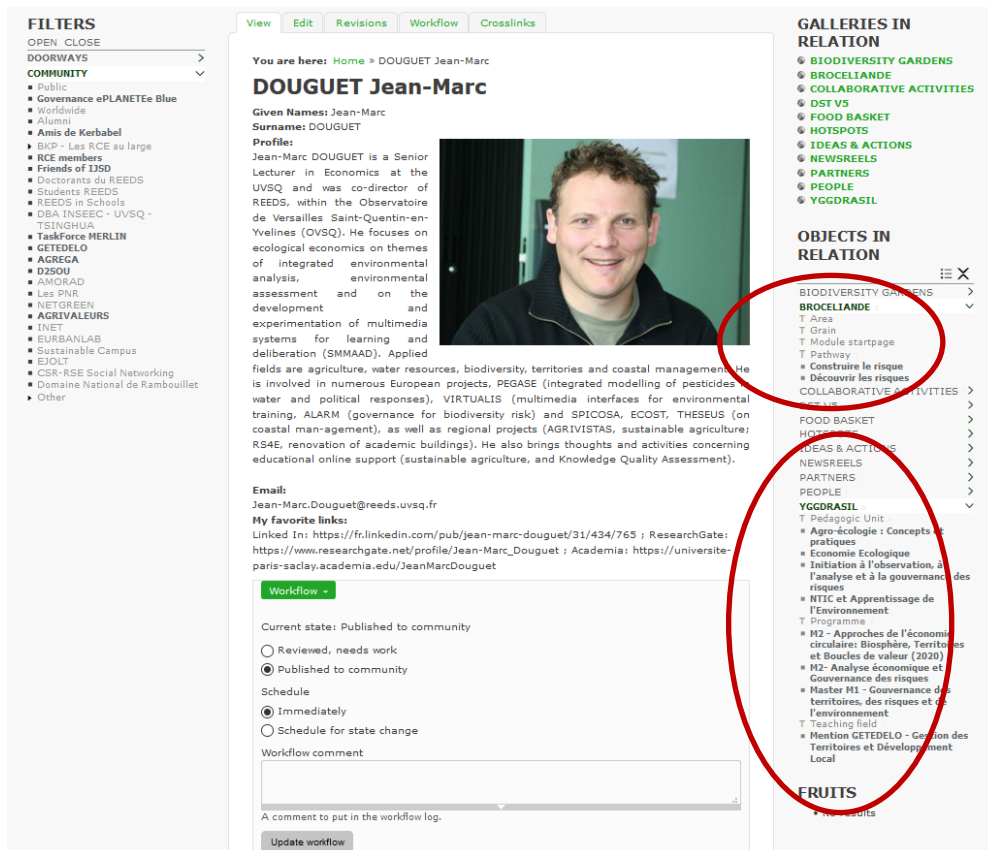
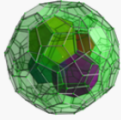


Figure : Profile of an user

- **Profiles of each User Community**, large or small (with an explanation of the activities, the funding, or other link factors that compose the community) (see picture below): It is the profile of each community of ePLANETE. The profile is composed of three part:
 - On the right part of the screen, there are different information about doorways and community list
 - In the centre of the screen, the description of the profile of the community (Acronym, Description, Project coordinator, Email of coordination, Portal, Doorways).
 - On the left part of the screen, three mains access to objects in or outside eplanete.blue
 - "GALLERIES IN RELATION" allows you to navigate horizontally from the current Gallery to one of those connected to it. This is the list of Direct Link Galleries. The icon to the left of the name of each linked gallery indicates a link to the home page of the target gallery.
 - "OBJECTS IN RELATIONS", opens an access to objects that already exist in ePLANETE.Blue. Under each Object Class, the list of Linked Objects appears. It provides access to the Crosslinks page as shown below. Possible links can be made to pedagogic supports in Broceliande and to courses in Ygddrasil.
 - Fruits: downloadable documents, image, URL related to the profile of the user.

Figure : Profile of a community



Gallery of People and Communities

FILTERS

OPEN CLOSE

DOORWAYS

▼

■ TOUTATIS

■ KerBabel

■ MERLIN

■ FairGround

■ CAMELOT

■ TALIESIN

COMMUNITY

>

You are here: [Home](#) > UPSay School BASE Mention - Gestion du Territoire et Développement Local

UPSAY School BASE Mention - Gestion du Territoire et Développement Local

Acronym:

GETEDEL0

Description:

This is the community of students, teachers and others associated with the Master's programme GETEDEL0 in the Graduate School BASE at the University Paris Saclay

Project Coordinator:

Dr. Jean-Marc DOUGUET

Email of Coordinator:

Jean-Marc.Douguet@reeds.uvsq.fr

Portal:

[UPSAY School BASE Mention "Master GETEDEL0" - site institutionnel](#)

Doorways:

TALIESIN

GALLERIES IN RELATION

- BROCELIANDE
- COLLABORATIVE ACTIVITIES
- IDEAS & ACTIONS
- NEWSREELS
- YGGDRASIL

OBJECTS IN RELATION

×

BROCELIANDE >

COLLABORATIVE ACTIVITIES >

IDEAS & ACTIONS >

NEWSREELS >

YGGDRASIL >

FRUITS

If they exist, you must be logged in to see the Fruits attached to this Object.

(A "Fruit" is a reference - PDF, JPG, XLS, DOC, XML, URL, etc. - stored in the "Babel Gardens" Document storage system.)

This Gallery of Objects is maintained by REEDS International, International Center for Research in Ecological Economics, Eco-Innovation and Tool Development for Sustainability, Rambouillet, France

"Conformément aux articles 39 et suivants de la loi n° 78-17 du 6 janvier 1978 modifiée en 2004 relative à l'informatique, aux fichiers et aux libertés, toute personne peut obtenir communication et, le cas échéant, rectification ou suppression des informations la concernant, en s'adressant à REEDS, 15 Bergerie Nationale, 7810 Rambouillet, France, ou par email à sysadminreeds@uvsq.fr"

- **Profiles of Partner Establishments** (institutions, or operational units within an institution) (see picture below): It is the profile of each partner of ePLANETe activities. The profile is composed of three part:
 - On the right part of the screen, there are different information about the status of the organisation and the type of activity
 - In the centre of the screen, the description of the profile of the partner (Identity, Description, Profiles of Activities and Competencies).
 - On the left part of the screen, three mains access to objects in or outside eplanete.blue
 - "GALLERIES IN RELATION" allows you to navigate horizontally from the current Gallery to one of those connected to it. This is the list of Direct Link Galleries. The icon to the left of the name of each linked gallery indicates a link to the home page of the target gallery.
 - "OBJECTS IN RELATIONS", opens an access to objects that already exist in ePLANETe.Blue. Under each Object Class, the list of Linked Objects appears. It provides access to the Crosslinks page as shown below. For example, "Activities" represents the research project AGREGA this partner is part of. Possible links can be made to pedagogic supports in Broceliande and to courses in Ygddrasil.
 - Fruits: downloadable documents, image, URL related to the profile of the user.

Figure : Profile of a partner

4.2.3 The five galleries of TALIESIN DOORWAY

The common threads of learning opportunities in ePLANETe.Blue is related to learning and the procedures which support making collaborative learning happen, have been identified as 4 key principles (Ewing & Douget, 2007).

- **Principle 1. Peer interaction and collaboration** is one of the principles because of its undoubted value in learning environments in the classroom, workplace or home. Group learning in its various formats has now been around for so long that not much needs to be said in its defence. The creating of shared learning environments using ICT based learning has to be specifically addressed and the experience of some research. It indicates that learners progress through stages of not believing in computer supported collaborative learning, not wanting to be part of it, ‘paying lip service’ to engaging in it, yet finally saying that more of their courses should be structured round it. Sharing as a part of learning does not come naturally to everybody and integrating it into electronic and online learning is certainly one of the more worthwhile ICT challenges for both teachers and learners.
- **Principle 2. Autonomy** for the learner is part of giving to the learner a large measure of control over the learning experience. Students have the right to choose in all sorts of ways and in the online learning environment this is enhanced by the inclusion of choosing the time and location of their

interaction with the learning material. The responsibility to engage with the learning material is not diminished, however, and where this has been designed to include learning within a group, neither is the responsibility to the others in that group.

- **Principle 3. Personalisation of learning** is an (almost) undeniable aspect of successful individual interaction with a learning event. Motivation, whether intrinsic or extrinsic, has its roots in the ‘feel good factor’ of involvement and endeavour, and when the learning environment is online, students often feel isolated and as a result, unmotivated. Part of the task of the designer of online learning material is to ensure that the learner does not experience such isolation. Achieving this involves meaningful (and possibly substantial) involvement of the tutor.
- **Principle 4. The enhancement of learning outcome** as a principle of electronic learning is to ensure that electronic and online media are not used just because they are available. It is not good enough to transfer successful learning from a traditional environment to an ICT based one. To justify using ICT as the medium for learning, it ought to be demonstrable that the learning outcomes would be enhanced compared with what might have been achieved by other means.

Five ePLANETE.Blue Galleries are presented below as ways to engage learners and users in a learning process:

- **Teaching Activities & Programmes Space – Associated gallery YGGDRASIL**

YGGDRASIL Gallery presents profiles for various sets of Teaching Programmes, Pedagogic activities and individual courses or other opportunities offered by Partners institutions. In some cases, the system offers the opportunity to the individual user for composing their own study programme, as a basis for enrolment applications or for selection of options.

- **KerBabel Learning Resource Centre Space – Associated gallery Forest of Broceliande**

During the years of development of Broceliande Gallery, a spectrum of teaching resources has already been composed as Modules, or varying complexity but all made up of bite-size “Grains” that, within the module, may be organized in distinct “Areas” roughly analogous to chapters in an electronic book. Navigation within this part of BROCÉLIANDE is possible [i] via a Table of Contents for a Module, [ii] by following one of the Learning Pathways proposed by the creator(s) of the module, or [iii] by “Surfing grain-to-grain”. Individual grains in Broceliande can be mobilized in more than one Module and, it is possible to surf “grain-to-grain” into different modules.

- **Elemental Catalogues Space– Associated galleries “Babel Gardens” and the “ToolKit”**

The Babel Gardens gallery is a set of catalogues of documents, teaching resources and websites, organised by research project, institution or collaborative programmes. This site stocks informative educational resources in a portal created by ePLANETE.blue and was designed to be particularly useful for students of MASTER SETE but could be adaptable elsewhere. Many fruits linked to the Forest of Broceliande are stored in this garden. It has multilingual options for navigation and requires user names and passwords to access the knowledge. The site provides material on knowledge mediation for sustainable development and environmental issues. The 2002 version is likely to be replaced by a new CMS facility in 2012.

The TOOLKIT (Theories, Methods and Tools) Gallery aims to provide a collection of objects that references and describes methods and tools. It also contains algorithm objects that support multi-criteria evaluation.

- **Knowledge Quality Assessment (KQA) Space – Associated gallery “Hot Topics”**

The purpose of this gallery “Hot Topics” is to offer an overview for uncertainty assessment relating to

complex science-policy problems. A set of tools are proposed to assess uncertainty in order to take into account three types of concerns. The first concern is the identification and the analysis of the various forms of uncertainty that stakeholders and decision maker have to face. The second concern is linked to the quality of knowledge and its evaluation by the scientific community and/or an extended community of peers. The third concern is the pertinence and “fitness for purpose” of our knowledge, including knowledge about uncertainties, in a given decision, policy or governance context. We therefore consider, in the gallery, topics related to characterization of uncertainty, to the complementarity of analytical and deliberative methods in the evaluation of the quality of knowledge, and to deliberation support tools intended to facilitate communication, structuring, and framing of knowledge in different sociocultural and political contexts.

In following sections, a detailed presentation of the two galleries that organise teaching materials: YGGDRASIL, an online information on teaching programmes and BROCELIANDE, an online interactive library of teaching materials.

4.3 Yggdrasil, online information on teaching programmes

Apart from the fact that we like the sound of the name YGGDRASIL¹⁴²- we also like the meaning “Tree of life” or “Tree of Wisdom” or “Tree of Knowledge”. Our Tree of Knowledge is the wisdom of light that shine beyond the comprehension of our own limitation. A light where wisdom flourish and where experience can grow as far as the horizon can see. A wisdom where ignorant are foolish and the wise are wiser. The wisdom to know is to resources. Our wisdom is our knowledge of resources and our resources is our gift of treasure that we will never forget. While working with Education you can never say you know it all, it is a life’s journey. It is like the growth of a tree, never straight but branching out, ever changing but yet always the same. Our main Philosophy concerning “Yggdrasil” generated from that notion. It is dedicated to online knowledge sharing platform on Teaching Programmes of Education around the world in the ePLANETe system.

If any institution of higher education now offers a website, some stand out for their willingness to offer information according to multiple organizational principles, allowing a real "virtual visit" of the offer of the establishment. For example, the integrated system "Yggdrasil" presents the training programs of the OVSQ (Environmental Sciences, Climate and Sustainable Development) at the UVSQ. The Yggdrasil tree is created with the Drupal 7 CMS for the online presentation of training programs (Specialty M2 level, License Pro L3 level ...) and all units of Education provided within the OVSQ.

Information on training programs and on the EU is developed according to a logic of "grains". Program profiles are organized in a modular way by thematic area, character of the training, level of training and language. For the profiles of the teaching units (EU), the selection can be made according to the title, the

¹⁴² In Norse mythology, Yggdrasil (from Old Norse Yggdrasill IPA: [ˈyɡːˌdrasilː]; meaning "Ygg's (Odin's) horse"[1]) is the world tree. Yggdrasil is attested in the Poetic Edda, compiled in the 13th century from earlier traditional sources; and the Prose Edda, written in the 13th century by Snorri Sturluson. In both sources, Yggdrasil is an immense ash tree that is central and considered very holy. The Æsir go to Yggdrasil daily to hold their courts. The branches of Yggdrasil extend far into the heavens, and the tree is supported by three roots that extend far away into other locations; one to the well Urðarbrunnr in the heavens, one to the spring Hvergelmir, and another to the well Mímisbrunnr. Creatures live within Yggdrasil, including the harts Dáinn, Dvalinn, Duneyrr and Duráprór, and an unnamed eagle, and the wurm Níðhögr. Scholarly theories have been proposed about the etymology of the name Yggdrasill, the potential relation to the trees Mímameiðr and Læraðr, and the sacred tree at Uppsala.

head of the EU, the EU code, the language. The system is designed to allow navigation from top to bottom and "horizontal" to discover in detail all the training programs and proposed UEs. Its originality is to identify the thematic proximity of an EU to others and to identify all the programs that may include the EU in question.

4.3.1 General presentation of YGGDRASIL

YGGDRASIL has evolved via various developmental versions into a site that uses current technology but is flexible and innovative enough to accommodate technology changes. YGGDRASIL (Version2) is created using the Content management system Drupal 7 of ePLANETe.Blue. It aims at presenting Teaching programs and Pedagogic units (course) in English or French language. A set of teaching programmes exist in YGGDRASIL.

Table 5. 1 List of teaching programmes

M2-Médiations des connaissances environnementales : partenariats pour le développement durable (UVSQ)
M2- Management of Eco-innovation (UVSQ)
Master M1 - Gouvernance des territoires, des risques et de l'environnement (Paris Saclay)
Master 1 - Innovation, Entreprise et Société (Paris Saclay)
M2 - Approches de l'économie circulaire: Biosphère, Territoires et Boucles de valeur (expected in 2020) (Paris Saclay)
M2 - Gouvernance de la transition, Ecologie et Société (Paris Saclay)
M2- Analyse économique et Gouvernance des risques (Paris Saclay)
Ecological Economics and Environmental Justice (Universtat Autonomia Barcelona, Catalonia, Spain)

In order to discover information, navigational pathways have been developed to facilitate the discovery of Teaching Programs and Pedagogic Units.

- Structured discovery of teaching programmes
- Structures discovery of teaching courses

A presentation of a teaching programme consists of :

- General information concerning the teaching programme (type of activities, programme level, contact information, teaching language, A message of the coordinator)
- Key themes and disciplines
- A set of pedagogic units
- Crosslinks to different activities
- Presentation of Partners, members and Communities
- Mode of course; Instructions Information, Examination details, identity and Practical information of the courses etc.

Figure 4. 1: Profile of a teaching programme in YGGDRASIL

Modifier Extra Icon
 - View(active tab)
 - Edit
 - Translate
 - Revisions
 - Create crosslinks
 - Existing crosslinks

Program Identity
 - Title
 - Acronym
 - Coordinator details
 - Diploma
 - Campus Site

Program Coordinator's Message

Program Summary
 - Aims (active tab)
 - Challenges
 - Career prospects
 - Skills acquired
 - Strengths

Contact details for program information

Filters-To refine the search and focus on what you are interested towards the same batch of programs

To attach documents you can use fruit link

The relation types crosslink for programmes . you can access by click directly to each subject.

The crosslink for program, pedagogic units, activities, partners and people

A presentation of a teaching programme consists of :

- Filters: type of activities, programme level, contact Discipline, teaching language, Themes
- General information concerning the teaching unit: identity, objectives, presentation, practical information
- Crosslinks to other pedagogic programmes and pedagogic units

The screenshot displays the Yggdrasil interface for a pedagogic unit. On the left, a 'Filters' sidebar allows users to refine results by 'Programme level' (Degree, Master, PhD, Post-doctoral, Other), 'Type of activity' (Degree, Continuing education, Alternating work/study programme, E-learning), 'Langue d'enseignement' (English, French, Mixed English/French, Other), 'Discipline' (Biology, Chemistry, Constitutional law, Economy, Engineering science, Environment, Geography, Health, Informatique, Interdisciplinaire, Logistique, Management, Multimedia, Physics, Private Law, Science of the Universe, Sociology), and 'Theme' (Sciences of the environment, Energy and climate, Territorial ecology, Ecological economics, Social science and sustainability, Environmental and territorial economics and governance, Arctic studies, Tools for sustainability, Operational research). The main content area, titled 'Pedagogic Unit: Economie du changement climatique et risques énergétiques', includes buttons for 'View', 'Edit', 'Translate', 'Revisions', and 'Create crosslinks', along with a section for 'Existing crosslinks'. Below this is the 'Identity' section, which lists the unit's name, 'Education level: Master 2', and 'Responsible teacher(s): Samir ABAL (UVSQ/REEDS)'. The 'OBJECTIVES' tab is active, displaying text about presenting risks associated with energy systems. A 'Plus' button is located below the objectives. The right sidebar features a section 'This Pedagogic Unit is also mobilised in' with 'OPEN' and 'CLOSE' buttons, and a 'Crosslinks by relation' section with a green background, also featuring 'OPEN' and 'CLOSE' buttons. A 'Filtres' section at the bottom right summarizes the current filters: Teaching language: French, Type of activity: Alternating work/study programme, Theme: Environmental and territorial economics and governance, Operational research, Programme level: Master, and Disciplines: Economy.

4.3.2 Navigating in YGGDRASIL

In order to foster interest of navigation in Yggdrasil (online resource platform of teaching program), Different navigation pathways have developed for different uses. The navigation has been improved by the introduction of Crosslink and filters in order to present teaching programs, pedagogic units or key themes.

Four navigation are proposed:

- Navigation among teaching programmes using crosslinks
- Navigation among pedagogic units using crosslinks
- Navigation among teaching programmes using filters

- Navigation among teaching programmes using filters

4.3.2.1 Navigation among teaching programmes using crosslinks

The navigation among teaching programmes can be done using crosslinks, in order to access to the presentation of teaching fields (“Mention” in Paris Saclay) composed of different teaching programmes, and of the set of pedagogic units. A pedagogic unit can be mobilized in different teaching programme.

The screenshot shows the YGGDRASIL * Teaching Programmes website interface. The top navigation bar includes HOME, PROGRAMMES, PEDAGOGIC UNIT, COMMUNITIES, and CONTACT. The main content area is divided into several sections:

- List of Teaching Fields:** A sidebar on the left lists various fields, including Sustainability studies, Collaborative Programs, and Master 1.
- Management du Territoire et Développement Local (GETEDEL0):** A central section with a red circle around its title. It includes a description of the Master 1 programme and a list of related programmes.
- Crosslinks by relation:** A sidebar on the right with a red circle around its title, listing related programmes (PRIMARY and SECONDARY).
- Programme:** A section for M2- Ecological Economics and Integrated Environmental Assessment (Expected in 2016) (EE & AIE), with a red circle around the PROGRAMMES navigation tab. It includes a description, identity, and coordinator message.
- Pedagogic Unit:** A section for governance territoriale, with a red circle around the PEDAGOGIC UNIT navigation tab. It includes filters, identity, and crosslinks.

Red circles and arrows highlight the navigation path: from the PROGRAMMES tab to the Management du Territoire et Développement Local (GETEDEL0) page, then to the Crosslinks by relation sidebar, and finally to the Pedagogic Unit page.

RELATIONSHIP (NAVIGATION) BY CROSSLINK

4.3.2.2 Navigation among pedagogic units using crosslinks

Pedagogic Units are built as “grains” that are linked to teaching programmes in a web page. Discovery of Pedagogic Units through the logic of relations between grains. They are called “Crosslinks” and allow learners to navigate between pedagogic units in order to access to an extension of a concept, an illustration of an idea...

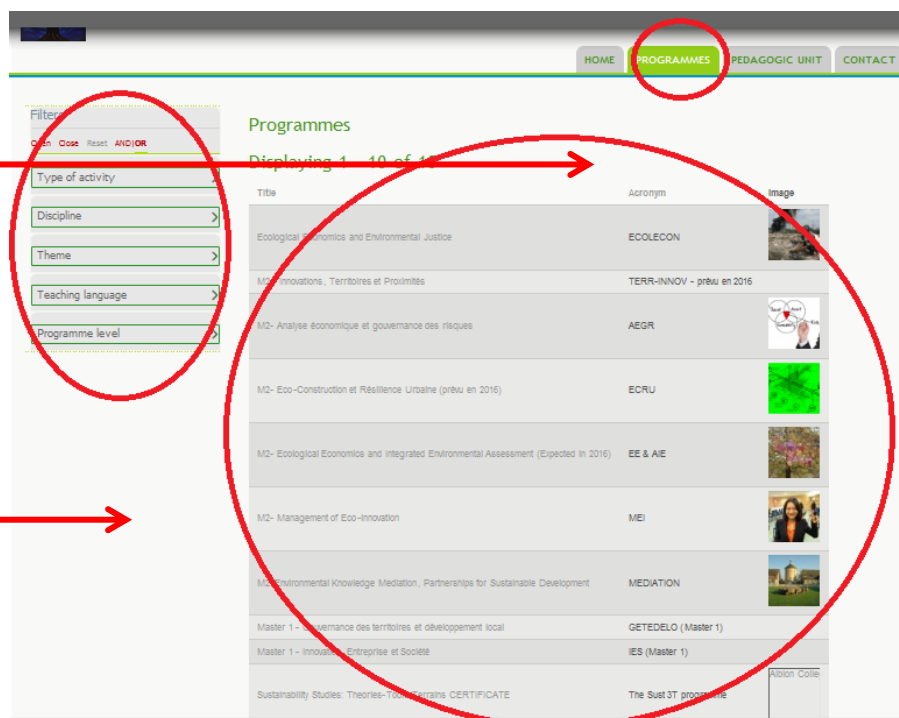
Figure 4. 2: Navigation among teaching programmes using crosslinks

The screenshot displays a web interface for pedagogic units. On the left, a 'Filters' sidebar includes categories like 'Programme level', 'Type of activity', 'Langue d'enseignement', 'Discipline', and 'Theme'. The main content area shows the details for a unit titled 'Economie du changement climatique et risques énergétiques', including its identity, objectives, and presentation. On the right, a 'Crosslinks by relation type' section shows a 'PROGRAMME (PRIMARY)' link. Annotations with red boxes and arrows point to specific elements: 'Extra icon to Modify or Edit' points to a gear icon; 'Here is the identity of pedagogic unit' points to the unit title; 'Pedagogic unit Summary' points to the filter categories; 'Filters for Pedagogic unit' points to the filter list; 'Pedagogic unit's relation to Program' points to the 'PROGRAMME (PRIMARY)' crosslink; and 'Mobilized position of pedagogic unit' points to the unit's position in the filter list.

4.3.2.3 Navigation among teaching programmes using filters

Structured Teaching Programs is done through a selection made possible through a system of filters. The filters are in the form of Contents of menu: Choices Type of Activity, discipline, theme, language of instruction, programme level can be selected to target research. The teaching Program of Yggdrasil offers a complete list of existing and potential courses offered by the University Paris Saclay. If you search list you will get 3 main points:

- **Programs:** The top right part of the Programmes display screen contains total program lists of teaching program and the form of filter system which provides a sorting function for faster searches of the specific program.
- **Filter:** The left part of the screen contains a Filter system that allows you to refine the search and focus on what you are interested towards the same batch of programs. Just click on one Type of activity or Discipline or Theme or language of instruction or Programme level, and Search will be made according to selected criteria for same batch program.
- **Total programmes list:** The middle part of the programmes display screen that shows the total programmes list alphabetical order.



4.3.2.4 Navigation among pedagogic units using filters

Navigation amongst pedagogic unit can be done using filters. The filters are in the form of Contents of menu. Choices in teachers' lists of Theme, Programme level, Type of activity, languages (EN, FR) can be selected to narrow the search.;

Figure 4. 3: Navigation among pedagogic units using filters

The screenshot shows a web interface for 'Pedagogic Units'. On the left, there is a 'filters' sidebar with several dropdown menus: 'Thème', 'Langue d'enseignement', 'Programme level', 'Discipline', and 'Type of activity'. The main area displays 'Pedagogic Units' with 'Displaying 1 - 50 of 487' items. Below this, there is a table with columns for 'Titre', 'Enseignant(s) responsable(s)', and 'Langue d'enseignement'. The table lists various units such as 'Achats responsables', 'Accroître', 'Agenda 21', etc. A red circle highlights the filters and the table content.

Titre	Enseignant(s) responsable(s)	Langue d'enseignement
Achats responsables : supply chain, gestion risques, responsabilité élargie, éthique, chartes		French
Accroître		French
Accus, cadre institutionnel et territorial du tourisme		French
Aérosols, pollution, climat		French
Agenda 21 et aménagement (Territoires durables)	Marie-Françoise Guyonnaud	English
Aménagement et mobilité		French
Aménagement urbain étude de cas		French
Analyse critique d'articles scientifique en anglais		French
Analyse d'images et proj.informatique		French
Analyse des données qualitatives et quantitatives		French
Analyse économique et gestion des risques urbains		French
Analyse économique et gestion du risque radiologique		French
Analyse économique et maîtrise des risques : gestion des risques et prévention des accidents	Marc DARRAS (OIE)	French
Analyse économique et maîtrise des risques : Gestion des Risques et Prévention des Accidents	Marc DARRAS (OIE)	French
Analyse économique et maîtrise du Risque		French
Analyse et méthodes statistiques		French
Analyse et traitement de IS#039;information		French
Analyse Prospective et Veille		French
Analyse statistique pour la physique et IS#039;environnement		French
Analyse technico économique et environnementale des technologies énergétiques		French
Analyse, gouvernance et gestion intégrée : Biodiversité	Jean-Marc Douquet	English
Analyse, gouvernance et gestion intégrée : les zones côtières		French
Analyses environnementales		French

4.4 The Forest of Brocéliande, an online interactive library of teaching materials

The creation and maintenance in online library of educational resources, has become a major global challenge. In France, part of this challenge is raised by the UNT (Thematic Digital Universities), including the UVED - Virtual University in Environment and Sustainable Development. UVSQ has been involved since the creation of the UVED association in 2005 in the creation and referencing of educational resource modules. Similarly, the UVSQ is a founding member of the UVED Foundation formed in 2011 by the transformation of the former association. The activities of creation and sharing of educational resources by the partners of UVED, and, the latter would be a vehicle for the advancement of UVED.

Within the UVSQ, the Forest of Brocéliande is an online library of modules of educational resources in the fields of ecological economics, environment and sustainable development, developed since 2003 by the team KerBabel™ (Martin O Connor & Jean-Marc Douguet) at the REEDS Research Centre. It is accessible on the internet; the modules can be created by inter-institutional collaboration (for example, European projects, ANR, see the UVED) and are generally open access. (Access restrictions are possible, however, to respect restricted communities of users). The current version (version 6.0, available online to the public since February 2011), was created with the CMS Drupal_6.

- Version 1 (2000-2003)

The original idea was to create an online teaching resource to support students. Expertise at C3ED (Centre for Economics and Ethics for the Environment and Development) formed educational resources outside the context of the University of Versailles as a stand-alone project. It was then into the pilot phase supporting the work of European Ecological Economics and Sustainable Development Policy at the UVSQ.

- Version 2 (2004)

From 2004, as a result of restructuring the Bachelor-Master-PhD to accommodate standardisation of European universities the Master SETE (Sciences of the Environment, Territory and the Economy) programme was created. The development of the Forest of Brocéliande reflected a need to harmonise the proposed educational fields with the structure of the site at a time when the university was developing digital virtual learning environments.

- Woods, Trees and Branches (2006)

The structure of the site was originally conceptualised as a walk in the forest. By 2006 the first level of navigation was a wood (now known as MODULE). A wood was composed of several trees (now known as AREAS) which corresponded to sections of academic courses. Each tree could have several branches. At each level of the forest you could see where you were visually via icons and page banners.

Two tools were developed to power the site. **Joomla** was the content management system. **eXe**, an e-learning XHTML editor, enabled content to be inserted. Once created it was imported into Joomla as a hyperlink. Both tools were necessary to place the pedagogic resources online.

From here the concepts of grains and fruits were developed but the basic ideas of how to provide complex information in an accessible environment was now established.

- Fine tuning Version 6

At the beginning of 2010, restructuring at the OVSQ-UVSQ saw C3ED phased out and REEDS research Centre established. Work continued on fine tuning the Forest of Brocéliande. Navigational pathways were developed to facilitate movement and connection between Areas and Grains. This operational manual was

produced and visual concepts for the live site established. <http://Broceliande.eplanetete.net>

The Brocéliande system is designed to be complementary to other digital tools and platforms with distinct functionalities [examples UVSQ: E-Campus2, organized according to Teaching Units]. Also, it is necessary to clearly distinguish groupings of scripted educational resources from only "catalogs" of objects of educational value. Brocéliande is conceived as a "whole", a composition of "grains" organized according to clearly defined thematic and pedagogical structuring principles.

The unitary elements of the system are grains, each of which explains a concept, an example, an analysis step, etc. in a web page or a tree of web pages. Each grain is composed on a common model, described from 12 categories of meta-information that characterize context as well as content. In terms of content, grains can integrate texts, images, videos, maps, exercises, animations ... The meta-information of the context around the grain facilitates the discovery of the mobilization perspectives of each grain for a learning activity. First, a grain can signal "external" objects, for example PDF files, videos, websites that are maintained outside Brocéliande and possibly listed in catalogs. Then a grain is an "agent" in a multi-agent system, a small system opens to other grains and vice versa. In Brocéliande 6 (2010), three main modes of navigation are proposed in synergy:

- Relationships between Grains define immediate connections between one or more grains (outside of Tables of Contents or Pedagogical Paths within a Module). The opportunity to jump from grain to grain facilitates a structured discovery of complementary knowledge through proximity signals.
- A Table of Contents of a Module. The structured discovery of grains according to the structure of the Table of Contents is analogous to the process of going through a book or collection of books. All the grains of an Educational Module are associated with Aires (similar to a chapter or a volume). Within a given Module, a grain can only belong to one Area (but, on the other hand, there is the possibility that a grain is mobilized in multiple pedagogical modules and, several courses within a Given module).
- Pedagogical Pathways offer learners paths of knowledge to gradually discover the contents of a Module. The idea of a pedagogical and cognitive path is to gradually discover the concepts, concepts, tools, methods, case study, bibliographic information ...

4.4.1 A walk through the Broceliande Forest

This is a virtual (online) library of teaching materials on environmental topics. Visitors have control over how they individually use the materials because the material is set out to accommodate this complexity. Materials may be used in a random fashion, such as browsing through a physical library until something captures your attention, or perhaps the visitor has a particular issue or specialised area of knowledge they want to pursue. In that case they may prefer to study the material provided in an optimal order. This is possible because our contributors offer a recommended path for each area of interest, just like having your own personal tutor on hand. In the Broceliande Forest, visitors can find different types of pedagogic resources:

Table 5. 2: Broceliande Forest, visitors can find different types of pedagogic resources:

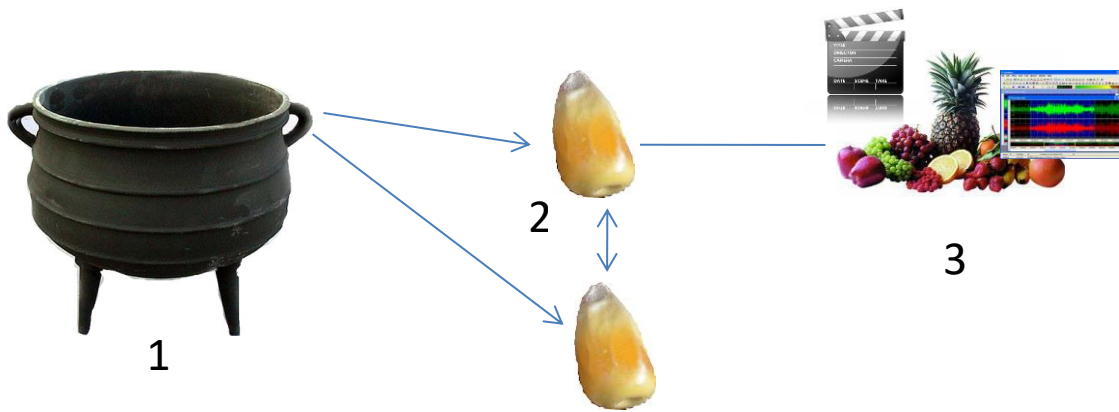
Acronym	Description	Types of Pedagogic resources
AGRI-GNOSTICS	Agricultures durables	Standalone Pedagogic resources
BEST	Biodiversité	Standalone Pedagogic resources
CXDD	Complexité et Développement Durable	Standalone Pedagogic resources
E-Climat	Une introduction à l'état des connaissances sur les sciences du climat	Standalone Pedagogic resources

KQA	Knowledge Quality Assessment	Standalone Pedagogic resources
SENT	Evaluation des risques sanitaires liés à l'environnement	Standalone Pedagogic resources
ZC	Zones Côtières	Standalone Pedagogic resources
ECOLECON	Ecological economics	Pedagogic resources related to methodology
EVALUATION	Module on evaluation concepts, methods, tools and applications.	Pedagogic resources related to methodology
AGREGA	Anticipation et Gestion régionales des Ressources En Granulats	Pedagogic presentation of outputs of research project
EJOLT	Environmental Justice Organisations, Liabilities and Trade project, EU Framework 7 Programme	Pedagogic presentation of outputs of research project
EJOLT - Methodology presentation	Detailed presentation of EJOLT methodology	Pedagogic presentation of outputs of research project
EJOLT - Ilmenite Exploitation in Madagascar	Environmental Integrated Analysis of Ilmenite exploitation in Madagascar	Pedagogic presentation of outputs of research project
Colloque-CNAM-COP21	Colloque international du CNAM, Novembre 2015, Paris	Documentation of International Seminar (in French language)
COP 21 - Jobs	International Seminar, CNAM, November 2015, Paris	Documentation of International Seminar (in English language)
ECO-INNOVATION in Territories	Innovation case studies and special events	Documentation of International Seminar (in French language)
Symposium Les Grands cycles de la Biosphère dans leurs territoires	Economie Ecologique, Analyse Intégrée et Gouvernance Environnementale	Documentation of International Seminar (in French language)
HISTOIRE ENVIRONNEMENT ET CLIMAT	Cycle de conférences de l'OVSQ/UVSQ	Documentation of International Seminar (in French language)
ePLANETe - Biodiversity Virtual Garden	ePLANETe - Biodiversity Virtual Garden	Documentation of ePLANETe Gallery
ePLANETe - YGGDRASIL (Version 2)	A teaching programme online presentation	Documentation of ePLANETe Gallery
Guide to the Forest of Broceliande	Guide to the Forest of Broceliande	Documentation of ePLANETe Gallery
Pollution de l'air	Restitution des travaux des étudiants AEGR (2016-2017)	Documentation of students work
RISQUES	Initiation à l'Observation, à l'Analyse et à la Gouvernance des risques	Documentation of students work

Over time the site continues to acquire additional study resources from many sources around the world. The site itself offers multilingual options. Visitors can choose to visit the French or English versions by clicking on the corresponding flags on the Home Page. Content of the site will be in various languages but material will **not** be translated. Instead it will be presented in its original language of creation.

Visitors will have diverse backgrounds; they may be scientists, university students, industrial and environmental sectors, NGOs, support agencies, community groups and areas of the public interested in the topics offered on this site.

There are many contributors making their teaching materials available. The Forest of Broceliande is a global community for sharing learning on ecological economics, the environment and sustainable development.



1. In a cauldron inside the Forest are stored all the grains of key knowledge on the site. The cauldron or grain bank is not visible to visitors but the individual grains are visible when you navigate to them.
2. Grains are accessible via areas within study modules. Some grains will be related to other key grains of knowledge and can be found via a relationship link
3. Some grains will have fruit attached. These are additional resources which support the main grain idea and could be pdfs, videos, slide presentations, photos, sound recordings, games etc. and are accessible from the grain via a hyperlink

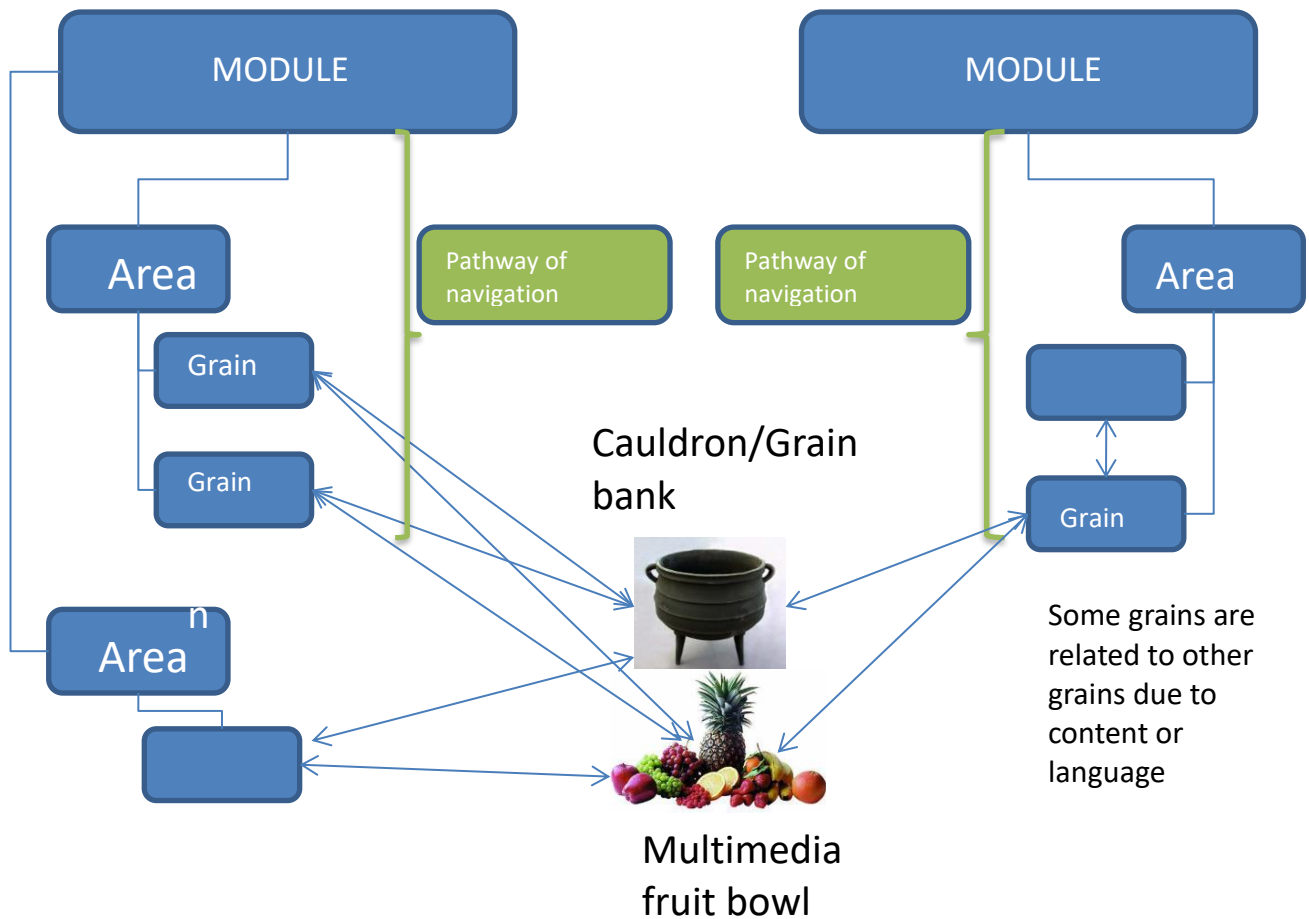


Figure 4. 4: Structure of the Broceliande Forest site

You click from a Module to an Area to a Grain via a pathway. Once in an Area you can also move between grains and also select fruit once you have arrived at the attached grain.

4.4.2 : ways to navigate this forest

The Forest of Broceliande provides **THREE** simple ways to explore the complexity of environmental issues. They can operate as stand-alone methods to explore the material on this site but they complement each other and provide an opportunity for visitors to choose how they want to study the material at any given time on any given day. The visitor is empowered and can take responsibility for their own learning. They can even change their mind about which means of navigation they prefer while inside the forest.

4.4.2.1 Table of Contents

An analogy for this would be to consider a book. It has chapters and within those there are pages. It's organised hierarchically, of course. The Table of Contents is always visible on the left-hand side of the screen, even if you choose another method to navigate the forest.

When you click on an area, it will expand to show you all its contents; its grains. It operates as a list so that you can see what information is contained within the entire module.

You will see that there are hyperlinks and these will take you straight to the Areas and the individual grains.

Module :
BEST

Table des Matières

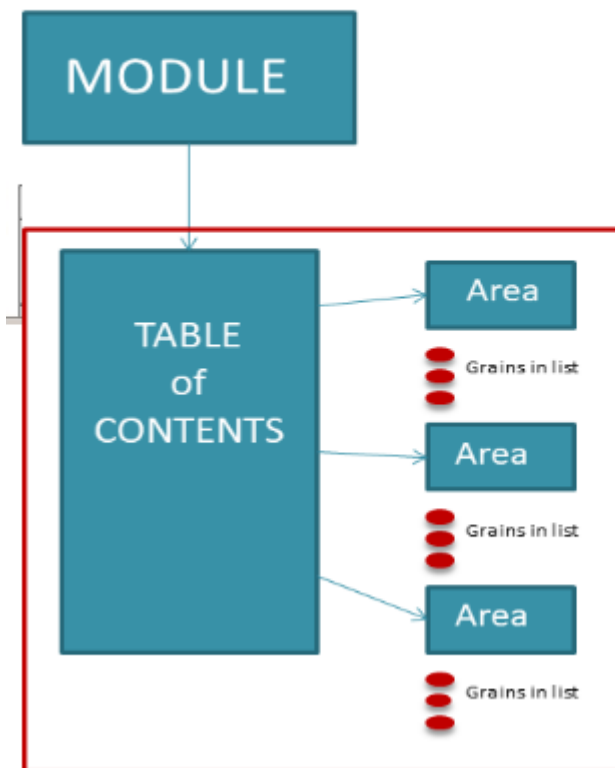
- ▶ Aire 1. Accueil
 - - Présentation des parcours BEST
 - - Présentation de l'Aire 12. DOCU
 - - Présentation de l'Aire 11. CQC (KQA)
 - - Présentation de l'Aire 10. Cartes & Données
 - - Présentation de l'Aire 9. Avenirs
 - - Présentation de l'Aire 8. La Foire aux Indicateurs (KIK)
 - - Présentation de l'Aire 7. Démarches d'Evaluation (avec kerDST)
 - - Présentation de l'Aire 6. Les Bilans Biodiversité des Entreprises
 - - Présentation de l'Aire 5. Enjeux de Gouvernance
 - - Présentation de l'Aire 4. Les TERRAINS « B-E-S-T »
 - - Présentation de l'Aire 3. Méthodologie RSE, analyse intégrée, Bilan Biodiversité d'Entreprise (BBE)
 - - Présentation de l'Aire 2. Le Jardin virtuel de Biodiversité
 - - Présentation de l'Aire 1. Accueil
 - - La Découverte des 12 aires du Module « B-E-S-T »
 - - Organisation du Module pédagogique B-E-S-T : RSE
 - - Kit pédagogique
- ▶ Aire 10. Cartes & Données
- ▶ Aire 11. CQC (KQA)
- ▶ Aire 12. DOCU
- ▶ Aire 2 : Le Jardin virtuel de Biodiversité
- ▶ Aire 3 : Méthodologie RSE, analyse intégrée, Bilan Biodiversité d'Entreprise (BBE)
- ▶ Aire 4. Les TERRAINS « B-E-S-T »
- ▶ Aire 5. Enjeux de Gouvernance
- ▶ Aire 6. Les Bilans Biodiversité des Entreprises
- ▶ Aire 7. Démarches d'Evaluation (avec kerDST)
- ▶ Aire 8. La Foire aux Indicateurs (KIK)
- ▶ Aire 9. Avenirs

Parcours Disponibles

- Les effets des produits chimiques sur la biodiversité en Europe

Table of Contents

I want to see everything on offer and then choose where to go

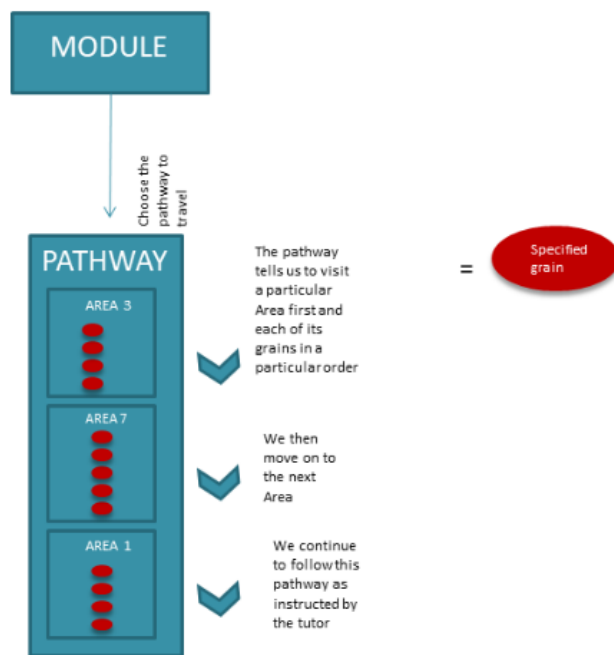


4.4.2.2. Pathways

These always appear underneath the Table of Contents. They are an excellent means of navigation through the forest. These pathways are recommended by our teachers as the most effective way to study the material on any given topic.

The material has been organised in such a manner as to build on learnings as you go, to deepen your understanding and facilitate thought. It also takes advantage of any knowledge prerequisites and extension study available on the site via grain relationships. We recommend you use these pathways to acquire the knowledge in the best pedagogical manner.

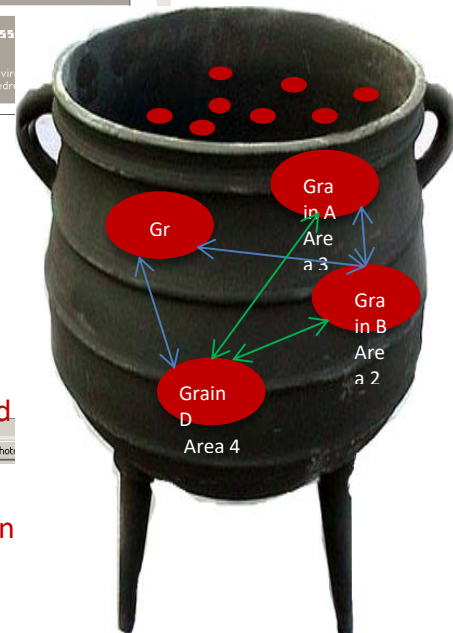
As you can see at left, clicking on a **Pathway** then offers up a menu of **Areas** and their **Grains** for you to explore in a recommended order.



4.4.2.3. Grain-jumping

The third way to navigate around the forest is to jump from grain to grain. Visitors can do this by simply clicking on the hyperlinked grains within Areas and they can do this by jumping around the grain relationships within a grain or area. They can also jump from grain to grain by using the grain hyperlinks in the Table of Contents.

Grains are stored in a central repository – the Caudron



Grains are organised via a Table of Contents or a Pathway but you can choose to jump around in the cauldron without any imposed order. You just need to start your access from a Module, find a grain and start

This method may be useful if they have quite specific material they wish to access. It is less useful for a comprehensive understanding of what might be involved in issues within entire Areas or Modules as it is not structured in a pedagogic manner.

The structure of the site allows for a guided pathway to acquire knowledge in a recommended order. However the site is also flexible enough to permit free navigation between grains in relationship. The types of relationship may be one or other of the following:

- The grain may be a Concept which may have an Illustration available
- The grain may be an Illustration from which it is possible to discover the Concept
- The grain may be a Beginning piece of knowledge and to select this grain will led to an extension of knowledge
- The grain may be an extension of an idea and by choosing the grain related to this one you will discover beginning knowledge
- The grain may have a conceptual relationship to another in close proximity
- There may be another reason for the grains to be related, such as being available in another language (cross-language link).

The fruit bowl is where the fruits are stored. Fruits are support materials in various file formats stored on diverse sites. They have been made available to illustrate and reinforce material in particular grains. They may consist of slideshow presentations, pdfs, videos, sound files, recorded webinars, photographs, for example. They are numbered and their hyperlinks recorded in a central database. They are only available to view if they have been linked to a grain.

These two ePLANETe.blue galleries (YGGDRASIL and BROCELIANDE) are considered to be structured ways to access to teaching materials. All components of ePLANETe.blue can be considered as elements that can be mobilized in pedagogical approaches. It is obvious that we can also mobilize knowledge from other media external to ePLANETe.blue.

CHAPTER 5: QUALITY EVALUATION VIA INNOVATIVE METHODS: A CASE STUDY OF UNIVERSITY PARIS SACLAY

5.1. General assessing way of University's Quality programmes

Debates around the content of the higher education, and how it is taught, have been overshadowed in the past decade by increasing focus on output-regulated educational systems or educational outcomes. The issue of identifying and developing knowledge mediation within educational systems has given approach to determining how capabilities are acquired and assessed. The emphasis on “key capabilities” is the outcome of the following two congregating actions.

5.1.1. Sustainability issues

The first is based on the reformulation of the sustainability through knowledge dissemination. Sustainability takes on even more significance with the projection of 9 billion people on the planet by 2050 (Horvath, Stewart, & Shea, 2013). It is an issue that has been present in many official agendas¹⁴³ for at least 15 years in private, governmental, and educational sectors (Velazquez, Munguia, Platt, & Taddei, 2006). However, as conveyed by the United Nations, the progress towards the goals established in Rio de Janeiro has been slower than it was expected, it would be and in some cases we are worse than we were then¹⁴⁴. HERE are not protected to this dilemma; Sometimes, “progress can be painfully slow and frustrating”¹⁴⁵. Hence, those who teach or serve as academic administrators in higher education institutions face a wide variety of challenges in their exertions to deliver the best educational experience to their students (Domask, 2007). How institutions and instructors define and evaluate the educational experiences they offer is one of the core determinants in deciding what types of educational experiences are offered (ibid, 2007). Some educators emphasize emancipatory, democratic, and pluralistic goals of sustainability education (Wals and Jickling, 2002; Hempel, 2002; Alvarez and Rogers, 2006), while others emphasize the more practical goals of skills building, practical applications, integrating disciplines, and job placement (Wille, 1997; Foster, 1999; Jucker, 2001; DiConti, 2005; Stelmack et al., 2005).

The role has full-fledged gradually diagonally countries since the successful accomplishment of Stockholm Declaration on the Human Environment in 1972¹⁴⁶ which has been recognized as the first orientation of sustainability in higher education. After that, there are numerous conferences, and declarations about the role of HERE in stimulating sustainability i.e. Belgrade Charter in 1975, Rio de Janeiro's Earth Summit in 1992, Kyoto Declaration in 1993, The Lüneburg Declaration in 2001, Lucerne Declaration in 2007, and Tokyo Declaration in 2009¹⁴⁷. At present, sustainability is determining both physical setup and curriculum planning on University campuses through the country as faculty and administrators work to deliver students with the

¹⁴³ Prugh T, Costanza R, Daly HE. The local politics of global sustainability. Washington, DC: Island Press; 2000

¹⁴⁴ United Nations Economic and Social Council. Implementing Agenda 21. United Nations; 2001. p. 4.

¹⁴⁵ Jenks-Jay N. Institutional commitment to the environment and sustainability: a peak of excellence at Middlebury College, in sustainability and university life. In: Filho W. Leal, editor. Peter Lang: Frankfurt am Main, Berlin, Bruxelles. New York: Oxford, Wien; 2000. p. 165

¹⁴⁶ See for the details, United Nations, Report of the United Nations Conference on the Human Environment (UN, 1973)[[Google Scholar](#)]

¹⁴⁷ See for the details, M.M. Ulkhaq, P.I. Prayogo, M. Firmansyah, D. Agustina, Int. J. Infor. Educ. Tech 6, 8 (2016)

knowledge and skills they will need for face the challenges of upcoming days. The educationest and education administrators realize that students need both knowledge sharing content and critical thoughtful skills to address both global and local challenges of sustainability. In this consequence, the concept of sustainability has been integrated into the universities' curricula, researches, operations, partnerships, as well as their assessment and reporting (Ulkhqaq, Wijayanti, Wiganingrum, Dewi, & Ardi, 2018). Some have a master plan, environmental plan, guidelines, or statement about being sustainable campus¹⁴⁸; some by signing of national or international declarations¹⁴⁹; and others create individual institutional policies or framework to achieve campus sustainability, such as ISO 14001^{150, 151, 152}, eco-management and audit scheme (EMAS)¹⁵³, green building initiative¹⁵⁴, environmental impact assessment¹⁵⁵, graphical assessment of sustainability in universities (GASU)^{156, 157}, sustainability tracking, assessment and rating system (STARS)^{158, 159}, Alshuwaikat and Abubakar's framework^{160, 161}(ibid,2018) and self-reflective case, that I will explain in this chapter concerning the university Paris Saclay's case studies on two quality evaluation approach: (1) at the mention Level(teaching programs) and (2) at the campus level.

5.1.1.1. Existing Sustainability Assessment

The sustainability evaluation of HERE is not the specificity of our study goal, we also analyzed the existing tools to sustainability and dealing capacity of it by using the knowledge meadiation portal as the perspectives of knowledge economy. Our goal is to enhance or perception about the methods' goals, the criteria, and the indicators, especially regarding the Teaching program and campus level sustainability. At the present, it is possible to mention many evaluation tools to measure the sustainable performance of the HERE. Some are directed outside of the universities while others are connected to the internal steering and management processes. During the 1990s, a series of initiatives that designed to evaluate HERE regarding sustainability arisen outside the academic domains. Currently, these initiatives are increasingly successful but are subject to deficiencies that limit their potential to contribute to improving the universities sustainable performance

¹⁴⁸ See for the details, L. Velazquez, N. Munguia, A. Platt, J. Taddei, J. Cleaner Prod. 14, 9-11 (2006)

¹⁴⁹ See for the details, T.S.A. Wright, Higher Educ. Policy, 15, 2 (2002)

¹⁵⁰ See for the details, R.M. Fisher, Int. J. Sust. Higher Educ. 4, 2 (2003)

¹⁵¹ See for the details, T.J. Price, Int. J. Sust. Higher Educ. 6, 2 (2005)

¹⁵² See for the details, N.A. Setyorini, M.M. Ulkhqaq, D.R. Rasyida, P.R. Setiowati, R. Trianto, Int. J. Adv. Agric. Env. Engg. 3, 2 (2016)

¹⁵³ See for the details, B. Delakowitz, A. Hoffmann, Int. J. Sust. Higher Educ. 1, 1 (2000)

¹⁵⁴ See for the details, K.A. Owens, A. Halfacre-Hitchcock, Int. J. Sust. Higher Educ. 7, 2 (2006)

¹⁵⁵ See for the details, T.B. Ramosa, T. Cecilio, J.J. de Melo, J. Cleaner Prod. 16, 5 (2008)

¹⁵⁶ See for the details, R. Lozano, J. of Cleaner Prod. 14, 9 (2006)

¹⁵⁷ See for the details, R. Lozano, J. Sust. Higher Educ. 12, 1 (2011)

¹⁵⁸ See for the details, M. Urbanski, W.L. Filho, Env. Dev. Sust. 17, 2 (2015)

¹⁵⁹ See for the details, A. Wigmore, M. Ruiz, Ramon Llull J. App. Ethics 1, 1 (2010)

¹⁶⁰ See for the details, M.M. Ulkhqaq, P.I. Prayogo, M. Firmansyah, D. Agustina, Int. J. Infor. Educ. Tech 6, 8 (2016)

¹⁶¹ See for the details, R. de Castro, C.J.C. Jabbour, J. Cleaner Prod. 61 (2013)

(Bouckaert, 2016). Firstly, these devices focus mainly on the environmental externalities of the university campus. The multidimensional nature of the sustainability issues is therefore insufficiently considered, leaving a scenario for a potential improvement of the existing methods (Vaughter et al., 2013; Sammalisto and Arvidsson, 2005; Yarime and Tanaka, 2012). From a general outline, we can find in the literature training accreditation tools that focus on the evaluation of the HERE teaching activities. Inside this category of assessment, we can remark the reference as the European Quality Improvement System (EQUIS) and the Association to Advance Collegiate Schools of Business (AACSB) label for 'écoles' and business courses, or the SMBG classification of HE programs in France. Furthermore, we can mention the evaluations implemented by the university authorities in certain countries, as the AERES (now HCERES) in France (Bouckaert, 2016). Many evaluations tools that are entire in HERE, and are used to compare the performance of the miscellaneous institutions to learn from them. These tools can be grouped into three categories: the international rankings, the scientific assessments, and the tools for assessing sustainability (Ibid. 2016).

5.1.1.1.1. International rankings:

There are a number of international ranking schemes used to compare universities across a range of indicators¹⁶²International rankings are assessment systems that materialized in the early 2000's. They were established to distinguish global universities according to their level of activities and performance. In order to this, they practise a set of indicators to collective the outcomes to arrive at a single score for each institution. These indicators are then united to deliver an overall score which decides a university's ranking. Between these international rankings, we can highlight the following ranking:

- QS World University Rankings: First accumulated in 2004. The QS World University Rankings presently ranks 1,000 of the world's premium universities. In 2018, UON positioned 214th in the QS World University Rankings, up an inspiring 84 places in six years.
- Times Higher Education – World University Rankings: The Times Higher Education (THE) World University Ranking is the greatest global universities ranking built on core operations including teaching, research, knowledge transfer and international outlook¹⁶³. THE World University ranking applies 13 performance indicators to quantity and quality performance on the 5 core missions i.e. Teaching, research, knowledge transfers and international outlook.
- Good Universities Guide: The Good Universities Guide activities for the performance of Australian universities on a comprehensive variety of indicators and observes the educational experiences and outcomes of graduates. To obtain five star scores in any sort, a university requirements to score amongst the top 20% of higher educations in the group.
- Academic Rankings of World Universities (ARWU): ARWU established by Shanghai Jiao Tong University and well recognised as the "Shanghai Rankings". The ARWU deliberates that every university that has any Nobel Laureates, Fields Medallists, Highly Cited Researchers, or papers published in Nature or Science. Besides , the HERE with a significant amount of papers indexed by

¹⁶² See, <https://www.newcastle.edu.au/research-and-innovation/resources/researcher-toolkit/international-ranking-schemes>

¹⁶³ ibid

Science Citation Index-Expanded (SCIE) and Social Science Citation Index (SSCI) are also comprised. In total, more than 1,200 universities are ranked and the best 500 are published on the web.

- Excellence in Research Australia (ERA): The Excellence in Research for Australia (ERA) initiative is an assessment of research quality and quantities in HERE by the Australian government. It is directed by the Australian Research Council (ARC) and was led in 2010, 2012 and 2015. The ERA assessment shields six years of research and judge's research quality and quantities.

5.1.1.1.2. Existing Scientific Assessments:

The scientific assessments are designated here as the tools used in the focused research projects. In general, these evaluations are profoundly heterogeneous, and almost all of them focus on the dimensions of the academic performance (Ibid., 2016). For example, evaluations may include studies of the research outputs through bibliometric analyses (Gingras, 2014); the effectiveness of the research or teaching activities through statistical tools (Kuah and Wong, 2011); the regional economic impacts of universities (Kelly et al., 2004, Asheim and Coenen, 2008); the returns from their research incubators and partnerships with industry (Monjon and Waelbroek, 2003); or the degree of social engagement with the local communities (Hart et al., 2007). The Programme for International Student Assessment (PISA) and Assessment of Higher Education Learning Outcomes (AHELO) studies conducted within the OECD are two characteristic examples of this variability of assessment. PISA is an international survey that goals to evaluate the education systems globally by examining the skills and knowledge of 15-year-old students. The AHELO feasibility study has as the main purpose to see if it is practically and scientifically feasible to assess what students in higher education know and can do upon the graduation (OECD, 2017a; OECD, 2014).

5.1.1.1.3. Existing Assessment Tools of Sustainability:

The main goal of the sustainability tracking and the assessment tools for HERE is the improvement of the HERE's sustainable performance. These assessment contexts resemble to the interests of our research due to encourage the development of sustainable development initiatives in the HERE and inside their campuses. Today, between the most well-known evaluation tools for sustainability are: the Sustainability Tracking, Assessment and Rating System (STARS), developed by AASHE; the Auditing Instrument for Sustainability in Higher Education (AISHE), developed in the Netherlands by the Dutch Committee on Sustainability in Higher Education (CDHO); the Learning in Future Environments (LIFE), created in the United Kingdom by the Environmental Association for Universities and Colleges (EAUC); and the French EVVADES developed by the FONDaTERRA and a consortium of associates. All of tools provide, share the same approach which is the multi-dimension qualified evaluation. They aim to provide to the HERE an opportunity of gratitude of their performance activities and new opportunities for intervention. Normally, these approaches use indicators about five broad categories: governance, education, research, campus operations, and outreach. Many of these assessment tools appear to be concentrated on the environmental issues (Yarime and Tanaka, 2012). Another comparison between those methods is the difficulty of each method, which encompasses in general about 150 indicators and depend on on data collection facilities, concluded self-reporting processes. For Bouckaert (2016), these factors are at the origin of several problems, such as the difficulties encountered by the members of the universities responsible for collecting information, or the impossibility of verifying the veracity of the data transmitted by the institutions, what can be a risk for the credibility of these tools. If we

defined our area of study to the French territory, we will explore the two main methods pragmatic on the university campus in France to measure sustainability: the STARS and the EVVADES.

STARS®: The Sustainability Tracking, Assessment & Rating System™ (STARS®) is administered by the Association for the Advancement of Sustainability in the Higher Education (AASHE). It is “a transparent, self-reporting framework for colleges and universities to measure their sustainable performance” (AASHE, 2016, pg.10). This framework aims to deliver a sustainability outline of all the HERE, to inspire continual development toward sustainability, to support knowledge to share about the higher education sustainability practices and performance. It also desires to contribute to the development of a campus sustainability community and to empower meaningful comparisons over time and across the institutions (AASHE, 2017). “STARS® wants to involve and recognize the full range of colleges and universities from community colleges to research universities, and from institutions just preparatory their sustainability programs to long-time campus sustainability influential Leader. STARS encompass longterm sustainability goals for already high-achieving institutions as well as entry points of recognition for institutions that are taking first steps toward sustainability” (AASHE, 2016, pg.10).

The STARS® method is composed of five categories, each one with specific sub-goals (Ibid., 2016): **Academics (AC):** with the sub-goals ‘Curriculum,’ and ‘Research’; **Engagement (EN):** with the sub-goals ‘Campus Engagement,’ and ‘Public Engagement’; **Operations (OP):** with the sub-goals ‘Air and Climate,’ ‘Buildings,’ ‘Energy,’ ‘Food,’ and Dining,’ ‘Grounds,’ ‘Purchasing,’ ‘Transportation,’ ‘Waste,’ and ‘Water’; **Planning and Administration (PA):** ‘Coordination and Planning,’ ‘Diversity and Affordability,’ ‘Investment and Finance,’ and ‘Wellbeing and Work’; **Innovation and Leadership (IN):** ‘Exemplary Practice,’ and ‘Innovation’.

The HERE’s overall score is constructed on the percentage of points it obtains by pursuing credits through all the categories. HERE can earn from 0 to 100 points with the credits exclusive the categories. They can also receive until 4 points with the ‘Innovation and Leadership’ category that are bonus points that institutions can have with exemplary practice credits (AASHE, 2017). The method considers the diversity of all HERE due to flexible and open for credits . For example, inside the sub-category ‘Food and Dining,’ the credits Food and Beverage Purchasing and Sustainable Dining are applicated just for the HERE that have on-campus dining services. By following this approach, institutions are not penalized when they fail to earn credits that they could not possibly earn due to their circumstances (Ibid., 2017). After obtaining the overall STARS® score, institutions can be classified through the STARS® rating system to get the Bronze certification, for a minimum score required of 25; Silver, for a minimum score required of 45, Gold, for scores over 65; and Platinum, with scores over 85. Each level of certification represents important achievement and leadership (Ibid., 2017). Furthermore, the STARS® community is composed of around 812 colleges and universities from 30 countries. All the complete cases assessments are visible on the STARS® website, donating to a social network system. For Lancelleur and Martin (2015): “Participating in STARS, which entails gathering extensive data and sharing it publicly, represents in itself a commitment to sustainability. So, the system design does not permit aggressive or hostile criticism but seeks to encourage and reward its members’ participation at the same time as providing transparency in the institutions’ self-assessment declarations” (Lancelleur and Martin, 2015, pg.12). The STARS® contributes with the engagement of all the university campus’ actors in the development of the sustainability practices and performance. However, the STARS® evaluation does not open the possibility for parallel evaluations by several actors of the higher education institution (Ibid., 2015).

EVVADES: The EVVADES (Acronym if French: Outil d’auto-Evaluation du Développement Durable dans

l'Enseignement Supérieur) is a self-assessment tool for French HERE in the field of sustainable development. The EVVADES tool was developed by FONDaTERRA and a consortium of partners, during 2009-2012, in parallel with the elaboration of the STARS® (FONDaTERRA, 2011b). The tool was created under the scenario of the French Grenelle I law. The Grenelle I mandatory efforts of all the HERE in building up an Sustainable development strategy strategy to discourse economic performance, social responsibility and environmental targets, formalized by the name of a 'Campus Green Plan,'. The Grenelle Law's prerequisite was converted into the operational Campus Green Plan scheme on 17 June 2010 via a self-assessment context. The framework was developed by the FONDaTERRA foundation on behalf of the two major higher education bodies: the Conférence des Grandes Ecoles - CGE and, the Conférence des Présidents d'Universités - CPU (Lanceleur and O'Connor, 2015). EVVADES also is a tool for controlling and monitoring the implementation of a Campus Green Plan for HERE. The HERE can evaluate and review their action plans, commit to specific targets, and write and publish a sustainability statement. It has highlighted by Lanceleur and O'Connor (2015) as:

- A sustainable development and social responsibility educational method;
- A tool for communicating and sharing desirable practices;
- A strategic guideline (continuous improvement objectives at 1, 3 and 5 years) that is aligned with the aims of the Green Plan scheme and ISO 26 000;
- A self-assessment tool (strong and weak points, completed actions);
- A spreadsheet that tracks the approach for operational managements and SD advisors;
- Moreover, a database that supplies a basis for certification (Green Campus labeling).

Table 5.1. Each of the 5 Focus Areas contains between 3 or 5 'strategic' variables, which are then divided down into 'operational' variables. In the last version of EVADDES, there are 63 variables, 19 of which are 'strategic.' Strategic values represent the primaries challenges for higher education and are expected to remain stable over the time. Operational variables are defined by an action against a changing background (targets for National or European Strategies) (Ibid., 2015). The self-assessment with EVADDES is performed for a "Campus." It means a Geographic or Organisational Unit (in French: Unite Géographique ou Organisationnelle, UGO) designed to accommodate a variety of HEI sregarding the geographic location and the organization. An institution's (or UGO's) progress is monitored, within a context of continuous improvement, by the movement to the right across each row of the above EVADDES performance table, as it is presented in **table 5.1** (Ibid. 2015)

Table 5. 1: EVVADES' key focus areas and performance level.

Performance Level EVADDES	Level 1 AWARENESS	Level 2 INITIATION	Level 3 CONFORMITY TO GREEN PLAN SCHEME TARGETS	Level 4 CONTROL	Level 5 LEADERSHIP
Area of Performance					
Strategy & Governance					
Training/Teaching					
Research					
Social policy and regional presence'					
Environmental					

management					
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Source: Lancelleur and O'Connor,(2015).

Institutions with numerous UGO are confronted with the problem of distinct assessment levels for a given variable as per the UGOs. This means creating as many 'focus area' reporting sheets as there are UGOs, to frame the Green Plan approach at the level of each Campus/UGO. The institution with numerous UGOs then can calculate its final rating using two options of weighting system (*Ibid.*, 2015):

- It may decide to consider all UGOs as the same; so, its overall score will be obtained simply by averaging the individual assessments of its UGO (weighting = 1);
- It may decide to determine the specific weighting for each of its UGOs in the overall rating; the latter thence represents a weighted average of the individual assessment of its UGOs.

Institutions have a free pass to choose its weighting system. Nonetheless, if it does decide to weight UGOs unequally, it is solicited to clarify the basis for the weights in the documentation sent to the reporting authority (that is, the joint *Conférences of the Universities* and the *Grandes Ecoles*). As the STARS, the EVADES system, propose flexibility to accommodate the diversity of establishments. Not all operational variables have to be applied in reporting for an HE institution or its constituent UGOs (*Ibid.*, 2015).

Practical experience of EVVADES: The REEDS unit in Rambouillet

In 2015, the implementation of the UVSQ in the BN was evaluated by the students of the Master's MEDIATION M2 class in the REEDS center, in Rambouillet. The students were divided into five groups.

Each group evaluated one EVVADES' performance area through data collection and actor's interview.

The most important points mentioned by each group of students in a study of the implementation of the UVSQ inside the BN are presented below:

Group 1 - 'Strategy and Governance':

The overall score for the theme 'Strategy and Governance' is 7.61 of 10. Despite limited financial resources, the budget allocated to the UVSQ unit in Rambouillet was optimized to provide a responsible and sustainable structure. Integrated into the historical heritage of Rambouillet, this unit is concerned with the respect of environmental standards as well as the comfort and well-being of the staff. REEDS is committed to providing a structure that respects the principles of the sustainable development through voluntary investment by employees and students who have successfully met the challenge of building a productive and work-friendly environment.

The Center REEDS relations with the national and the foreign institutions have also contributed to the development of activities. Numerous internal and external projects have been launched in collaboration with European institutions. The formalization of the sustainable development strategy and CSR in the management policy of the UVSQ unit located in Rambouillet proved to be less efficient. The CSR approach, still in a young vision, is integrated into the context of the crisis that UVSQ was facing, which reduces the staff's ability to meet all the CSR requirements (UVSQ, 2015).

Group 2 - 'Training and Teaching'

The overall score for the theme 'Training and Teaching' is 8.46 of 10. It can, therefore, be said that the UVSQ unit based in Rambouillet is proactive in the field of SD, regarding education and training. Indeed, it fully integrates the issues of SD and CSR within the training programs.

The REEDS unit in Rambouillet is also involved in the development of a knowledge base concerning the principles of the SD and the CSR in the company, notably through the ePLANETE system (*Ibid.*, 2015).

Group 3 - 'Research'

The overall score for the theme is 8 of 10. The REEDS center has worked on SD and SR research projects with the partners in the national and the international levels (i.e., more than 40) since 2010, resulting in a significant number of publications published in public each year. Between these publications and projects include subjects in SD, sustainable research, innovation, and other scientific publications. The center also organized or participated about 520 conferences and published many publications since 2010

in the national and the international level with national and international partners (*Ibid.*, 2015).

Group 4 - 'Social policy and regional presence'

The overall score for the theme is 7.12 of 10. The parity and the diversity are not the subjects of a specific policy. However, it was observed that the principle is respected in practice and that there is a particular attention on the part of the management team. The management team has an inclusive attitude toward staff, regardless of their hierarchical position. On the issue of the internal mobility and training, the management team has always encouraged the non-academic staff to take advantage of the vocational training system to acquire new skills. On the other hand, a specific budget is allocated to enable doctoral students to attend the international conferences (*Ibid.*, 2015).

Groupe 5 – 'Environmental management'

The overall score for the theme is 6.4 of 10. This index reflects the proven involvement of the stakeholders in a sustainable development approach both in the design and implementation of the project. The site is a leader concerning the energy performance, according to environmental and social criteria and relative to air quality. Nevertheless, although there is a real desire for continuous improvement, awareness of eco-gestures and eco mobility remains fragile (*Ibid.*, 2015). A global evaluation of each area of performance of the implementation of the UVSQ/BN is presented in Table 5. 3:.

Table 5. 2: Global evaluation of the UVSQ/BN,

AREA OF PERFORMANCE	GLOBAL SCORE
Strategy & Governance	7.61/ 10
Training/Teaching	8.46/ 10
Research	8.0/ 10
Social policy and regional	7.12/10
Environment al	6.4/ 10

Source: Thesis of Mariana Bittencourt, 2017

From all of these assessments, I think the STARS and the self-reflective case are the best. Hundreds of institutions are currently measuring their overall sustainability performance using the Sustainability, Tracking, Assessment, and Rating System (STARS), which offers a boost to an institution’s inclusive sustainability rating if that institution demeanours a “sustainability literacy assessment”. Largely due to the popularity of STARS, many faculty and staff who are involved with campus sustainability management are seeking an easy-to-replicate assessment process and instrument (Horvath, Stewart, & Shea, 2013). The need to assess sustainability literacy is articulated widely among sustainability professionals on HERE, college campuses, particularly during development of the Sustainability Tracking, Assessment, and Rating System (STARS) tool, released by the Association for the Advancement of Sustainability in Higher Education (AASHE) in 2009. This rating system was developed as a tool to be used by campuses in tracking their progress in sustainability across these categories: education, research, operations, planning, administration, and engagement (*ibid*, 2003). One way campuses can gain credits in the curriculum category of the STARS tool is to evaluate sustainability literacy on campus of HERE. The STARS technical manual states that this must be an

assessment of sustainability knowledge and not simply a check on values or behaviors (AASHE, 2012). This guidebook also allows for elasticity as to if a demonstrative sample of the student population must be charted or if a tool can be a pre/post-test after one course. This assessment module of the STARS tool ongoing a nationwide dialogue among sustainability leaders on HERE or college campuses. Educanist and Leaders of HERE agree that they necessity a sophisticated analysis tool but need not to find models to deliver insight into how to start the process, arrangement an valuation, or, at the heart of the badly-behaved: regulate what kind of questions to ask.

5.1.2. Innovation issues

The second emerges from the image of the innovation to develop a most globally modest knowledge-based socially consistent knowledge economy and society through the arrangement content of teaching programs. As significances, several HERE have integrated their facilities of sustainability and innovation into their teaching programs i.e. curricula, research, programs, projects, partnerships, and assessments. Teaching nowadays must include innovative communication methods that impart knowledge (Sachou, 2012). Some innovative methods of teaching could be multimedia, the combination of various digital media types such as text, images, audio and video, into an integrated multi-sensory interactive application or presentation to convey information to an audience¹⁶⁴. The position of education is an active engine for the growth and progress of economy and society. It not only conveys knowledge, skills and inculcates values, but is also accountable for construction of human capital which breeds, drives and sets technological innovation and economic growth. Today, information and knowledge stand out as very significant and critical contribution for growth and survival of life. If we are looking for education simply that as a means of attaining social up, the society must consider education as an engine of advancement in an information era pushed by its wheels of knowledge and research leading to expansion. Currently, many HERE are touching to problem-based learning as a resolution to producing graduates who are resourceful and can think critically, analytically, and problem solving issues. Since knowledge is no longer an end but a means to generating better problem solvers and encourage leal learning like lifelong learning. That's why; Problem-based learning is becoming increasingly popular in HERE as a tool to discourse the insufficiencies of outdated teaching. Those traditional styles do not encourage students to question"what they have learnt or to associate with previously acquired knowledge, problem-based learning is seen as an innovative measure to encourage students to learn how to learn via real-life problems". They need proper and realistic styles. The view of realistic styles, There are many multimedia technologies that are available for developers to create these innovative and interactive multimedia applications, such as Premier. etc. The teacher uses multimedia mediation tools, cooperating methods to modify the contents of the material. It helps to teacher to represent in a more meaningful way, those using different media elements. These media origins can be converted into digital form, modified and customized for the final presentation. By integrating digital media elements into the project, the students are able to learn better since they use multiple sensory modalities, which would make them more encouraged to pay more attention to the information and knowledge presented and recall the information better. The new forms of the technology change in the classroom experience, It has integrated to classroom based education and portal based education. There are a lot of those various types of new styles of teaching methods.

¹⁶⁴ See for the details, Damodharan, V. S. & Rengarajan, V., Innovative Methods of Teaching

The use of innovative methods in HERE has the potential not only to improve education, but also to development and empower people, reinforce governance and stimulate the effort to achieve the human development goal for the country. For this point of view, we want to offer and suggest very simple and very easy innovative method of teaching and learning that will deal our ePLANETe blue which will present in the next sections. Besides, this chapter will analyses the development and Quality Evaluation process, assessment instrument, significant findings, and recommendations for campuses seeking to conduct a sustainability knowledge assessment to meet the needs of university paris saclay campus to contribute a model for the greater higher education community by using the totally innovative method and tools that I will present in the next sections. It will also analyse the gap between what the Paris Saclay University has done in the teaching programs campaigning for integrated approach of sustainability and innovation and what the students have perceived.

5.1.2.1. Existing Innovative Method: B4U

Before presenting the B4U method, some clarifications needed regarding definitions appear to be crucial to discerns “innovations,” “eco-innovations,” and “urban innovation” (Thesis Mariana Bittencourt,2017). Innovation is a complex phenomenon, difficult to quantify and with often long time lags before an impact can be measured (EC, 2012). Innovations can be described as *“the implementation of a new or significantly improved product (goods or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”* (OECD, 2005b, p.46). They can be characterized as *“a change in economic activities that improves the overall performance of society across the economic, (social) and environmental dimensions of sustainable development”* (Huppés et al., 2008, pg.28). Eco-innovations can be regarded as *“a change in economic activities that improves both the economic performance and the environmental performance of society”* (Huppés et al., 2008, pg.28) or *“all the technologies applied directly, in a preventive or ‘curative’ way, for preserving the environment in the classic sense of the term (i.e., water, air, soil, waste, noise, and others), energy efficiency, reduction of GHG emissions and renewable energies”* (Chambolle, 2006, pg.06). Besides, Eco-innovation, consequently, is a subclass of the innovation but important of real word. The eco-innovations are also considered by environmental improvements with economic degradation or economic improvements with environmental degradation. The urban innovations can be identified *“as urban development projects that incorporate systemic innovations, in which new or modified concepts, systems, products and/or techniques are used, which contribute to low-carbon, climate resilient development on the scale of a neighborhood or upwards”* (EURBANLAB, 2017b). B4U is a method for the urban innovation assessment. We decided to incorporate this tool in this analysis due to the significant relevance of the eco-innovations for this study but also for the achievement of sustainable products, process, buildings, cities and universities. Furthermore, eco-innovations are essential to meet the Goal 9 of the SDGs presented previously (UN-HABITAT, 2016). The Eurbanlab has developed an assessment method that gives confidence and trust in innovative urban concepts, such as products, technologies, systems (Thesis Mariana Bittencourt, 2017). It provides organisations with a means¹⁶⁵ (1) to evaluate or predict the positive impact of a (proposed) project, (2) measure and learn from the achieved sustainable impact of a completed project and/or (3) identify the process required to accelerate the achievement of sustainable results(ibid,2017). The “Benchmark for You”

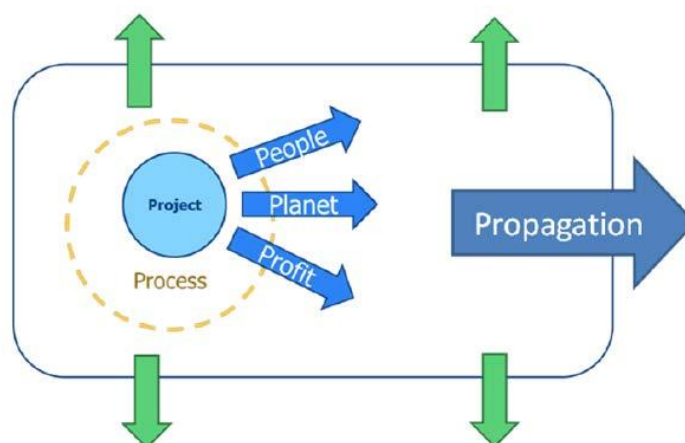
¹⁶⁵ See, Summary and outcomes Scientific review of the Eurbanlab Assessment Method, <http://eurbanlab.eu/wp-content/uploads/2013/12/here.pdf>

or B4U, developed inside the EURBANLAB project, is a comprehensive assessment methodology that has its fundamental principles in the environmental and the social sciences. The tool was designed to identify the urban innovations that contribute significantly to the sustainability of the urban environment, but also that have the potential to be widely applied in other locations (EURBANLAB, 2017b). The method can be applied to the residential buildings, the business park, the public projects (e.g., libraries, universities), to new and retrofit buildings, and to transportation projects. It is composed of indicators that are classified in qualitative and qualitative (ibid, 2017). The B4U's indicators were developed in collaboration with the public, the private and the academic sector which tool delivers an assessment of the innovative concepts and the technologies in their local context in a triple level structure. The main objectives correspond to the 5Ps and are represented by the performance issues that are measured by their indicators (Bosch et al., 2013).

The Triple-P approach of sustainability, where 'People' determined a project's contribution toward the long-term attractiveness and liveability of urban developments, 'Planet' involves the low-carbon and the climate resiliency strategies, and 'Profit' evaluates the economic viability of the project for the neighborhood, for its users and its stakeholders (Thesis Mariana Bittencourt, 2017). It was extended in which way the projects have been established, and how the innovations have been applied. Therefore, the 'Process and the 'Propagation' were also involved as imperative parameters to evaluate the urban innovations. The political environment, the governance issues, and the quality of the expansion process are essential means of in control the factors of success in development. Once the project is completed, it is possible to analyze the possibilities for up-scaling and transferring new concepts or technologies that were applied, or in other words, the opportunities and conditions of the project propagation to other cities and countries (EURBANLAB, 2017b).

The Top-Goals or the 5Ps (People, Planet, Profit, Process, and Propagation) contains in the total 60 indicators (7 People, 15 Planet, 6 Profit, 14 Process and 18 Propagation) and some descriptive information to better understand the evaluation impact (ibid, 2017).. The relation between the 5P categories is summarized in Figure 5.1.

Figure 5. 1: Impact of an innovative project.



Source: Bosch et al. (2013).

REEDS played a key role in this project. Its members have created the methods that structured the B4U. For example, the Kербabel Deliberation Tool or kerDST, developed by REEDS, was a methodological

reference point for the development of the B4U. The B4U tool was designed as part of the ePLANETe platform and is integrated into a structure of online catalogs or "galleries" of objects. In addition, REEDS researchers conducted case study evaluations with this tool.

Practical experience of “B4U method” with The REEDS unit in Rambouillet : The ‘Aile Sud’ building implementation Assessment

The B4U method was experimentally applied in the ‘Aile Sud’ case study in 2014 by the REEDS Research Center inside the EURBANLAB project. The primary goal of this study was to test the method to provide some feedback on the experience and the improvement possibilities.

The first part of the study consisted of an exhaustive data collection about the implementation of the UVSQ inside the BN. All the documents, meeting reports, emails, architectural plans, technical building reports, energy and water bills were analyzed for the first part of the data collection. The second part of the data collection was consisted by interviews with the project actors like the project leader, the project manager, the building occupants and others.

The data collection allowed us to fill the ‘Template’ document presented in Annex 7 which consists in giving values to all the quantitative and the qualitative indicators. Every sub-goal will have a total of scores, and every goal will have a total of scores as well. The total scores from 0 to 10 of Each Top-Goal are placed in the Spider Diagram where the 5 P's are graphically represented.

During the data collection, the stakeholders were interviewed, however, after the data collection, the assessment is held by the delegated assessor. Thus, the evaluation has as primary sources the data collection and the interpretation by the delegated assessor. The delegated assessor had a profile in the architecture and civil engineering, with a specialization in the building impact assessment. This actor worked inside the ‘Aile Sud’ building for two years and also had the capacity to answer questions regarding the user’s satisfaction in the post-occupancy phase.

Impact Assessment Results

The impact assessment showed us relevant information for each sub-goal. As the project is not a social dwelling, some indicators were judged not relevant to the project. It is the case of Fuel poverty, Affordability of housing and Social housing (see Figure 5.2.)

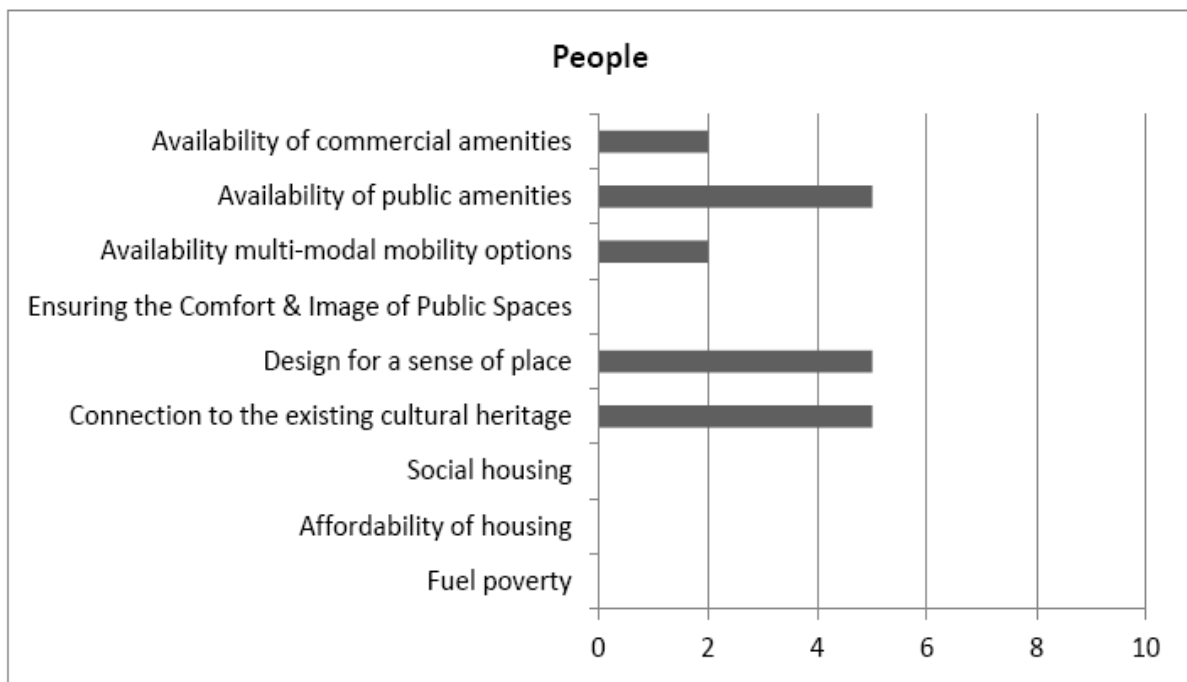
The score of this Top-Goal is below the average¹⁶⁶ according to the spider diagram (Figure 5.10) that shows a total score of 6,2 for the ‘People’ category.

The results of the category ‘People’ assessment showed that the improvement of the building’s comfort and quality were taken as priorities in the ‘Aile Sud’ building renovation project. Attention was given to provide mobility and services to the building occupants, as seen in the *Availability of public amenities* and the *Availability of multi-modal mobility options* indicators. The indicator *Design of a sense of place* also had a significant score in the evaluation due to the building team efforts on creating a "sense of place" especially through the interior building design. The indicator *Connection to the existing heritage* also received a high score due to the strong connection with the existing cultural heritage (see Figure 5. 2).

Analyzing the spider diagram (see Figure 5.10) of the final evaluation we can notice that the high score of 5 regarding the ‘Planet’ category. Even though renewable energy production was not applicable in this project, the *Climate resilience design* indicator contributed significantly to the total score of the ‘Planet’ Top-Goal (Figure 5.3.), and it is correct to affirm that climate adaptation was a central concern for the project

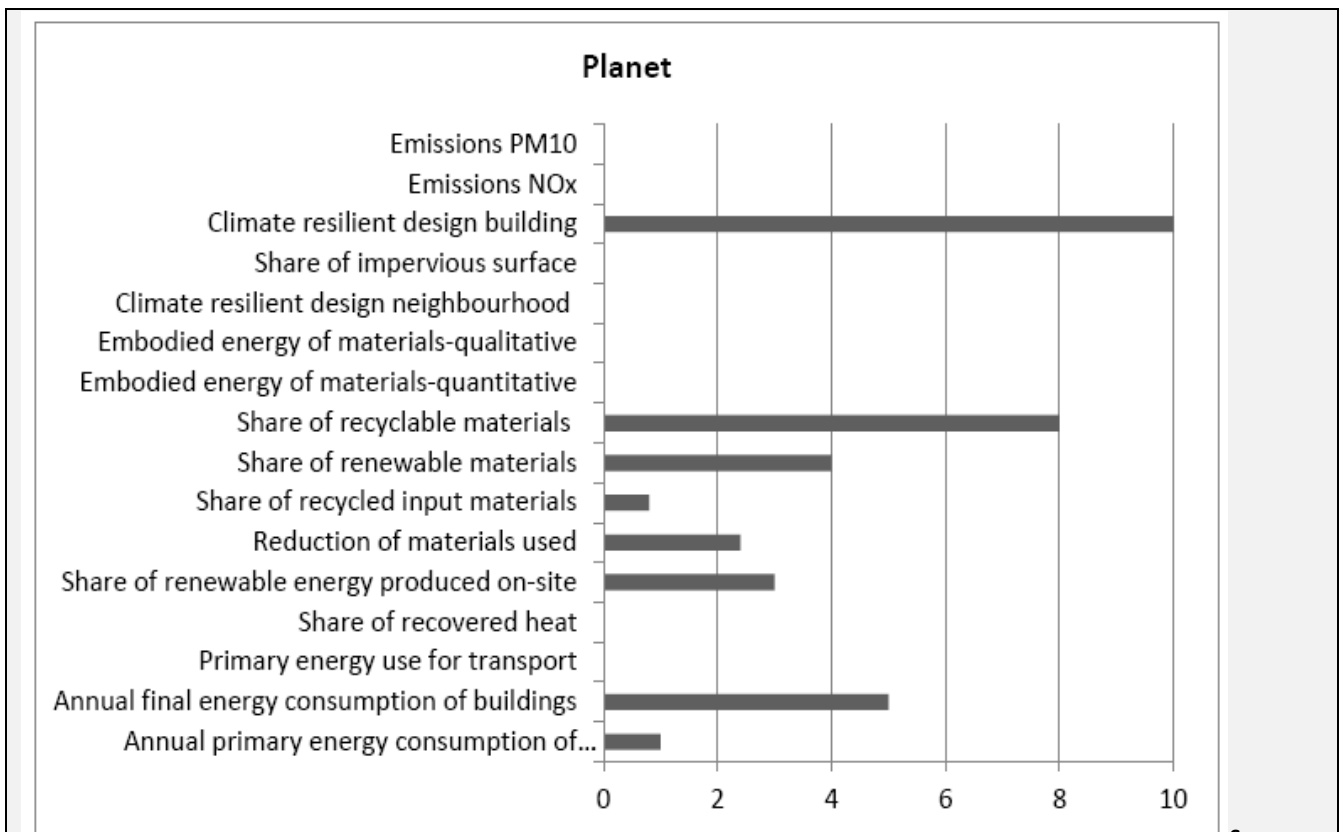
¹⁶⁶ The average was calculated according to the other European urban innovations also evaluated by the B4U method.

Figure 5. 2: B4U assessment results from the Top-Goal 'People'



Source: Bittencourt et al. (2015).

Figure 5. 3: B4U assessment results from the Top-Goal ‘Planet’



Source:

Bittencourt et al. (2015).

The indicator *Annual final energy consumption* received a big score because of the significant efforts in the renovation of the building to improve energy efficiency. The *Share of recyclable materials* and the *Share of renewable materials* were highly scored. Windows' frame, existing furniture and one part of the building framework are made of wood which is a renewable material. The new furniture is made of wood certified by the FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification) labels.

The 'Profit' category received a score of 5.5 for the assessment of the UVSQ implementation in the BN (Figure 5.10.). Indicators as *Payback period* and *Net present value* (NPV) were not considered in the assessment because the case study is an educational institutional with a financial context.

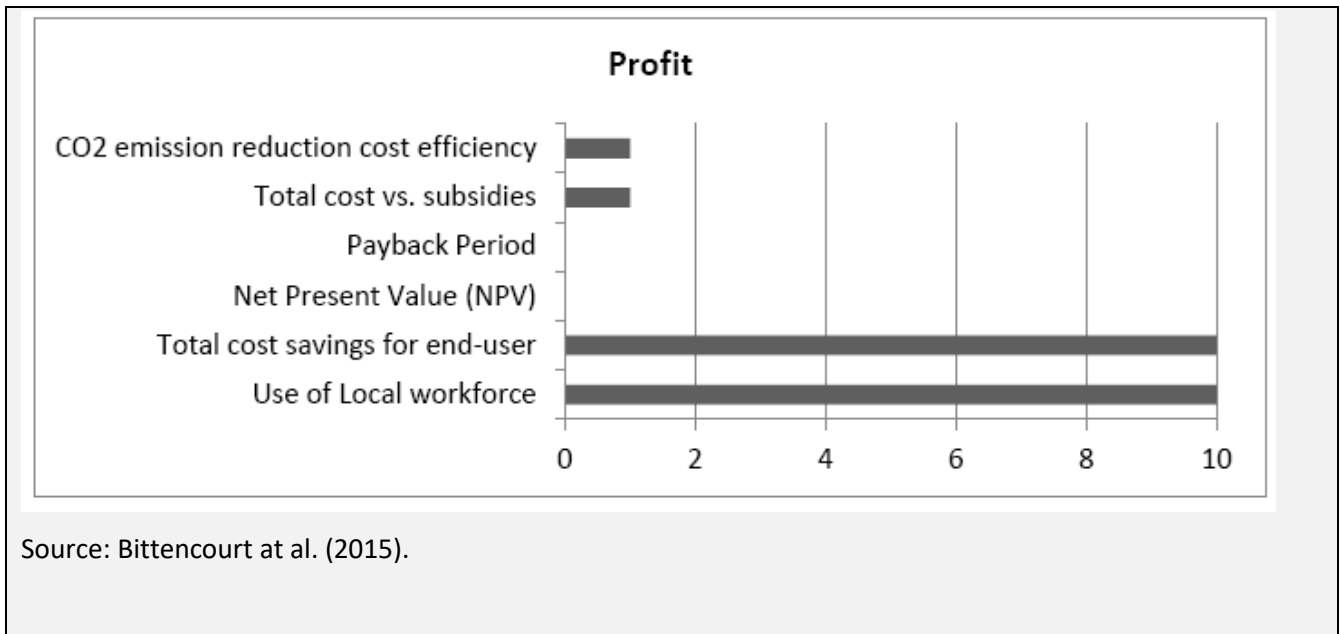
The indicator *Total cost savings for end-users* has a significant score in the 'Profit' Top-Goal and relates to the total cost savings with energy bills. Before the building renovation the energy bill was about €26 251.38/year and after the renovation, €14 645.94/year. The Use of Local Workforce has a considerable impact for the 'Profit' Top-Goal. This criteria was assessed regarding the companies that are situated in the same region of the project (5. 6).

The communication between the stakeholders had a crucial role for the UVSQ/BN project conclusion. A restrict monitoring, and reporting plan ensured the project schedule and the budget during the project implementation. During the operational building phase, the energy consumption control much influenced the energy efficiency of the system (see Figure 5. 7). The final assessment spider diagram of the UVSQ/BN case study pointed a score for the 'Process' category of 7.8 (see 5. 10).

The *Leadership* feature significantly contributed to the project achievement. As the UVSQ developed the project in a cultural site

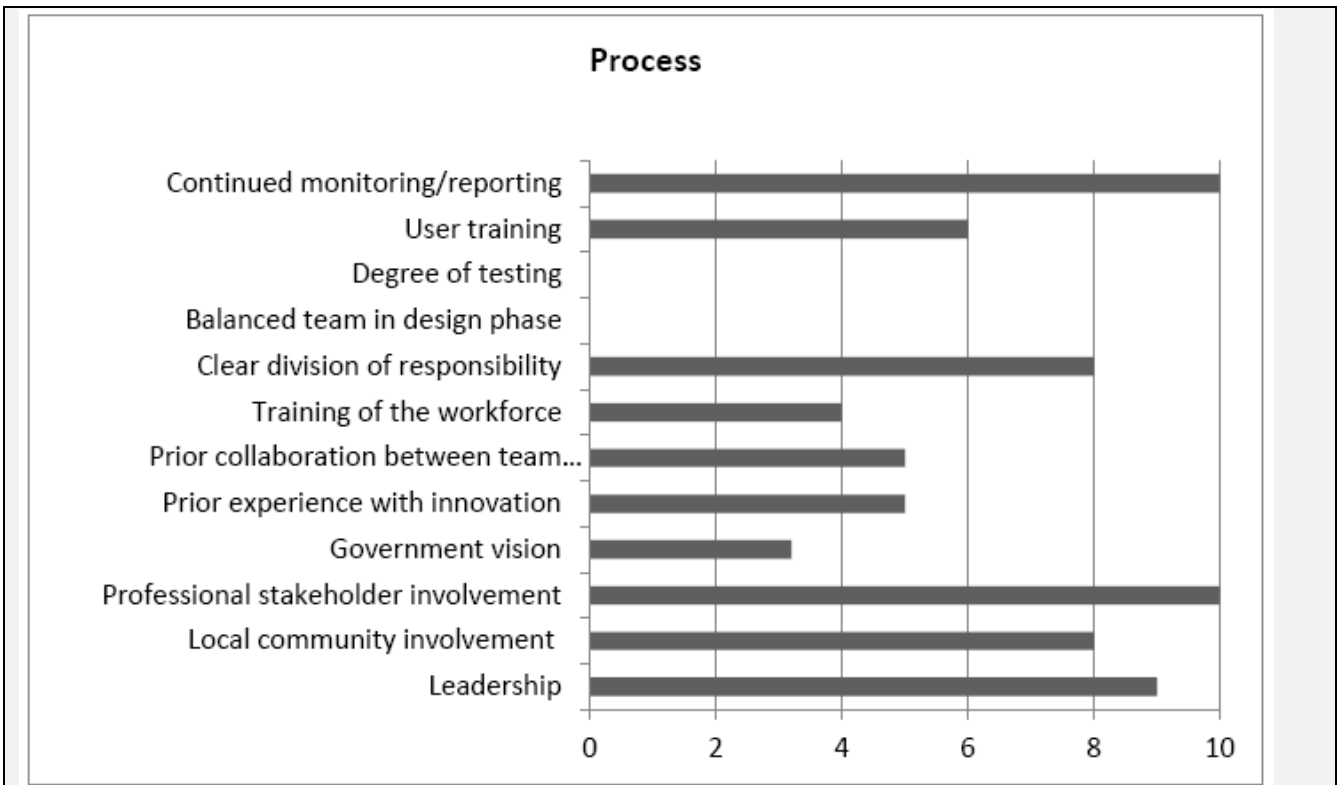
(Parc du Chateau) of the city of Rambouillet, the project leader succeeded in creating the right connections to support the project development.

Figure 5. 4: B4U assessment results from the Top-Goal 'Profit'



Source: Bittencourt et al. (2015).

Figure 5. 5: B4U assessment results from the Top-Goal 'Process'. Source

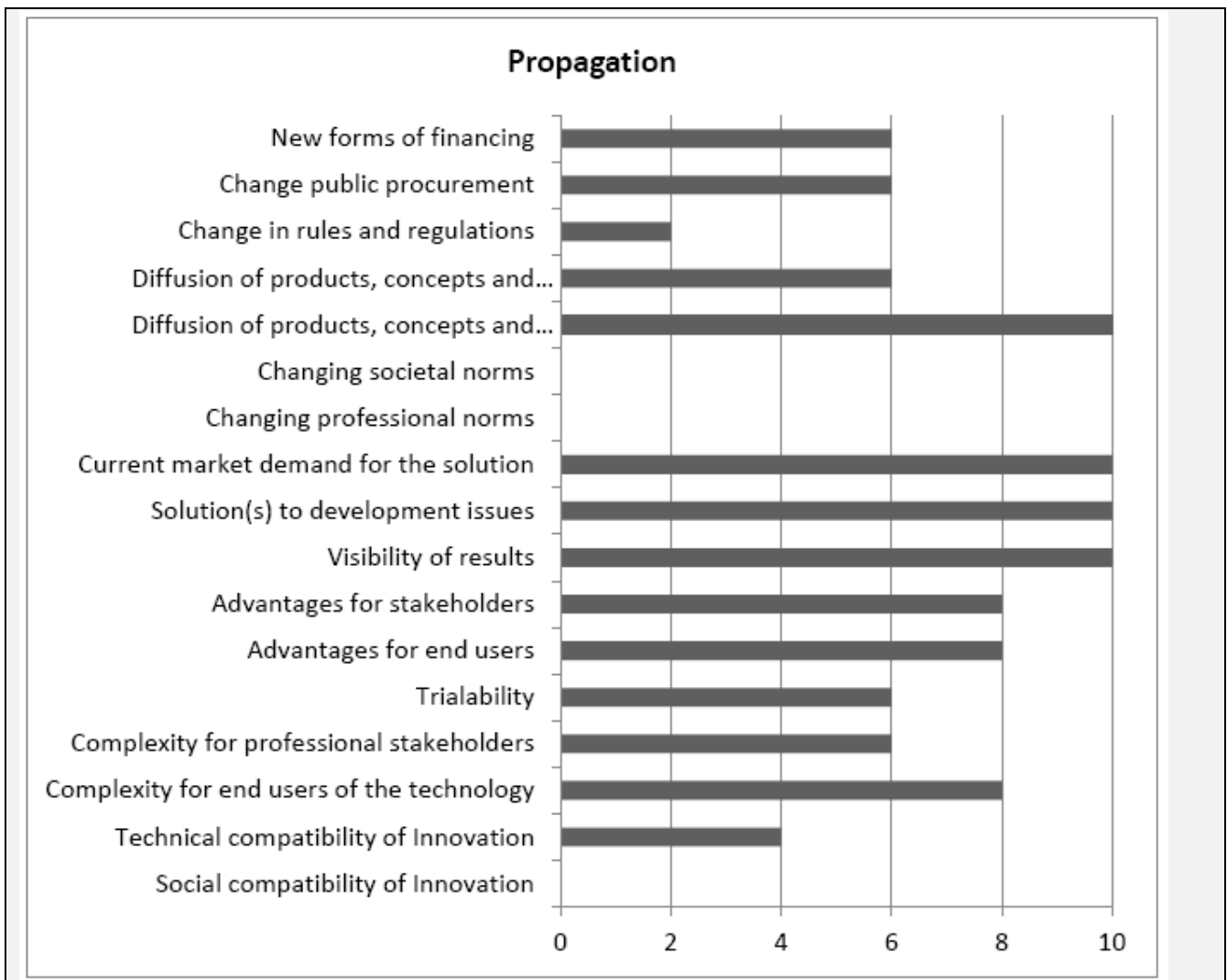


Bittencourt et al. (2015).

Every planning and development meeting required the presence of at least one representative of the department, the regional council, the city hall, the BN, the UVSQ, the project manager, and the construction companies. Because of this, it is possible to find high scores for *Professional stakeholder's involvement* and *Local community involvement*. *Continued monitoring/reporting* was appreciable during the project implementation.

The Propagation Top-Goal's final score reached 7.1, representing a score above the average (see Figure 6). Relatively high scores are represented in by *Diffusion of products, concepts and technologies to other locations*, *Solution to development issues*, *Visibility of results* and *Current market demand for the solution* indicators (see Figure 5. 8).

Figure 5. 6: B4U assessment results from the Top-Goal ‘Propagation’.



Source: Bittencourt et al. (2015).

This happened because the innovation implemented is highly visible to external actors. All the building was renovated internally - the walls were painted, the lighting system was modernized, and all the interior design and the visual identity was remade.

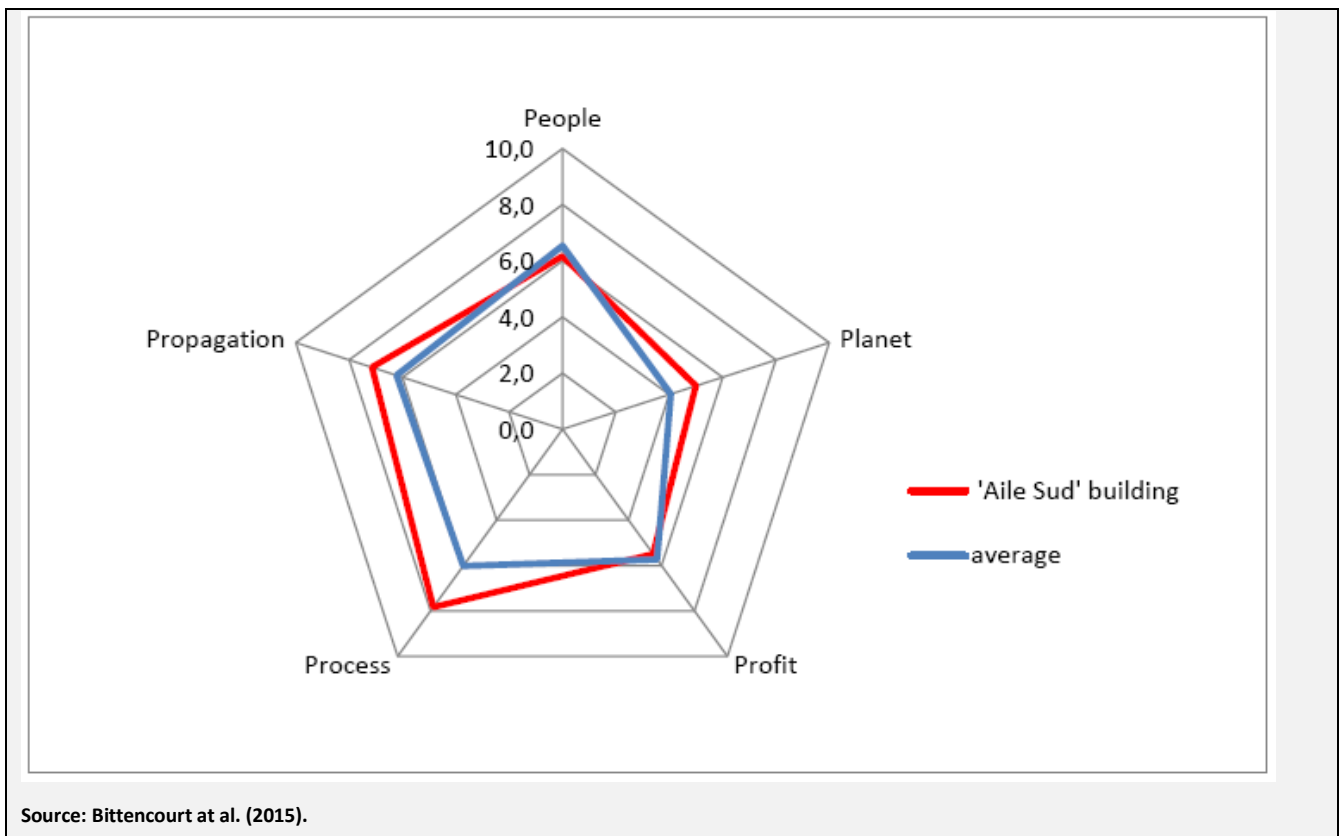
Furthermore, the project offers a solution for the common problems to most European cities that is the building retrofit, the building energy efficiency improvement, and the GHG emissions reduction. It is possible to affirm that there is a widespread market demand for the offered solution. Despite all these indicators that contributed to a high score in the Propagation Top-Goal, lower scores were identified in the *Technical compatibility of innovation* and *Change in rules and regulations* (see Figure 5.8).

Final Assessment

The spider diagram presents the scores of all the Top-Goals of the evaluation of the ‘Aile Sud’ building renovation project and its implementation in the BN (5. 10).

Spider diagram of the UVSQ/BN assessment with the B4U method

Figure 5. 7: Spider diagram of the UVSQ/BN assessment with the B4U method



The project is above the average for the 'Planet,' 'Process,' and 'Propagation' categories. The top-goals 'People' and 'Profit' are a little bit below the average. This can be explained because some indicators were not considered in the study since we were evaluating a research center building and not a social dwelling. We could suggest some indicators to improve the B4U tool, however the current method do not allow a fit for purpose according to the university buildings issues (Thesis Mariana Bittencourt, 2017). With the B4U method application in our case study, it is possible to conclude that the method has an interesting structure to measure urban innovations. The 'triple P' structure that added the 'process' and the 'propagation' categories can have positive aspects for a sustainability assessment (Bittencourt, 2017). We believe that the B4U method might increase the value regarding the GBR system and EVVADES and STARS methods (ibid,2017). Inside the EURBLANLAB project, once the results of the 5P are available, the assessment can be published in a platform online in a collaborative learning process. Inside this learning community, the accent is placed on comparative evaluation and thus, learning from others' experiences (Lanceleur and O'Connor, 2015).

Nonetheless, the main limitations of this method are presented by Lanceleur and O'Connor (2015) in their report *'Design Concepts: Towards a Sustainable Campus Social Network'* but also was experienced with the BN/UVSQ assessment with the EURBANLAB's project method. The method is limited regarding flexibility, mainly due to two main reasons:

- The variation of the innovations that the method can address is limited because the indicators cannot be added or removed, to fit for the case of study purpose;

- The lack of the diversity of judgment for the innovation in the sense that one assessor delegated is responsible for the whole evaluation.

Even having interesting indicators regarding the five categories, inside our limited try to evaluate the UVSQ/BN case of study we can affirm that many indicators were retained for the case study assessment and many indicators were not used for some reasons (ibid ,2017):

- Indicators were not relevant for the case study;
- The information needed to measure the case study was not available or was hard to find;
- Besides that, some indicators were not appropriated for the university building issues.

There is a lack of indicators related to the building issues as the water use, the waste management, and the indoor air quality improvement (ibid, 2017). This can be explained by the Eurbanlab project approach that put on an accent about building energy efficiency and urban resilience. Furthermore, it is relevant to mention the lack of the indicators to represent the specific concerns of the university campus. As significant concerns for the university building, it is possible to mention the adaptation to digital innovation, flexibility in the design of interior spaces, campus as a living lab, sustainable strategy, student life, raise awareness between building occupants(ibid,2017). Even with the limitation of the tool regarding the performance indicators, there is a possibility for the implementation of the B4U to access the university buildings. This requires a fit for the purpose of the B4U tool to adapt to the universities buildings issues. Furthermore, more flexibility would be needed when adding and moving indicators to the tool (ibid,2017). The fit for the purpose of the B4U tool would require active participation from the diverse actors of the case study analyzed. The involvement of the actors would help in the decision of which issues are relevant for the case study, for then propose ways to measure the performance through the indicators candidates (ibid,2017). The role of the actors is also essential for the evaluation. Currently, the B4U limits the assessment process to one point of view, which is the delegated assessor. The delegated assessor interprets the answers that the actors gave during the data collection. Inside the B4U context, the delegator assessor will provide results inside an expert system. It is not the role of the delegator assessor the organization of deliberation and mediation meetings between the actors (ibid,2017).. On the contrary, many actors highlight the importance of the actor's participation. For Sala (2015), 'Broad participation' is an important principle of sustainable assessment to strengthen legitimacy and relevance (Sala et al., 2015).

5.1.3. Potential Valuation Methods and Tools of Sustainability

Sustainable management of contaminated sediments requires careful prioritization of available resources and focuses on efforts to optimize decisions that consider environmental, economic, and societal aspects simultaneously (Sparrevik, Barton, Bates, & Linkov, 2012). This may be accomplished by uniting different analytical methodologies such as risk analysis (RA), cost-benefit analysis (CBA) and life cycle assessment (LCA), multicriteria decision analysis (MCDA), and economic valuation methods.

5.1.3.1. Risk analysis (RA):

The international risk management standard (ISO 31000) has a dissimilar explanation of risk than the financial risk management. Normally, Risk is the effect of uncertainty on objectives and this effects can be positive (opportunities) or negative (threats). Sustainability is great at creating positive effects, but does not know how to use them to offset the threats and it also helps organizations to set "responsible" objectives (Robert Pojasek, 2014). The Sustainability highlights the possible for long-term environmental, social, economic, cultural well-being and requires knowledge based economic innovation, collaboration and technology in all of these areas. Besides, the practices of sustainability integrate the triple bottom line of profit, people, and planet into core business judgements and exploit economic innovation, collaboration, and technology to reinforce its aims. The adoption of sustainable or socially responsible property investment practices is not yet a mainstream activity and the issue is only gradually emerging on property investment agendas (see, for example, Pivo and McNamara, 2005 and UNEP FI, 2006).

If we consider the university campus, the Environmental risk management is an indispensable part of activates planning. It can save you time and money by establishing competences in your progressions and can mean the difference between project success and failure. Environmental risk valuation recognizes possible future threats and trials to reduction your adverse impact on the health of operators of your site and on your local environment. By exploratory scenarios and anticipating future challenges, risk assessment will ensure you have integrated and budgeted for all possibilities for the future of your site. It also supports you to deal proximately with existing problems i.e. sources of pollution, thus avoiding exclusive remediation at a later phase. The outline of risk valuations deliberates human health, groundwater and surface water resources and local ecosystems. Biotops production brings much more environmental welfares but also sustainability challenges as the outline of new biofuel estates could touch fragile ecosystems. By reviewing the parts that will be bare to change, and using computer plotting, we can measure the possible impact. A risk valuation will allow our knowledgeable teams to deliberate any corrective action you need to take for the achievement of your project as well as to meet agreement with valid regulations. To exploit your competences of sustainability and minimize your loss to the environment, human health and local ecosystems, we expression at the risks to your position users and neighboring communities related with air, noise and vibration emissions from your work site. Using the up-to-date in computer modeling we put on possible pollution ways, attention levels and estimated exposure rates to site labours or the local community.

5.1.3.2. Cost-benefit analysis (CBA) and life cycle assessment (LCA)

In a classical approach, dating back to the early 20th century, cost-benefit analysis (CBA) has often been used as a main monetary valuation method to measure the profit that a company can draw from its

development projects (Thesis Mariana Bittencourt, 2017). This methodology is used to evaluate proposals for public or private investment by associating the expected welfares of the projects with their costs. To assess the sustainability of development projects, the CBA measures the balance between social costs and the benefits of several investment solutions(**ibid,2017**). Furthermore, the CBA expected benefits can be translated into monetary units. This monetization is often the subject of much debate, especially in the environmental field. (Gassama, 2016).

Some criticism can be noticed due to the single-criteria approach of the CBA. For some authors (Norgaard, 1989 and Hanley, 1992), the technique fails in representative the involvedness of environmental and social systems when reducing all the parameters into economic value. Janseen and Munda (1999) highlight that the simplification of each monetary value and the subsequent CBA implicitly assumes the complete replacement of the natural capital by the human- made capital. However, the replacement of the natural capital by another kind of capital can continue until the systems reach a critical natural capital¹⁶⁷ when the devastation amount to the environment cannot be compensated for by any quantity of alternative goods (Faucheux and O'Connor, 1998). Inside this perspective, a CBA might conduct to unsustainable solutions (Janseen and Munda, 1999). Thus, to improve the elements needed to increase the political decision-making process, multicriteria approaches have also emerged (Gassama, 2016).

Life cycle analysis approach to assist the environmental impact assessment:

The initial lessons achieved on the environmental impacts date from the 1960s and 1970s. These lessons were absorbed on the assessment or judgment of products to consumers. They were limited to a small analysis of the use life cycle stage(Thesis Mariana Bittencourt,2017). The idea of life cycle analysis (LCA) emerged in the 1980s and 1990s with the growing importance of considering the product life cycle the transportation, production, and disposal stages (Guinée et al., 2011).

At the beginning of the 90's, the LCA was considered as the main tool to evaluate buildings' environmental performance(Thesis Mariana Bittencourt,2017). For Haapio and Viitaniemi (2008), LCA can vary according to many factors, as:

- the nature of the building assessed (e.g., existing buildings, new buildings, refurbishment works, building product or component, residential, office, another type);
- the diversity of users (e.g., professionals, producers of building products, investors, building owners, consultants, residents, facilities managers, researchers, and authorities);
- the several phases of the building's life cycle (e.g., production, construction, use and operation, maintenance, demolition, and disposal);
- the several needs and purposes of the assessment.

The LCA systems were developed to assist in the identification of the improvement possibilities (Thesis Mariana Bittencourt,2017). The **Life cycle analysis approach** can be united in the separate moments of the building life cycle and in the decision-making development. It is used to regulate the environmental impact assessment (EIA) of structure's products and of the life cycle's phases, but is also used to deliver a

¹⁶⁷ For Chiesura and Groot (2003), the "Critical natural capital (CNC) is commonly defined as that part of the natural environment, which performs important and irreplaceable functions".

multi-scale and worldwide impression of the environmental influences on lifestyle, safety, ecosystem quality, and resources.

A correct definition of product life cycle was given by Rebitzer et al. (2004). According to the authors:

"Every product has a 'life' starting with the design/development of the product, followed by resource extraction, production (production of materials, as well as manufacturing/provision of the product), use/consumption, and finally end-of-life activities (collection/sorting, reuse, recycling, waste disposal)" (Rebitzer et al., 2004, pg.701). LCA has been applied at the various stages in the construction sector for particular reasons, such as decision making of building materials and products, or the whole building assessment (Bittencourt et al., 2012; Erlandsson and Borg, 2003). Bribián et al. (2009) noted that architects, engineers, and consultants use the LCA in preliminary phases, early design (sketch) and design of a renovation project; for selecting products or process, to size a project, to set targets at the municipal level, and choose a building site. Furthermore, Arena and Rosa (2003) also highlighted that LCA could be implemented in buildings' project to identify opportunities to reduce energy consumption and negative environmental impacts during the operational building phase. The building LCA implicates the collection and the evaluation of quantitative data on inputs and outputs of materials, energy and waste flow linked to the building's life cycle (Hikmat and Saba, 2009; Wang et al., 2005).

4.3.3 Multi-criteria analysis and decision-making support

A multi-criteria analysis decision analysis (MCDA) is a decision-making methodology that can be used when various alternatives must be evaluated according to a set of several criteria in a flexible manner of the structured and intelligible framework (Janeiro, 2011; Cinelli et al., 2014). The use of MCDA is recurrent even in simple daily life and personal choices, as selecting a new house. Relevant criteria can include access to public transport, price, and security. Every decision that we take in life demands the observation of multiple factors or criteria (Belton and Stewart, 2002).

For Belton and Stewart (2002, pg.2), multi-criteria decision analysis (MCDAs) are *"formal approaches which seek to take explicit account of multiple criteria in helping individuals and groups explore decisions that matter."*

Exploring decisions is important when there is much information of a complex or conflicting nature, contrasting distinct points of view the main goal of the MCDA methods is to assist decision makers in the organization and synthesis of all the information to provide a certain and comfortable situation to decide (Thesis Mariana Bittencourt, 2017). Decision makers should feel that all the factors have been considered and that they possess all the knowledge to make the most rational decision (Belton and Stewart, 2002; Hopfe et al., 2013).

In the construction sector, MCDAs are essential tools to support decision makers to learn and to understand the main problems of the several phases of the buildings' life cycle to guide them to identify actions (Mateus and Bragança, 2008). Many writers discovered in their research the applications of MCDA approaches in the sustainability building sector due to its complexity.

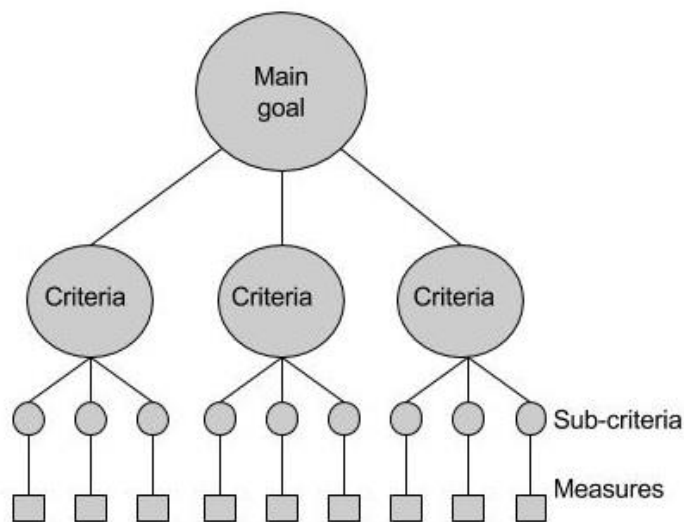
Jensen and Maslesa (2015) tested a multi-criteria tool that can be used as a decision support for the renovation projects in cases of study located in Denmark. Wang and Zeng (2010) presented a multi-objective decision-making process for the reuse selection of the historic buildings in Taiwan. The methodology established allows decision-makers to comprehend better the multifaceted relations of the

substantial characteristics in the reprocess selection problems, which may successively improve the satisfactoriness of the decision (see Figure 5.8).

Seddiki et al., (2016) proposed a multi-criteria group decision-making method for the thermal renovation of masonry buildings in Algeria. The main goal of the method is to rank various renovation solutions. Lizana et al. (2016) developed a multi-criteria assessment methodology for the environmental, economic and social evaluation of the various residential energy retrofit solutions in Spain. Govindan et al. (2016) created a hybrid multi criteria decision-making approach for sustainable material selection for the construction industry.

It is essential to highlight that MCDA assists in structuring the problem providing information for discussion and it does not desire to replace the intuitive judgment or experience that we mentioned previously(Thesis Mariana Bittencourt,2017). As highlighted by Belton and Stewart (2002, pg. 5), the main goal of the MCDA *“is to help decision makers learn about the problem situation, about their own and other values and judgements, and through organization, synthesis and appropriate presentation of information to guide them in identifying, often through extensive discussion, a preferred course of action”*.

Figure 5. 8: Ideal steps of decision-making process



Source: Adapted from Wang et al. (2005).

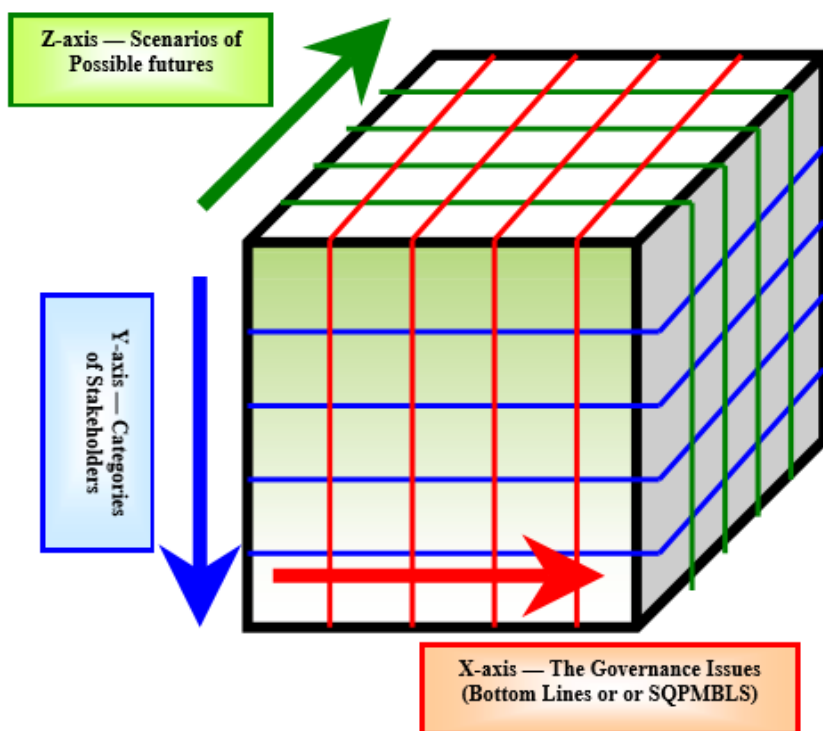
The ideal steps of the decision-making process were described by Wang et al. (2005) as (1) defining the problem; (2) identifying the objectives and the criteria, (3) the criteria weighting, (4) generation of the alternatives; (5) rating each alternative on each criteria, and (6) calculating the optimal solution. Most of the cases of the decision-making process structure the criteria in a decision-tree, where indicators help to evaluate in which way the alternatives meet the overall goal (Nielsen et al., 2016).

MCDM has been used extensively as powerful instruments to perform sustainability assessment. We can find many examples in the literature (Cinelli et al., 2014):

- For the utility-based theory: Multi Attribute Utility Theory (MAUT) and Analytical Hierarchy Process (AHP);
- For the outranking relation theory: Elimination and Choice Expressing the Reality (ELECTRE) and Preference Ranking Organization Method for Enrichment of Evaluations (PROMETHEE);
- For the sets of decision rules theory: Dominance based Rough Set Approach (DRSA);
- For the deliberation process (Deliberation Support Tool – DST): "Kerbabel for you" (K4U) and the KerBabel™ Deliberation Matrix (KDM). K4U and KDM are deliberation support tools established by the International Center REEDS. The K4U allows stakeholders to build a collaborative assessment of a specific case of study (e.g., buildings, mobility, and others) and to draw a final spider diagram (**Thesis Mariana Bittencourt, 2017**). The KDM is *"a highly didactic presentation of the process and outcomes of judgments offered by each category of stakeholders, for each of the options or scenarios under evaluation, with reference to a spectrum of governance or quality- performance issues"* (O'Connor et al., 2007a, pg.03).

Figure 5.12 presents the KerBabel™ Deliberation Matrix (KDM) with its three-comparison axis: The Governance issues, Categories of Stakeholders, and Scenarios of Possible Futures (ibid ,2017). By an angle of the matrix, for example, it is possible to see rectangular arrays of cells, each being a layer of the matrix within which each row denotes the assessments so long as by a group of stakeholders, of a given scenario. besides, observed at from another angle, one gets the assessments by each stakeholder, of a given scenario

Figure 5. 9: KerBabel™ Deliberation Matrix.



SOURCE : O'Connor et al. (2007a)

5.2. Points of Integrated study of sustainability and innovation to the University campus level and teaching programs strategies

A sustainable university is defined by Velazquez et al.¹⁶⁸ as “A higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles”(Velazquez et al, 2006). Cole¹⁶⁹ also defines a sustainable campus community as “the one that acts upon its local and global responsibilities to protect and enhance the health and well-being of humans and ecosystems. It actively engages the knowledge of the university community to address the ecological and social challenges that we face now and in the future” (Alshuwaikhat & Abubakar, 2008). Mainly, Sustainability assurance means that the full costs of development proposals are identified, mitigated, compensated or offset (cole, 2003). There is a common understanding in the literature that a sustainable university campus implies a better balance between economic, social and environmental goals in policy formulation as well as a long-term perspective about the consequences of today’s campus activities(Newman L, 2006). Sustainability is characterized by economic growth based on social justness and efficiency in the use of natural resources^{170, 171, 172}; and it includes the recognition that all stakeholders’ co-operation and participation are required to effectively achieve sustainability goals (Alshuwaikhat & Abubakar, 2008). The need for environmental sustainability in university campuses has been stressed in many articles.^{173, 174, 175, 176, 177, 178}

From the view point of new challenges of sustainability of education, we can say Universities make a significant contribution to the development of our society, and, therefore, have a special societal responsibility, in particular with regard to youth training and public awareness about sustainability(Viebahn , 2002) Therefore, universities should promote a pattern of development that would be compatible with a safe environment, biodiversity, ecological balance, and intergenerational equity(Alshuwaikhat & Abubakar, 2008). As sustainability concept is applied to universities, it should serve as a means of configuring the campus and its various activities so that the university, its members and its economies are able to meet their

¹⁶⁸ Velazquez L, Munguia N, Platt A, Taddei J. Sustainable university: what can be the matter? Journal of Cleaner Production 2006;14:810e9. p. 812

¹⁶⁹ Cole L. Assessing sustainability on Canadian University campuses: development of a campus sustainability assessment framework. Canada: Royal Roads University; 2003. p30

¹⁷⁰ Lozano R. A tool for a graphical assessment of sustainability in universities (GASU). Journal of Cleaner Production 2006;14:963e72.

¹⁷¹ Brundland Commission. World commission on environment and development. Our common future. Oxford, United Kingdom: Oxford University Press; 1987.

¹⁷² Annual report on sustainable development work in the OECD. Organisation for economic co-operation and development; 2005.

¹⁷³ Barnes P, Jerman P. Developing an environmental management system for a multiple-university consortium. Journal of Cleaner Production 2002;10:33e9.

¹⁷⁴ Bernheim A. How green is green? Developing a process for determining sustainability when planning campuses and academic buildings. Planning for Higher Education 2003:99e110.

¹⁷⁵ Cortese AD. Integrating sustainability in the learning community. Facilities Manager 2005;21(1):28e35.

¹⁷⁶ Viebahn P. An environmental management model for universities: from environmental guidelines to staff involvement. Journal of Cleaner Production 2002;2002(10):3e12.

¹⁷⁷ Shriberg M. Institutional assessment tools for sustainability in higher education: strengths, weaknesses, and implications for practice and theory. Higher Education Policy 2002;15:153e67.

¹⁷⁸ Corcoran PB, Calder W, Clugston RM. Introduction: higher education for sustainable development. Higher Education Policy 2002;15:99e103.

needs and express their greatest potential in the present and planning and acting for the ability to maintain these ideals in a very long-term (ibid, 2008). It should create an organizational structure done either a department or establishment or a committee and delivers the essential resources required to accomplish the sustainability idea. When such principles are exist in HERE system, applying a sustainability methodology like this becomes stress-free. The HERE should be modeled as centers that can improve teaching, learning and accommodate the requirements of all learners and to attend as center of the community for encouraging sustainability that could sustenance the concept that HERE are important symbols of “place”. It should also be welcoming to all members of their community for promoting partnership and collaboration with all stakeholders in policymaking and preparation a sustainable environment for learning and research. This can outcome in problem solving and innovations that provision the aims of a sustainable campus. This approach to attaining more sustainability on HERE recommends adopting two main strategies, namely: sustainability in campus level; and sustainability teaching and learning in an integrated way. Each strategy has some initiatives, variables and Indicators and those could lead to achieving the sustainability mission of a university as can be seen in the framework in table 5.3.

Table 5. 3 : Indicators of Quality Assessment

Initiatives for Issues/Challenges	Variables	Indicators	Remarks
Sustainability: TEACHING LEVEL	Sustainable development goal4: Towards inclusive and equitable quality education and long-life learning for all	-Scholarships -Teachers and educators -Fostering an effective interdisciplinary curriculum - linking students to work experience and Job opportunities	
	Sustainability strategies' of Higher Education	-Connecting the academic with the practice - Conferences, seminars and workshops - Sustainability in courses and curriculum - Designing Effective and Innovative Courses	
	Value Creation Strategic in	-Offer of international programs	

	higher education: Globalization	-CBHE	
Sustainability: CAMPUS LEVEL	Promoting education for sustainable development	-knowledge society/economy -sustainability -territory development and land management -livable settlement	
	Sustainable Development At higher education	-Effective learning environments -equity -care of handicap	
	Sustainable campus Green Campus/ knowledge economy	-Green building -green transportation -campus preservation	
Sustainability: INNOVATIVE LEVEL	Transformation of education landscape: Supporting equitable access to higher education/	Portal for Campus related engagement Learning styles inventory	
	Building capacities, Empowerment	-Campus community -alumni -partnership	
	Technology facilitation mechanism for building effective partnerships for education	MOC Education4.0 Dot technology/framework	<ol style="list-style-type: none"> 1. Science-industry co-operation (funding allocated to consortia, networks or platforms of business and higher education and research institutes) 2. Strategic research programmes (funding channelled to research institutions) 3. Innovation 'brokers' such as science parks, incubators and technology transfer offices providing advisory services to innovative firms (funding of intermediaries) 4. Funding of innovative companies (direct financing of businesses via

			grant, loan/ guarantee and equity modes of funding) 5. Cluster policies (funding to cluster managers and/or clusters of companies)
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This section focuses specifically on the above following indicators, which are particularly important to evaluating the sustainability at campus level and teaching programs

Table 5. 4: Challenging Cross-Point of our Study

KnE KnS	Education	Sustainable development	Innovation
Education	<p>1</p> <p>Sustainable development (education) goal4: Towards inclusive and equitable quality education and long-life learning for all</p>	<p>1</p> <p>Promoting education for sustainable development</p>	<p>1</p> <p>Transformation of education landscape: Supporting equitable access to higher education/</p>
Sustainable development	<p>2</p> <p>Sustainability strategies' of Higher Education</p>	<p>2</p> <p>Sustainable Development At higher education</p>	<p>2</p> <p>Building capacities, Empowerment</p>
Innovation	<p>3</p> <p>Value Creation Strategic in higher education : Improving learning processes and outcomes</p>	<p>3</p> <p>Sustainable campus Green Economy/ knowledge economy</p>	<p>3</p> <p>Technology facilitation mechanism for building effective partnerships for education</p>

➡ Sustainable Development At higher education

Table 5. 5: Key Questions for Assessment of teaching Programme

Questions	Source(s)	Method(s)	Analysis
Who is involved in the planning of learning objectives, methods, and assessments?	Teachers Students	Observation Interviews Documents (i.e. lesson plans)	Content analysis
How is learning assessed in the program?	Teachers Students	Observation Interviews Assessment Documents (i.e. lesson plans)	Content analysis
What are the roles of teachers and students within the UPSaclay community? What do they look like?	Teachers Students	Observation Interviews The Class Activities Questionnaire	Content analysis, Means and Standard Deviations Consistency and Direction
What assignments are students expected to complete? What must they do to be successful on the assignments?	Teachers Students	Observation Interviews The Class Activities Questionnaire	Content analysis, Consistency and Direction
What are the roles of teachers and students in discussions? What types of questions are asked?	Teachers Students	Observation Interviews The Class Activities Questionnaire	Content analysis, Means and Standard Deviations, Consistency and Direction
What technologies are Available within the learning environment?	Teachers Students Learning Environment	Observation Interviews Audit of Technologies	Content analysis
How is technology utilized for teaching and learning by the teachers?	Teachers on the team Students	Observation Interviews	Content analysis
How is technology utilized for teaching and learning by the students?	Teachers on the team Students	Observation Interviews	Content analysis

5.3. Quality Assurance Criteria of Teaching and Learning programmes

Quality assurance is a program for the systematic monitoring and evaluation of the various features of a project, service, or facility to certify that standards of quality are being met. Quality in higher education is multifaceted and complex, but ultimately, the quality of an education program should be measured in terms of what students know, understand, and can do at the end of the curriculum (Persky, Joyner, & Cox, 2012). Consequently, quality monitoring should emphasis on improvement and enhancement of student learning. Two components critical to achieving this objective are how course outcomes are identified and the teaching and learning strategies used to achieve them¹⁷⁹.

¹⁷⁹ See article, Horsburgh M. Course approval process. *Qual Assur Higher Educ.* 2000;8(2):96–99.

One of the principal mechanisms for ensuring the quality of learning and teaching is peer review of teaching and evaluation of the curriculum, including the instructional methods^{180,181}. There are a lot of publications that have been published that provide guidelines regarding peer observation of classroom teaching, the evaluation of the curriculum and related teaching, learning, and assessment practices. Horsburgh¹⁸² explored factors that impact student learning through a quality assurance process and found that the most important were the curriculum, the instructors, how the teachers taught and facilitated learning, and the assessment practices used. Curricular evaluations and course reviews, often driven by accreditation expectations, tend to be isolated events that are not well integrated into institutional processes for accountability and often fail to improve teaching and learning (Persky, Joyner, & Cox, 2012). Ideally, the course review process needs to be efficient, effective, and economical.¹⁸³

In this trend, the concept of quality has been defined in several ways as (Campbell and Rozsnayi, 2002, pp. 19–20):

- **Quality as excellence:** This definition is considered to be the traditional academic view that holds as its goal to be the best (ibid, 2002).
- **Quality as zero errors:** This is defined most easily in mass industry in which product specifications can be established in detail, and standardized measurements of uniform products can show conformity to them. As the products of higher education, the graduates, are not expected to be identical, this view is not always considered to be applicable to higher education (ibid, 2002).
- **Quality as fitness for purposes:** This approach requires that the product or service has conformity with customer needs, requirements, or desires (ibid, 2002).
- **Quality as transformation:** This concept focuses firmly on the learners: the better the higher education institution, the more it achieves the goal of empowering students with specific skills, knowledge and attitudes which enable them to live and work in the knowledge society (ibid, 2002).
- **Quality as threshold:** Defining a threshold for quality means setting certain norms and criteria. Any institution that reaches these norms and criteria is deemed to be of quality (ibid, 2002).
- **Quality as value for money:** The notion of accountability is central to this definition of quality with accountability being based on the need for restraint in public expenditure (ibid, 2002).

¹⁸⁰ See article, Dill DD. Is there an academic audit in your future? reforming quality assurance in US higher education. *Change*. 2000;32(4):34–41.

¹⁸¹ See article, Massy WF. *Energizing Quality Work: Higher Education Quality Evaluation in Sweden and Denmark. Project 6, Quality and Productivity in Higher Education*. National Center for Postsecondary Improvement SCA; 1999.

¹⁸² Horsburgh M. Course approval process. *Qual Assur Higher Educ*. 2000;8(2):96–99.

¹⁸³ See article, Moreland N, Horsburgh R. Auditing: a tool for institutional development. *Vocational Aspect Educ*. 1992;44(1):29–42.

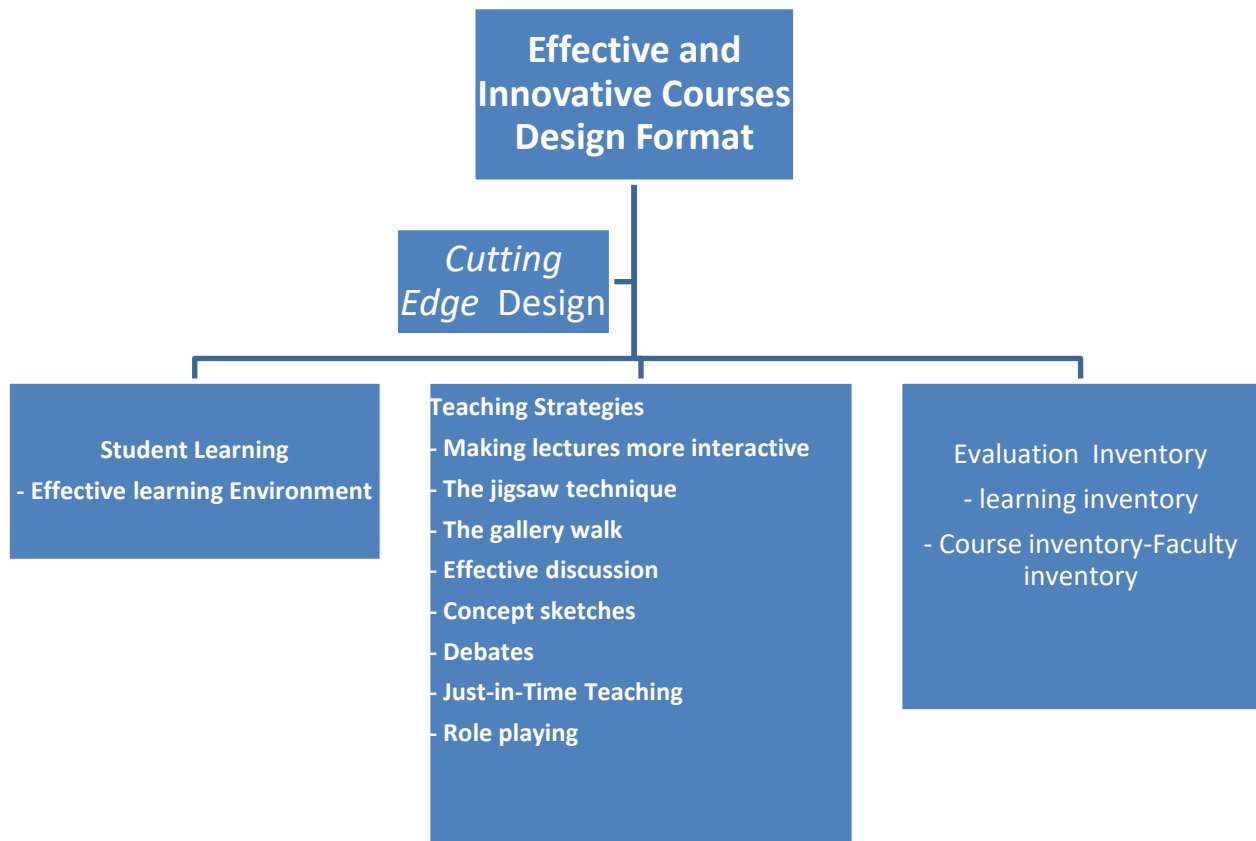
- **Quality as enhancement or improvement:** This concept emphasizes the pursuit of continuous improvement and is predicated on the notion that achieving quality is central to the academic ethos and that it is academics themselves who know best what quality is at any point in time(ibid,2002).

5.4. Quality Assurance Methods

For example Six Sigma, stress the importance of developing a factual understanding of the current quality status of a program, locating sources of problems, establishing a process map, measuring the process, and collecting data to serve as a baseline(ibid,2012). A program assessment process should categorize the excellence of specific courses and pinpoint areas in each course and evidently more international areas for improvement. This process should focus on foundational aspects of teaching, learning, and assessment, such as presence of appropriate learning objectives; degree of learning-centered activities; assessment methods consistent with learning objectives; and course goals(ibid,2012). The assessment process should also analyse consistency in direction of appropriate course policies, strategy and content.

Besides, The Cultural Considerations (Towards inclusive and equitable quality education and long-life learning for all, Sustainability strategies and globalization) in Evidence-Based Practice within higher education is emerging, the effects of which have trickled down to (Territory Management, innovation and Local Development) education, particularly in the development of processes to review curricula. The university Paris Saclay already lunched these types of teaching fields, and trying to improve its quality assurance . Since 2014, the REEDS(the EX-Research Unit of UVSQ) has been published the number of articles, resource documents, organized the talented work on Projects and Thesis work , established specific Knowledge Mediation Tools for networks and discovered a totally innovative framework of quality evaluation process that describing quality improvement processes within these teaching fields.

5.4.1. Effective and Innovative Courses Design Format



5.4.2. Student Learning

The debate regarding several points relevant to course design emerge in one of the best summaries of the field, the National Research Council's 1999 publication¹⁸⁴:

- People learn by actively participating in observing, speaking, writing, listening, thinking, drawing, and doing¹⁸⁵.
- Learning is enhanced when a person sees potential implications, applications, and benefits to others¹⁸⁶.
- Learning builds on current understanding (including misconceptions!)¹⁸⁷.

¹⁸⁴ See report on **'How People Learn: Bridging Research and Practice**, the National Research Council's 1999 publication

¹⁸⁵ *ibid*

¹⁸⁶ *ibid*

¹⁸⁷ *ibid*

Box: What messages can we take home for course design?¹⁸⁸

- If student learning is the goal, effective teaching means creating effective learning environments and **environments where students are actively participating and engaged with the material are crucial to student learning.**
- Students are more likely to learn and retain if we ask them to do more than learn information. **Including activities where students can explore applications and implications will improve learning.**
- A traditional lecture classroom focused on presentation of content by an instructor does not typically promote active participation and engagement.
- Most students dutifully write down what the instructor writes on the board or shows on PowerPoint slides but are not actively processing the information. [For others, the statement "the light's on, but nobody's home" would be most appropriate]
- A few students are engaged in thinking, comparison, analysis and projection during the lecture. They're the ones who raise a hand and say, "But what about X"? or "That must mean that"
- Because many faculty members were this latter type of student, it is hard for us to recognize that **traditional lecture is not an effective learning environment for many of our students because so many students do not participate actively during a traditional lecture.**
- **Source:** Course Design Tutorial website:
<https://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/strategies.html>

5.5. A Case study of UPSaclay for facing the new challenges of Education, Innovation and Sustainability

In 2016, IDEX wrote that "Although the potential and the excellence of the individual members is great, the IDEX has not yet managed to capture and sum up that excellence, to create an integrated research university which can become visible internationally". It difficult to assess of evaluation perfectly due to move from an alliance of institutions to their integration within a single university. Over the last two years, university authority concentrated their effort on the institutional challenge of integrating our existing universities and grandes écoles within Université Paris-Saclay. This process has led to a major redefinition of our institutional perimeter (Idexparis saclay rapport evaluation, 2017).. Five higher education institutions have decided that the required level of institutional integration was too high for them and chose to leave University Paris-Saclay to launch their own project((Idexparis saclay rapport evaluation, 2017), and seven institutions, together with the seven national research organizations (NROs), have continued to work towards the target university that has been supported by the IDEX project since 2012¹⁸⁹. This reduction of our perimeter was necessary for

¹⁸⁸ Teaching strategies. (1999). from Course Design Tutorial website:

<https://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/strategies.html>

¹⁸⁹ mentioned in 2015 report: "We are aware that it is possible that not all 18 institutions will be able to progress at the same rhythm and that some may choose to remain associated rather than join the future Université Paris-Saclay, but we are convinced that we must continue to move forwards if we want to achieve our ten years target of being one of the

university of paris saclay to move forward, as planned, without compromising our original ambition. It will enable us to finalise our institutional trajectory in 2020 with the closure of the ComUE Université Paris-Saclay, the creation of a fully-fledged university that retains its brand, merges with Université Paris-Sud and integrates four *grandes écoles* and IHES (ibid, 2017). The new Université Paris-saclay will have Faculties and Schools with a similar degree of autonomy to that of the Schools of universities such as Cornell (ibid, 2017). They will be formed respectively from the main components of Université Paris-Sud, and by the *grandes écoles*¹⁹⁰.

UPSaclay 2020 will be created on January 1st, 2020. It will be a public university, with an experimental statute, formed by¹⁹¹:

- The internal structures¹⁹² of Université Paris Sud, which will become **“Faculties”** of UPSaclay 2020 (Université Paris-Sud itself ceasing to exist);
- four *grandes écoles* (CentraleSupélec, ENS Paris-Saclay, IOGS, AgroParisTech), which will keep their legal personality, but with an amendment of their statutes which will mention they become **“Schools”** of UPSaclay 2020¹⁹³;
- IHES, which has decided to integrate the target university as a whole. However, being a research institute, it will continue to participate in the governance and actions of the target university with the other NROs.
- Faculties, Schools, and IHES will be hereafter referred to as **“Parties”** to the target university. National research organizations (CNRS, CEA, INRA, Inserm, Inria, ONERA) will be strongly integrated into the governance of the target university. The opposite figure gives a schematic vision of UPSaclay 2020. The universities UVSQ and UEVE will merge with Université Paris-Saclay in 2025, after a process that will lead to their reorganization and the creation of the Paris-Saclay undergraduate college. Until then, they will appear as **“Member universities”** of UPSaclay2020, fully associated to its governance and actions but keeping their legal personality and still delivering some undergraduate and Master degrees under their own brand.

The figure below gives a schematic vision of the whole route.

world’s leading universities” (p.6). The five institutions that left are: Ecole Polytechnique, ENSTA ParisTech, ENSAE, Télécom ParisTech and Télécom SudParis.

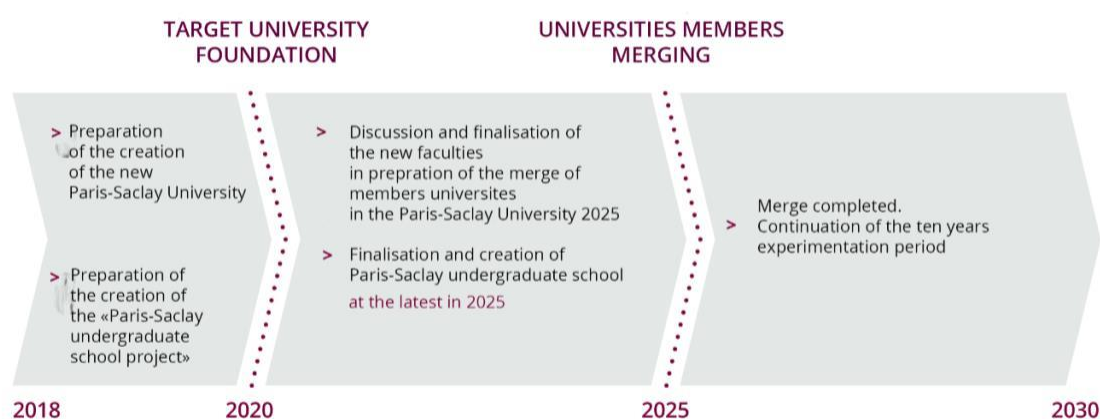
¹⁹⁰ These will keep their legal personality, as planned by the new law on ordonnances currently being passed by the French state

¹⁹¹ See , dexparis saclay rapport evaluation, 2017

¹⁹² Faculties of Law, Economics and Management, Faculty of Medicine, Faculty of Pharmacy, UFR of Science, Faculty of Sport Sciences, Polytech Paris-Sud, and the three IUT of Cachan, Sceaux and Orsay.

¹⁹³ Faculties of Law, Economics and Management, Faculty of Medicine, Faculty of Pharmacy, UFR of Science, Faculty of Sport Sciences, Polytech Paris-Sud, and the three IUT of Cachan, Sceaux and Orsay.

Figure 5. 10 : A schematic vision of the whole route UPSaclay



Source: Idexparis saclay rapport evaluation, 2017

5.6. Application of ePLANETe platform: Innovative Way and Strategy of Evaluation on teaching programs and campus level sustainability Activities

5.6.1. Sustainability Assessment as Social Choice

In quality/performance assessment, as in all rating systems, there are necessarily conventions of evaluation and compromises for procedures of comparison that are open to criticism. We will suggest at the end of this paper a collaborative framework for HERE appraisal that is the fruit of extensive experience with deliberative multi-criteria frameworks and with internet-based platforms for collaborative work and social networking.

We adopt the view that, for a wide variety of “stakeholders” in society — including decision makers in public administration and company management roles — learning about environmental governance challenges can effectively be achieved by **participation in procedures (real or simulated) of selection and deployment of indicator systems for an evaluation activity** (O’Connor, Small, & Wedderburn, 2010). Examples are the evaluation by stakeholders (including management, employees, shareholders, commercial partners and customers) of a company’s performance against specified corporate social responsibility criteria; the evaluation of public policy options such as alternative scenarios for land use or water resource use and quality assurance, or hazardous waste stockage, and so on (ibid,2010).

Our chosen approach is grounded in participatory multi-criteria assessment methods that, in different ways, have been developed and deployed since the 1990s in a wide variety of policy fields.¹⁹⁴ In particular, we draw on recent work by O’Connor and Spangenberg (2007) combining methodological and empirical components,

¹⁹⁴ Examples of analyses that have informed our own approach, or that are broadly comparable in evaluation methodology and political theory terms, include: Simos (1990); Munda (1995, 2004); Jacobs (1997); O’Neill (1997, 2007); De Marchi et al. (2000); Fleisher Trainor (2006); Procter & Dreschler (2006); Frame & Brown (2008); Bremer (2011).

which has outlined operational procedures for indicator-based sustainability assessment procedures (henceforth SA). They argue for sustainability assessments to be organised in a parsimonious but multi-level way. Sustainability assessment information can be placed at three main levels (*Table xxx*), which are articulated by moving “upwards” and “downwards” relative to a deliberately derived set of SQPMBLs (*Sustainability Quality-Performance Multiple Bottom Lines*).

Table 5. 6: Framework for Deliberative Sustainability Assessment

LEVEL	OUTCOME
Characterising “Sustainability”	Agreement about vision of “Sustainable Development” or “Governance for Sustainability” as the pursuit or achievement of a coevolution of interdependent systems respecting simultaneously multiple “bottom lines”.
Articulating relevant “Bottom Lines”: Sustaining of What, Why and for Whom?”	Agreement by Stakeholders on the set of Performance/Quality considerations that are affirmed as “Bottom Lines” for the specific policy situation or class of management challenges being addressed.
Proposing and Mobilising Baskets of Indicators of Quality or Performance	Consensus about baskets of appropriate indicators to be mobilised in each category of SA, as a function of issues, stakeholder diversity and the range of sites, scales and options under discussion.

Source: O’Connor and Spangenberg (2007).

This multi-layered discursive approach considers sustainability goal specification and indicator development as a deeply social decision-making process for which a diversity of viewpoints must be brought together in a strongly schematically structured way. The objective is to produce, through a process of stakeholder dialogue with a spectrum of stakeholders and including tasks of identification and exploitation of a selection of indicators, an evaluation that responds transparently to the spectrum of performance issues (the multiple bottom lines) and stakeholder perspectives. Implementations of this procedure have been carried out by European research teams, notably at the former C3ED and Ex- REEDS where, for the organisation and communication of the evaluation, use is made of an online deliberation support tool kerDST (described in detail by O’Connor et al. 2007)¹⁹⁵

The kerDST system permits a stakeholder community, working on line or in proximity, to declare indicators as a function of perceived pertinence in a specific context. In methodological terms, the process consists of three main steps. The first phase is to “build the problem” by defining the 3-D array of (1) actor classes, (2) performance issues and (3) options or situations to be evaluated. The second phase is for each class of stakeholder to declare a judgement for each option or scenario, relative to each criterion or performance issue. The third phase is to deepen the assessment through motivating each judgement by reference to

¹⁹⁵ The acronym kerDST refers to “KerBabel™ deliberation support tool”, a system available on-line during 2006-2009 at www.kerdst.c3ed.uvsq.fr and, from 2010 onwards at kerDST.KerBabel.net maintained by the “KerBabel” team based at the international centre REEDS at the UVSQ. The origin of the Deliberation Matrix and its prototypes in the GOUVERNe and VIRTUALIS projects is described in O’Connor (2006b). Step-by-step exposition for the use of the different variations of kerDST is found in Reichel et al. (2007abcd).

indicators. Reflecting on the pattern of judgements built up, the user is encouraged to appreciate the pros & cons of each option (or the relative merits and deficiencies of each situation) and also, the cogency and limits of each category of information (or speculation) mobilised as an indicator.¹⁹⁶

A vital question for the expansion and use of “deliberation support tools” (DST) is: What emphasis to place on analytical resolutions and research procedures that support the demonstration of the situations, institutions or scenarios under inspection, and what emphasis to place on procedural resolutions that may support structure the connections of “actors” and stakeholders of the assessment process and, one way or another that provide for the “reconciliation” or “arbitration” of conflicting visions and claims?

Engaging in explicit built deliberation about problems of “social choice” is defensible not only as an ethical and political choice, but also as a scientific carriage that is in line with experimental ‘social facts’ , particularly the “impossibility” of analytical resolution of situations considered by high decision stakes, ex ante indeterminacy and diversity of social values.

As the empirical work reported by the C3ED, REEDS and their collaborators which implementing a stakeholder based evaluation procedure is not a trivial task. There are not only the requirements of approaches, tools and data, but also those of mobilising and organising the interactions of stakeholders in order to achieve a meaningful outcome. Appreciation of this has directed those researchers to best bit participatory evaluation as a multi-steps progression and to put the accent as much on process design necessities as on tool variety for each step. In particular, they have been directed to articulating participatory evaluation as a “integrative” progression placed on problems of social choice. From the circumstances of social choice and participatory evaluation, we can easily apply the INTEGRAAL Meta-Method of REEDS for the quality evaluation at the mention Level and at the campus level sustainability of the university of Paris Saclay and UVSQ’s that will be presented in next section

5.6.2. A multi-stakeholders multicriteria framework

Sustainability is par excellence a problem of social choice (O’Connor 2002a, 2002b; Frame & O’Connor 2010). In regional development as in all public policy, company planning, or collective risk management contexts, there is a need to identify, appraise and choose amongst the various different options or courses of action that present themselves(O’Connor et al,2007). Following fundamental conventions of economics analysis, we may propose to develop evaluation methods in terms of the comparison of one thing or action with another (ibid,2007). If an action “A” is anticipated, the questions may be asked: What is achieved (or gained) by action A? What is lost or excluded by choosing A rather than B (or ‘not-A’). Economists speak of the ‘opportunity costs’ of an action, this being defined as the value of the most attractive alternative foregone (ibid,2007). The question then is: In what ways might the ‘values’ and the ‘trade-offs’ be represented and (perhaps) quantified by the distinction made by Frame & O’Connor (2010), between ‘mono-metrical’ and ‘poly-phonic’ valuation perspectives.

¹⁹⁶ These various facets of the evaluation process with kerDST are documented in several published papers and unpublished theses and reports, including: Chamaret (2007); Chamaret, O’Connor & Récoché (2007); Chamaret, Reichel & O’Connor (2008); Maxim & O’Connor (2009); Da Cunha et al. (2010). Overviews of the range of C3ED deployments of the Deliberation Matrix during 2006-2009 are found in Raharinirina & O’Connor (2010) and O’Connor et al. (2010).

A ‘mono-metrical’ approach to decision support, favoured by many (but not all) economists, is to seek to establish a ‘rational’ justification for a choice between A, B, C, etc., on the basis of relations of preference along a single scale (ibid,2007). If C is chosen over B, and B is chosen over A (etc.), then C is the highest-valued for action. Nevertheless, this apparently simple attitude of establishing first choice, or a standing of situations or of options, is not always relaxed to apply. In the view that follow recapitulate schematical ways that the recognized problems can stimulate an substitute ‘poly-phonetic’ assessment perspective.

Resource management choices usually relate to complex entities, processes or outcomes, each option (A, B, C, etc.) being characterised by a range of attributes (ibid,2007). Evaluation of choices means linking a vector of qualities with a diversity of concepts, units of amount and standards. It is not always informal to pass from a multiple criteria evaluation to a standing of substitutes along a single scale.

Consequences of choices are distributed in time and, often, different aspects of outcomes (good and bad, as perceived by different constituencies) will have distinctive time profiles, e.g., financial costs and returns, but also natural system features such as climate change,

radioactive waste decay, fish population dynamics, dilution of chemical pollution by natural processes, coastal erosion

Multi-Criteria	Option A	Option B	Option C
Principle 1	Not Applicable	SATISFACTORY	INACCEPTABLE
Principle 2	SATISFACTORY	INACCEPTABLE	Not Applicable
Principle 3	INACCEPTABLE	Not Applicable	SATISFACTORY

etc (ibid,2007). For all actions whose consequences will be revealed through time, there is uncertainty due partly to natural system complexity and partly to ‘social’ indeterminacies such as other decisions not yet made or whose consequences are not yet known (ibid,2007).

Many dissimilar explanations or philosophies can be place forward as validations for the acceptability, or not, of different results including perceived uncertainties and risks, distribution of benefits and costs across different constituencies within society, or across generations through time, etc. The different principles may be complicated that is incomparable in the sense of being grounded in qualitatively different considerations. The significance for assessment of a variety of justification values, considered as irreducible, can be emphasized by a recognized decision theory construct, the concept of a “conflict matrix”. This portrays the ‘classic’ **multi-criteria situation** where no one option dominates all the others on all criteria. This is really the typical situation of multi-criteria analysis (see Munda 1995, 2004). It is also the circumstance of multi-stakeholder dialogues. Because, of course, the primary reason for valuation difficulties — one which is relevant for almost all public finance and policy problems of any significance is that whenever the choices (A or B or C, etc.) involve or will have consequences for more than one person, judgements may differ fundamentally as to what is preferable (ibid,2007). Normally, the different choices (A, B, C) will produce differing deliveries of benefits, risks and costs for the individuals or sectors of society concerned.

Now if we demonstrate the second ‘conflict matrix’. For example, each of three stakeholder groups of a society such as *Alpha*, *Beta* and *Gamma* that put forward their desired policy, A, B and C correspondingly.

We get a ‘poly-phonetic’ profile of judgements; see the above table where the cyclical case existing, no overall ranking emerges.¹⁹⁷

Choosing between choices consequently requires some category of ‘arbitrage’ or ruling over the “weight”

Multi-Actor	A	B	C
Beta	MEDIOCRE	GOOD	VERY BAD
Gamma	VERY BAD	MEDIOCRE	GOOD

given to dissimilar criteria or to dissimilar stakeholder claims. The question of fitting weights for dissimilar standards is quite what divides the stakeholders. The different protagonists may not only have divergent interests (as regards, notably, the distribution of benefits, opportunities, risks and costs, meaning a problem of fairness, justice, and equity); they may also propose quite different

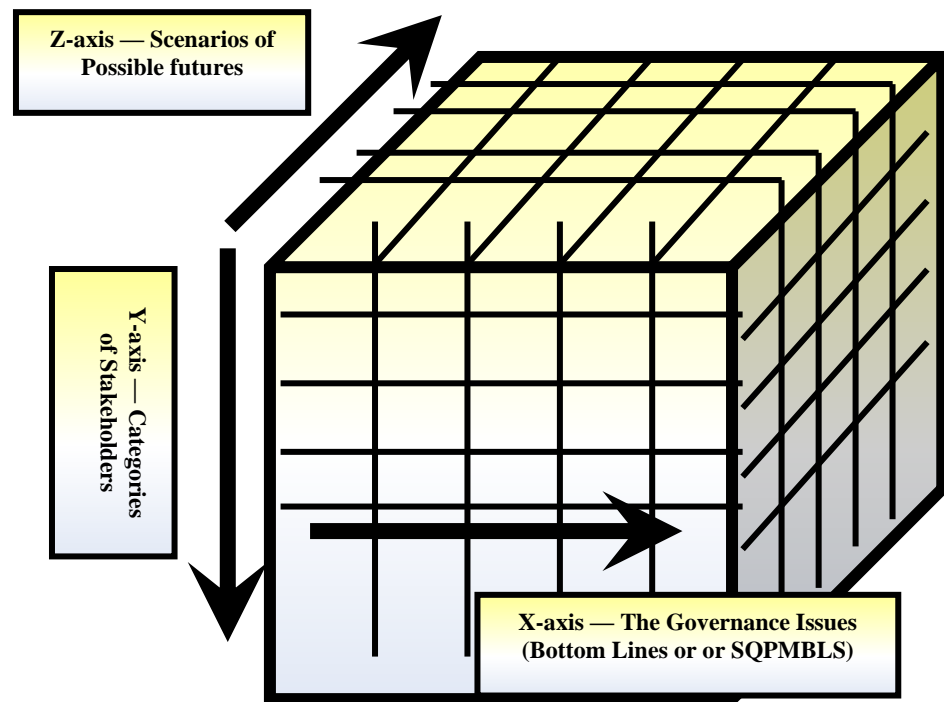
principles of fairness and of performance quality for resolving this “problem of social choice” (ibid,2007).

Finally, we can easily be known that, most often, separate stakeholder groups will have their idiosyncratic attachments to philosophies of quality, performance and adequacy; and also they will scheme their own idiosyncratic ‘content’ for each of the values (e.g., justice, equity, nature conservation, profitability). This leads us to frame the generic problem of ‘social choice’ as requiring a **multi-criteria multi-stakeholder deliberation** about the merits and demerits of the options for action that present themselves to the society (ibid,2007). By bringing together the two ‘conflict matrices’ introduced above, we obtain a three-dimensional array (see below) which has been made the basis of the **KerBabel™ Deliberation Matrix** (see O’Connor 2006d, 2007).¹⁹⁸

Now, we will present this framework that is operationalised in on-line deliberation support tools and then achievement it as a catalyst for a typology of multi-criteria multi-stakeholder evaluation frameworks

¹⁹⁷ This is the typical situation of multi-criteria analysis; see Munda (1995, 2004).

¹⁹⁸ The Deliberation Matrix concept was crystallized, and given a prototype multi-media implementation, in the EC-funded multi-partner GOUVERNe project on interactive tools for integrated management of ground water resources (*Guidelines for the Organisation, Use and Validation of information systems for Evaluating aquifer Resources and Needs*: Contract No. EVK1-CT-1999-00043, European Commission 5th Framework Programme, Thematic Programme: Environment and Sustainable Development, 2000-2003, coordinated by Martin O’Connor, C3ED, France). A comprehensive exposition of the GOUVERNe prototype and its use is provided by Amorsi (2013). The version known as KerDST, available on line after 2006, is presented in O’Connor (2006a, 2007), with detailed guidance to users in English (Reichel et al., 2007) and in French (Bureau et al., 2007).



5.6.3. The Structure of Evaluation: the KerBabel Deliberation Matrix

The methodological frame adopted to characterise evaluation methods along four major axes¹⁹⁹: (1) the OBJECTS of evaluation attention (e.g., institutions, sites, strategies, actions...); (2) the framing of the PERFORMANCE GOALS AND CHALLENGES; (3) the identification and roles of the different “ACTORS” OR STAKEHOLDERS in the evaluation process; and (4) the type of INDICATORS OR “SIGNALS” OF PERFORMANCE. Attention to these four axes then allows us to characterise the PROCEDURES for indicator selection, mobilisation and synthesis into aggregate indices or scores. The logic of the 3-dimensional Deliberation Matrix as developed by the KerBabel research team, is to permit a didactic presentation of the process and outcomes of *judgements* offered by *each* category of stakeholders, for *each* of the options or scenarios under evaluation, with reference to a *spectrum* of governance or quality-performance issues (O'Connor, Bureau, & Reichel, 2007). The spectrum of quality-performance issues, the categories of stakeholders, and the list of objects to be evaluated and compared, must be determined by a KerDST user who, as the designated *problem holder*, will “build the problem” within the on-line deliberation support tool(O'Connor et al, 2007).

In the 2006 version of KerDST, it is essential to specify a “*small number*” of fundamentals along each of these three axes (*ibid*, 2007). The limitation to a “*small number*” (typically between 3 and 8) is partly for ergonomic reasons of on-screen conception (O'Connor, Bureau, & Reichel, 2007). It is justified also on cognitive terms: individuals typically can “hold” up to 5 or 7 objects as separate items in their minds and

¹⁹⁹ O'Connor, M., Bureau, P., Reichel, V.. (2007). DELIBERATIVE SUSTAINABILITY ASSESSMENT WITH THE ON LINE KERDST DELIBERATION SUPPORT TOOL. 18

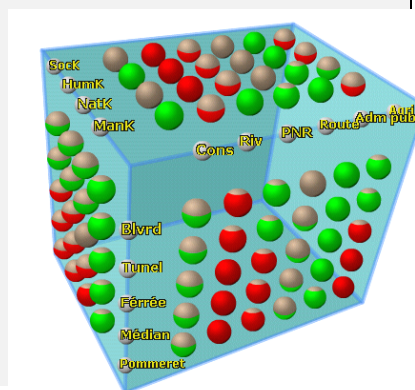
Building a deliberation with more than 8 elements along a single axis becomes unwieldy both on-screen and in cognitive terms **that is** constraint to “small numbers” along each of the structuring axes for “building the problem” can, in principle, be relaxed by introducing internal structure along each axis (**ibid, 2007**). For instance, one strength offers a hierarchical construction of “top goals” and “subgoals” for categorizing the quality-performance criteria. We will return the question of *interior construction* along each of the three constitutive axes,²⁰⁰ but focus here on the **roles of the actors** in the evaluation process and the **mobilisation of indicators** to compose the evaluation(**ibid,2007**).

The kerDST process is provides for three main phases or forms of participation by real persons as “actors” in the evaluation (see O’Connor et al. 2007): The first phase of stakeholder participation is to “build the problem”, a process that, one way and another, culminates in the definition of a 3-D array: (1) the key stakeholder or social actor classes, (2) the relevant spectrum of performance issues and (3) the range of evaluation objects (e.g., higher education establishments, business strategies, industrial sites, projects, territorial development scenarios, technologies, investment options...) to be evaluated. Although one person will be empowered as a specific KerDST user to be the **problem holder**, many people can be involved in discussions before or during the real process of “building the problem” within the on-line deliberation support tool (**ibid, 2007**). The second coat is for individuals who acting as legislatures of a class of stakeholder, declare a judgement for *each* evaluation option (e.g., site or scenario) and relative to *each* criterion or performance issue. By directing on each cell of the Deliberation Matrix, the value is that that *each* stakeholder class should thus offer a judgement (*satisfactory, poor, intolerable, etc.*) of *each* option/scenario in relation to *each* of the key supremacy or decision matters. One gets in this way, for each stakeholder (actor class), a rectangular array of cells, being a layer of the Matrix, within which each row represents (issue by issue) the evaluations furnished by a given class of stakeholders for successive options/scenarios(**O-Connor et al, 2007**). The third form of stakeholder contribution is the opportunity for extending the assessment done motivating each cell-level judgement by reference to indicators (**ibid, 2007**). This technique can have numerous surfaces including not only the range and weighting of indicators for the “basket” of indicators within a “cell” of the DM, but also helps by members of the user community to construction up lists or banks of indicators measured as appropriate to the problem at hand(**ibid, 2007**).

**KERDST — AN ON-LINE DELIBERATION SUPPORT TOOL
FOR MULTI-STAKEHOLDER MULTI-CRITERIA EVALUATION**

The evaluation exercises or tasks are organised with a “grid” or array in three dimensions, built up by specifying, for a chosen problem:

- ◆ **The Evaluation/Governance Issues:**
A small number of distinct Quality/Performance concerns
- ◆ **The Major Types of Actors or Stakeholders**
A pragmatic demarcation of “interests” and collective identities
- ◆ **The Policy Options or Possible Futures:**



²⁰⁰ The 2015 version of kerDST within the ePLANETe platform, permits a hierarchical structure of assessment criteria, and also provides for several different ways of organising the evaluation objects and the “actors” engaging in the evaluation process.

A small number of Options for Action and/or Decision Scenarios

If the task is to evaluate a specific activity or to compare several situations, then the user can specify a site or sites rather than scenarios.

Source: (O-Connor et al, 2007).

From the above three facets of the KerBabel deliberation support procedure, we already get “ how the forms of real stakeholder participation are inseparable from the procedures for mobilising indicators and for “scoring” or reporting evaluation results at cell level and then at higher levels of aggregation. If we still taking KerDST as our methodological case study, we need to more closely at the interaction of evaluation structure and actor contributions.

In 2006, **KERDST** on-line deliberation support tool integrated two major features within the basic multi-stakeholder multi-criteria comparative evaluation framework.

The first, already mentioned, is the **mobilisation of indicators** as a basis for the cell-by-cell judgements. These indicators are catalogued — in a corresponding “KerBabel™ Indicator Kiosk” (**KIK**)²⁰¹ which can be accessed through on-line interfaces with the Deliberation Matrix. Users of the Deliberation Matrix can contribute to the definition of indicators, thus adding elements to the catalogue, in the course of a participatory evaluation.

The second is the accommodation of **multiple participants as members of the on-line deliberation community**, each participant being associated with one of the stakeholder categories defined in the Deliberation Matrix for the social choice problem being addressed, and contributing to the building up of composite judgements for the cells of the **DM** corresponding to that particular stakeholder category(**ibid, 2007**). By mixture of these two features, we recognise the four main types of taking advantage of the **KERDST(2006)** system’s possibilities. These are summarised in the tabular presentation below.²⁰²

The simplest procedure is that of “Colouring in the Cells” by single representatives of each stakeholder category (or by a single expert acting “on behalf” of all stakeholder categories) for a qualitative multi-stakeholder multi-criteria assessment of a situation or of options for action (this is Variation ‘A’ in the schema).²⁰³ This opens up naturally (O-Connor et al, 2007): Towards Variation ‘B’ where several participants contribute to a “composite” judgement per issue (that is, per cell); and, On the other hand, towards Variation ‘C’

²⁰¹ We use the term “kiosk” (and, in French, “Foire” as in open marketplace or fairground) to highlight the notion of “going shopping for indicators”. The KIK is, in itself, a generic deliberation support tool whose metainformation structure addresses the contexts of indicator use and pertinence as well as the more traditional domains of information sources (see O’Connor 2004, 2006c; also van der Sluijs et alia 2006). In the overall programme of C3ED tool development work, the DM and the KIK are seen as naturally coupled, and the KERDST system establishes this coupling for use on-line. However, just as the DM can be used without indicators (other than the colours and text commentaries associated with the cells), so also it is also possible to develop an “Indicator Kiosk” as an indicator catalogue permitting documentation of and deliberation about the indicators themselves, prior to eventually engaging the ‘higher level’ deliberation process represented by the DM itself. In *SRDTOOLS* our emphasis is on evaluation relative to multiple bottom lines by a stakeholder community, hence we focus primarily on the DM and refer secondarily to the KIK.

²⁰² This 2x2 typology is set out in various KerDST reference documents (O’Connor 2006a, 2007; Reichel et al. 2007; and Bureau et al., 2007). An overview of the range of C3ED deployments of this version of the Deliberation Matrix during 2006-2009 is found in Raharinirina & O’Connor (2010).

²⁰³ The “default option” suggested for colour codes is RED for bad, YELLOW for moderate, and GREEN for good; but users can if they wish define their own list of judgements and corresponding colours.

where single representatives of each stakeholder category (or a single expert acting “on behalf” of all stakeholder categories) work to produce a “non-participatory evaluation supported by indicators”, thus linking indicators to societal goals.

KERDST® Typology of Deliberation Processes with the “KERDST” Deliberation Support Tool © KerBabel™ C3ED (2006)		ROLE OF INDICATORS IN THE EVALUATION	
		NO INDICATORS “Colouring in the Cells” (with or without commentary) <i>For each Cell, a single judgement (by colour) is registered for each stakeholder category (via discussion or expertise)</i>	WITH INDICATORS The judgement for each Cell of the Matrix is informed by a “Basket of Indicators”. <i>The colour of the Cell depends on the signification and relative weighting attributed to each indicator in the ‘basket’</i>
USER COMMUNITY	CLOSED The deliberation is not open to an extended community. <i>A single (synthetic) judgement is registered for each actor/stakeholder category</i>	A. QUALITATIVE MULTI-STAKEHOLDER MULTI-CRITERIA ASSESSMENT	C. NON-PARTICIPATORY INDICATOR-BASED ASSESSMENT
	OPEN An extended user community. <i>Multiple participants within each stakeholder category may contribute to the evaluation</i>	B. QUALITATIVE MULTI-ACTOR PARTICIPATORY ASSESSMENT (WITHOUT INDICATORS)	D. MULTI-ACTOR PARTICIPATORY INDICATOR-BASED ASSESSMENT

Source: [kerDST Users’ Manual](#) available in French and English (Reichel, Bureau, Legrand, O’Connor & Sunde 2007).

The modest version of KERDST (the Variation ‘A’) uses colour codes to form up a three-dimensional array of qualitative judgements. This technique of “scoring” or “signalling” by colour is well-maintained for the more difficult differences, but with resolutions for the “composition” of the cell-level signals.

For the Variation ‘B’, **PARTICIPATORY ASSESSMENT WITHOUT INDICATORS**, the cell-level judgement is a merged of the colour signals from each of the individual participants in a stakeholder class. The convention of on-line version of KerDST (2006) is the cell itself takes the colour that has the highest quantity of indications by users within the stakeholder class.

For **KERDST WITH INDICATORS** (Variation ‘C’), a user, signifying a stakeholder class that must integrate a expressive basis for the judgement (colour) proposed in each cell of the Deliberation Matrix, through the choice of a **‘BASKET’ OF INDICATORS** taken to characterise applicable qualities of the evaluation object (scenario/choice or activity/site/territory) under inspection. In the 2006, KerDST, It is allowed to indicate UP TO 5 DISTINCT INDICATORS for each “basket” corresponding to a Cell. For each indicator positioned in a basket, the user must specify the JUDGEMENT by choice of colour code and the relative WEIGHT compared with other indicators.

In the Variation ‘C’, the judgement at the cell level in the Matrix that is obtained not by a simple choice of colour for the cell, but as a weighted “amalgam” of the qualitative judgements allocated to each indicator in

the “basket”. The colour (or composite) of each Matrix cell is a purpose of the relative weight and implication attributed to each indicator in the consistent basket. The convention of the 2006, on-line version of KerDST , is the cell itself takes the colour that has the highest percentage within in the “basket of indicators”.²⁰⁴

Variation ‘D’ of KERDST is the most determined in procedural terms. It delivers for individual users as members of each stakeholder group to express their judgements through indicator baskets in terms of the different sites, scenarios or other evaluation objects to be assessed.

In the 2006 version of KerDST was a rather weighty procedure and not very accessible. The Variation ‘D’ can be effective for registering the indicator ideas and judgements of members of a user community. But it was not easy for users themselves to access the data at disaggregated levels (ibid,2007).

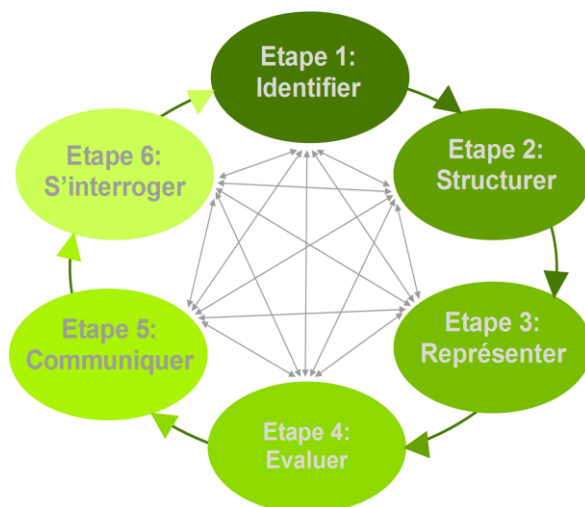
5.6.4. Quality Evaluation process using INTEGRAAL Meta-Method:

INTEGRAAL²⁰⁵ is a framework for sustainability assessment that has developed by REEDS and its predecessor C3ED. It consists of six steps which guiding the process of multi criteria and multi-actor assessment and deliberation. Although presented here as a sequence of steps, Integraal is not to be conceived as a rigidly linear process. The six steps form an iterative process, which can be showed in cycle.

²⁰⁴ This convention was adopted, after some experimentation, because it tends to produce clear visual contrasts between cells and, at the next level up, between rows or columns of cells in the Deliberation Matrix, or again, between entire layers (or “slices” of the Matrix. This illustrates an important more general point, to which we will return, of the accessibility (in cognitive as well as technical terms) and appropriation by users of the results of a participatory evaluation process

²⁰⁵ The six-step schema that we outline here, was formulated by researchers in the C3ED, REEDS and FONDaTERRA (not Fonterra!) during 2006 as a way to situate the use of the kerDST multi-criteria multistakeholder evaluation tool within a wider social process of problem framing, stakeholder participation and communication. Building on the VALSE project vision of environmental valuation as a collective social process in which formal tools are ‘embedded’ in wider contexts for negotiating meaning and purpose (O’Connor 2000; De Marchi et al. 2000), it draws also on experience since the 1990s with participatory integrated environmental assessment (see O’Connor 2006; Munda 2004; Douguet et al. 2009), and with participatory indicator-based approaches to CSR reporting (Faucheux & Nicolai 2004a, 2004b, leading to O’Connor & Spangenberg 2008). Expositions of the *INTÉGRAAL* procedure for territorial applications are found notably in French language reports by Chamaret, Reichel & O’Connor (2009); Reichel, Chamaret & O’Connor (2010); and Da Cunha (2010). The name itself is a play on words that reflects the objective of an “integrative” process, the researchers’ adoption of Celtic symbolism for their key concepts and creations, and the virtuous but utopian (Holy Grail) status of consensus solutions to ‘impossible’ social choice problems.

Figure 5. 11: The Integrated Environmental Assessment Method



The attitude is to constitute a “deliberation forum” that offers opportunities to contributors to discover gradually, or in parallel, different facets of the settled problem. In the view of the REEDS team, deliberation exercises can be iterative, allowing participants to go deeper and to gain or exploit more detailed information (e.g., in the choice and mobilisation of different indicators). It can be anticipated as shared learning continues that new policies for addressing the issue or sub-issues will be identified, stakeholder’s values may be declared and new information, dot technology or analysis requirements may be highlighted.

Step ONE — Identification by the stakeholder community of the social choice problem, or range of options: The objective of this task is to deliver the context, the scale, and the dynamics of the exercise. According to the level of participation, this step can be accomplished by the Research Community (O’Connor, 2006), or in a more participative way.

Step TWO — organise the social choice problem in terms of the actors concerned, the situations or options being assessed, and the value criteria. This means developing in a pragmatic way, typologies or classifications(O’Connor, 2006) of :

- (1) the stakeholders who are impacted by the problem or by the impact of the means of addressing it;
- (2) the policies, strategy options, or scenarios to be appraised; and
- (3) The issues against which the performance of the policies, options or scenarios will be appraised (for example: preservation of the environment, decent work, health, etc.)

Step THREE — Identify and mobilise information and tools for system representation (e.g., maps, models of processes and systems): These information and tools can help to ‘ground’ the deliberations in a robust knowledge base and, more particularly, this will assist in populating catalogues of indicators representing the stakeholders’ reference points when working to evaluate situations and scenarios(O’Connor, 2006),. This step principals to the classification of indicators, which are units of information submitting to certain physical qualities.

1. Make an inventory of available tools and date to represent the system

No particular method is advised at this stage, but a classification of tools may be useful. O’Connor (2006)

mentions "analytical and representation tools, with their underlying conceptual frameworks, for visualising the situation under discussion, from the point of view of a governance of its evolution". These tools can be diagnosis, studies, maps, schemes, mathematical models (O'Connor, 2006),

2. Conduct required studies and diagnostics for the demonstration of the system circumstances to evaluate . The output will be various types of documents: diagnosis, studies, maps, etc.
3. Figure out a database of indicators significant for the social choice problem
4. Figure out an inventory of available indicators and build a database of candidate indicators.

Step FOUR — mobilise the actors for tasks of deliberation.

This step be dependent on the structure and information developed in steps 1-3 above. It produces results in the formal logic of a multi-actor multi-criteria evaluation. It also delivers insights and learning to contributors via the discussions that take place and remark of the respective positions accepted and of how these evolve through the collective learning that occurs.

Deliberation exercises of current performance or future options are undertaken in a multi-stakeholder multi-criteria perspective at appropriate scales (e.g., from farm to region to nation...), corresponding to defined contexts or "theatres" of collective debate and action(ibid, 2006). There may, in principle, be many separate evaluation exercises. The REEDS team "piecewise deliberation" that can be roughly attached by attractive mutual typologies of stakeholders and performance values or by bearing in mind the same or analogous strategies.

The deliberation step can be organised in 3 sessions (ibid, 2006):

1. A preliminary session

Once information is gathered, all participants, representing stakeholders, can be invited for a presentation of the preliminary results, which leads to settling the axis of deliberation (categories of performance issues, scenarios or alternatives, and any forgotten stakeholder). Adjustments can be made at this phase. The discussion on scenarios or alternatives will take place only in the second session. The aim of this first session is to explain the method, reinforce the contact with the stakeholders, and increase their willingness to participate to deliberation.

2. The evaluation session

During this session, the facilitation team proposes a deliberation support tool, for example the KerDST deliberation matrix. The participants are invited to give their perception of the performance of the scenarios according to the different performance issues, by filling up the matrix.

- The evaluation can be done by gathering all the actors
- Or it can be done in several sessions, by categories of stakeholders and geographical proximity

Deliberation can initiate at this stage, on the basis of the analysis of the preferences of the different actors: where their evaluation regarding each scenario and each performance issues diverge or converge. REEDS has developed a tool, the Deliberation Matrix (KerDST), which can be used to organise the interfacing of the options for evaluation relative to the stakeholders and relative to the performance criteria.

3. The deliberation session

The actors enter a process of arguments and negotiation on the best alternative(s) since the previous session,

by giving their preferences. The aim of the third meeting is to compare and discuss the evaluations of the different groups. Each stakeholder group will be handed a document with the results of his category, with the indicators which supported his/her evaluation.

To improve the quality of the debate, the facilitator can manage the debates towards the key messages and the future possible evolutions. To conclude, a balance must be done on proposals and actions to develop on the basis of this deliberation exercise.

Step FIVE — Communication of Results & Recommendations.

This is the final reporting stages of an evaluation exercise, includes all tasks “along the way” of information distribution relating to the design and arrangements of deliberations, documentation of discussions and intermediate outcomes.

Communication must take place around all features of the social learning process and its outcomes such as the framing of evaluation tasks, the range of indicators, the resolve of reference values (by whom, for whom?), and the reporting of outcomes of multi-criteria evaluations).

A huge documentation might be produced, many designed to remain unpublished in a process interrupted by rich profile benchmark & strategic reports, brochures, and scientific publications. Management of these merchandises (e.g., with CMS technologies on a website) becomes a substantial task in itself.

Step SIX — Reflection on the outcomes obtained and, in an iterative sense, coming back to Step ONE of the progression in order to valuation the entire evaluation sequence to seems to be fit, to express new specific evaluation problems.

Table 5. 7: Summary of INTEGRAAL framework

Deliberation Step	Key Phases	Adapting to decision-making for policy processes
<p>1. Identifying the problem Identify « Our Common Problem » (on what terrain(s), at what scale(s), for whom, with whom?)</p>	<ul style="list-style-type: none"> ➤ What is the problem? ➤ At what scale does it occur? ➤ Who is it a problem for? ➤ Why is it a problem? 	<p>Inevitably problems in the policy realm are often defined by broader policy processes. Nonetheless, this first step remains important in this context, as it forces the policy-maker to engage with the process and compels them to organise their decision-making processes in a way which can then be deliberated effectively. In particular, this step forces policy-makers to accurately define the scale and extent of the problem as well as confirm what constitutes the core problem.</p>
<p>2. Organise the problem Organise the Problem (in terms of ACTORS, OPTIONS and the Quality/Performance ISSUES (the Societal Values or Q/P Multiple Bottom Lines)</p>	<p>☒☒What are the options/strategies to address the problem? ☒☒Who are the stakeholders/actors in regards to the problem and the strategies? ☒☒What are the value issues involved (the criteria by which problem and strategy are evaluated)?</p>	<p>In the decision-making for policy context, the organisation of the problem is often based on the intuition of the planner. Selecting stakeholders in this context often becomes a process where the planner defines the stakeholder groups who may be impacted by the process, and then defines the values which will need to be assessed to take account of these values. However, attempting to reflect the values of multiple groups may lead to the identified values becoming generic to a “population” rather than specific (and</p>

		comparable) to individual groups of stakeholders. It is important under these conditions to ensure that the definition of values to be assessed takes account of this and that where necessary the impacts of values on different stakeholders are assessed individually.
3. Identify and mobilise tools for representation Identify and Mobilise TOOLS for Representation (e.g., indicators, maps, models of processes and systems)	☐☐ Maps ☐☐ Models of processes and systems	As noted above, in the planning process, and particularly in the absence of any representative groups of stakeholders, much of the deliberation process will rely on the intuition of the planner themselves assessing the consequences of any proposed intervention. As a result, the deliberation process itself is ideally deployed with the outputs from any modelling or mapping undertaken. This will clarify that these outputs inform the deliberation process, rather than provide a separate representation of what may happen. The actual process of deploying mapping or modelling to inform this process must be open to questioning by the planner, and allow them to work on the outputs until they provide information which they feel is robust and relevant to the issue under consideration.
4. Deliberate the consequences of the proposed strategy Mobilise Actors for TASKS of deliberation about ACTIONS to undertake... Multi-Actor Multi-Criteria Evaluations	☐☐ Who are the stakeholders? ☐☐ What are the identified value criteria?	As mentioned in Step 2, it is essential that when deliberating the impact of any strategy, it is necessary to clearly define who will be affected and not allow the assessment to be generic to a population.
5. The preparation, validation and communication of the results and recommendations. Actions of Preparation, Discussion/Validation & Communication of Results & Recommendations		As in all the steps above, the process of communicating the results of the deliberation process must be integrated into the ways that the information will be used. At the planning-decision-making interface, this information must be presented in a way which allows those involved to feel confident in the way they use this information.
6. Return to step one (the deliberation process is iterative).		Within the policy-making environment, the reiteration of this process is likely to be tied to the continuing process of planning. It is important, therefore, for the process to be well-integrated with these broader processes. As highlighted in feedback from workshop participants,

Source: (O'Connor et al, 2006)

5.6.5. Application and task of the INTEGRAAL Meta-Method through ePLANETe Platform

The *INTÉGRAAL* procedure outlined in previous sub-section is wider in its scope than the evaluation framework provided by the **kerDST** system itself. To complete our methodological framing we need to situate the formal evaluation tasks within our wider social learning perspective. Given the iterative, distributed and sometimes parallel nature of the activities that make up the *INTÉGRAAL* deliberation Cycle, it is helpful to think of the process in terms of task types rather than mechanical steps (O'Connor, Small, & Wedderburn, 2010).

Especially, The Deliberation Support Tools Gallery aims to provide a set of tools used in a multi-criteria evaluation. This is a place where categories of actors (Stakeholders) can deliberate about any kind of problematic, in an organised framework following the *INTEGRAAL* method.

The Deliberation Support Tools Gallery aims: Source: Association of ePLANATe blue	
<ul style="list-style-type: none"> • Worksite: <u>Worksites</u> define the scope of evaluation work. • KRR (KerBabel Representation Rack) : KRRs define pertinent Indicators in a specific context. Knowledge Carriers setup pertinent Indicator list for each cross of Objects to Compare (like Scenarios for example), Issues and Method&Tools axes. A pertinence index of 1, 2 or 4 is assigned to Indicators. All indicators of index 4(strongest pertinence) produce the Indicator Candidates that will be used by a dependent DM or K4U. • DM(Deliberation Matrix) : DMs define an evaluation process. They are of three types: <ul style="list-style-type: none"> ○ <u>DM type 1</u>: Stakeholders are filling each cell of the Matrix by entering a judgement. Each judgement value is assigned to a color. ○ <u>DM type 2</u>: It works the same as above but each judgement is created picking up Indicators from a Kik. At each cell, 1 to 5 indicators may be used. It creates a "Basket of Indicators". A relative weight is assign to indicate which indicator is more or less important in the basket. Each judgement weight are summed up, then compared. The bigger value win and produces the overall color of the basket. This is the resulting display of the cell. A toggle button display or hide indicators of the overall Matrix. New Indicators can be added to the Kik, adding them to the Indicator selector, available for the entire DM. ○ <u>DM type 3</u>: Here the Indicator selector shows the Indicator Candidates, coming from the parent KRR(an ex-ante process). New Indicators can be added(ex-post) to the Indicator Candidates selector, extending the list to all Stakeholders, and extending the Kik used by the KRR. ○ K4U (KerBabel for You) : <u>K4Us</u> define performance evaluation. This type of evaluation needs a KRR done for this purpose. The KRR deals with Top-Goals and Sug-Goals issues. Doing a K4U means building an assessment for a particular case study. A specific algorithm converts and agregates each indicator value to draw a final spider diagram that weights each Top-Goals. ○ Knowledge Carrier can discuss about each indicator via specific Forums. 	

Relationship each others :

- One Worksite is a parent of zero to many KRR and/or zero to many DM(type 1, 2 or 3),
- One KRR is a parent of zero to one DM type 3, or zero to one K4U,
- a KRR is crosslinked to one Kik
- a DM type 3 uses its KRR's Kik
- a DM type 2 uses its own crosslinked Kik
- a K4U uses its KRR's Kik and its crosslinked K4U Algorithm

Crosslink with "Les Kiks" and "Methods&Tools" Galleries:

To perform evaluations Indicators and Algorithms may be used. It is required by KRR, DM type 2 or 3, and K4U. Particular crosslinks must exist to indicate to the KRR, the DM or the K4U which Kik's Indicators need to be taken or which Algorithm should be used. So the crosslink has a different meaning in complex Galleries: they enable some features. For KRR, and dependant objects (DM type 3 and K4U), one unique crosslink must be done at the upper level: the Worksite. Then we end up with one only Worksite-Kik crosslink to deal with the objects previously cited.

For DM type 2, one direct crosslink with a Kik is required. It works differently from DM type 3 because it does not depend on a KRR to read through a Kik. To be clear: no Worksite-Kik is needed for DM type 2. However, a Worksite can be parent of different objects like KRR, DM type 1, 2 and 3. Then a Worksite can get a Kik crosslink (that will be used by a KRR and/or DM type 3 and/or K4U), and it can get one to many DM type 1 or 2 childs, the latter having their own Kik crosslinked. For K4U, an assessment is done regarding to a specific algorithm object of the Methods &Tools Gallery. We may have one to many K4U Algorithm object crosslinked with a K4U. More instructions are given when creating a K4U object.

For DM type 1, no crosslink are needed. This type of DM only depends on a Worksite parent object.

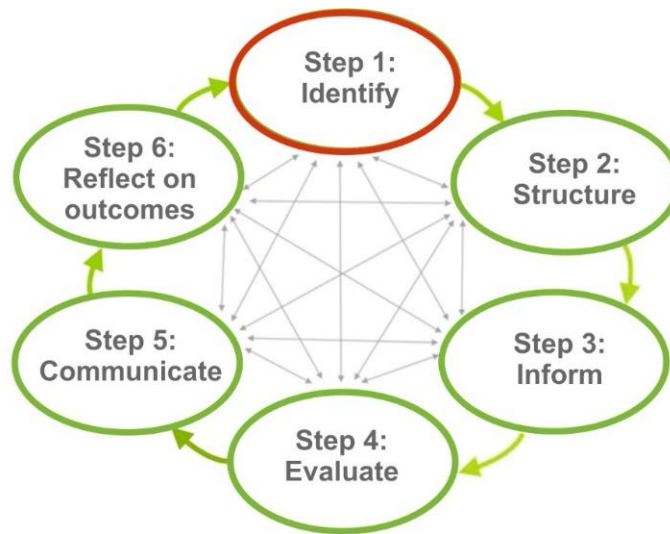
Many combination of crosslinks may exists for each object. Don't be confused between standard crosslinks, that link objects through ePLANETe to create a motivated navigation experience, and "technical" crosslinks who are in charge to enable standard features of this Gallery. The standard crosslinks is genereally using a "Promixity with" relation type. Relation types of "Link"(to target a Kik) or "Lookup"(to target a K4U Algorithm) are used to enable standard features in DST Gallery. Also, there is a difference between parent-to-child relationship and crosslink. A parent-to-child relation binds the child to its parent. A child cannot exist without parent. The parent is a container object. In DST Gallery, an evaluation is limited to a Worksite. That is why KRR, DM and K4U are dependent child of a Worksite. This relation parent-to-child is NOT done by crosslink. Standard crosslinks are aimed to link objects of different Galleries in a motivated way. It helps to navigate from an object to another. There is no particular indication about why this relation exists.

Following the *INTÉGRAAL* schema, there are four (4) further task types that can be sequenced or woven organized as contributions to social learning.

5.6.5.1. Step 1: Identification of the problem

The main resolution of this step is to select and describe the field of problematic study, the case study, the main performance issues, the actors related to it, and the problem of the evaluation to avoid any confusions (Thesis Mariana Bittencourt,2017). This step corresponds to the first step of the *INTEGRAAL* framework as is presented in 5.12

Figure 5. 12: Step 1 of the INTEGRAAL framework.



The various interpretations of the concept of sustainable development (Bonnett, 2002, 1999; Stables and Scott, 1999; Haque, 2000; Holt and Barkemeyer, 2012; Fischer et al., 2017), and the questions it raises about economic growth (Baker, 1997; Bosselmann, 2001), make its implementation difficult (Vargas, Lawthom, Prowse, Randles, & Tzoulas, 2019). Despite the difficulties in progressing towards sustainable development, policymakers at national and international levels have widely adopted the term (Estes, 1993; Baker, 1997; UN, 2015). So, how could the difficulties in implementing sustainable development be overcome and who are the actors that could help overcome these difficulties (Vargas, Lawthom, Prowse, Randles, & Tzoulas, 2019). The Higher education institutions are one of the actors that may help to overcome these difficulties by developing new processes of change (Cortese, 2003). Randles and Laasch (2016) suggested that financial concerns, as well as governance issues, may be critical factors in understanding how organisations embed sustainable development practices. However, there is a dearth of studies focusing on these issues in relation to the implementation of sustainable development in higher education (Stephens and Graham, 2010). The determination of a macro study (i.e. HERE) to analyze the implantation of the sustainability of the university campus and teaching programmes is an interesting approach to learn more about the project governance, understand the influence of the regional, the national policies, and the education & culture in the project. Besides, Higher education institutions have multilevel and complex structures (Arbo and Benneworth, 2007; Denman, 2009), because of its groups or individuals who engage with external stakeholders to support regional transition paths to sustainable development (Radinger-Peer and Pflitsch, 2017). Radinger-Peer and Pflitsch suggested that the dynamics of interaction between staff and external stakeholders depend on their activity (e.g. teaching, research, outreach) (2017). When doing research, staffs are engaged with the national and international aspects of the change processes (Radinger-Peer and Pflitsch, 2017). Local and national stakeholders influence higher education institutions (Radinger-Peer and Pflitsch, 2017). Besides, higher education institutions depend on their local and national stakeholders (Radinger-Peer and Pflitsch, 2017). Stakeholder theory has been criticised for being descriptive and lacking elements of predictability (Donaldson and Preston, 1995; Jones, 1995; Mitchell et al., 1997; Rowley, 1997; Wood, 1991; Key, 1999). However, it may facilitate identifying and recognising the importance of direct and indirect links between organisations (Key, 1999). Brusca et al. (2018) have applied stakeholder theory (Freeman, 2010) to understand processes

of change towards sustainable development at higher education institutions. Brusca et al. suggested that internal and external stakeholders are drivers for organisational change if the appropriate channels for participation are in place and leadership is supportive of these. For instance, stakeholder participation is relevant for advancing sustainable development reporting at universities (Brusca et al., 2018; Ceulemans et al., 2015). Therefore, using stakeholder theory could help understand the influence of external stakeholders through their links in relation to higher education organisational change towards sustainable development. Whereas teaching and outreach provide the opportunity to support sustainable development at local level (Radinger-Peer and Pflitsch, 2017). Academics' participation in international conferences is crucial to building links between knowledge at international level and practice at local level (Berchin et al., 2018). Linking the different areas of universities' activity connects the international and the local level (Radinger-Peer and Pflitsch, 2017). Success factors in the implementation of sustainable development at local level include interaction between stakeholders with different areas or levels of expertise in and outside academia (Bebbington et al., 2017). This in turn, supports the transition paths to sustainable development by multilevel bridging (Radinger-Peer and Pflitsch, 2017). Therefore, stakeholder participation in the context of higher education is crucial in bridging theory and practice at the interface of different levels (i.e. international and local). External stakeholder pressures drive organisational change in higher education (Radinger-Peer and Pflitsch, 2017).

Universities are responsive to the influence of external stakeholders (Radinger-Peer and Pflitsch, 2017). But, the degree of control over organisational change is greater for internal changes than for external pressures (Lozano, 2013). External factors are critical to the implementation of sustainable development in higher education institutions (Blanco-Portela et al., 2017). Barriers to change at universities due to external factors include lack of commitment of external stakeholder and stagnation of government progress towards sustainable development (Lidgren et al., 2006; Franz-Balsen and Heinrichs, 2017; Ferrer-Balas et al., 2008; Corcoran and Chacko Koshy, 2010; Wright, 2010; Djordjevic and Cotton., 2011; Krizek et al., 2012; Ralph and Stubbs, 2014; Fernandez-Manzanal et al., 2015). Drivers of change due to external factors include pressure from peer institutions and from other external actors, and financing programs to support sustainable development in higher education (Sammalisto & Arvidsson, K., 2005; Ferrer-Balas et al., 2008; Ferrer- Balas et al., 2009; Lee et al., 2013; Wright and Horst, 2013).

The Social network analysis includes identifying, differentiating and categorising stakeholders and the relationships between them (Provan and Kenis, 2008; Reed, 2008). It has been suggested that planning is a precondition for long-term and thriving sustainable development initiatives in higher education (Leal Filho et al., 2018). Policy frameworks are constructs that provide direction for processes of change and planning. Implementation of policy frameworks refers to putting into effect the information included in them (Newig and Koontz, 2014). Since policy frameworks often identify key stakeholders and their interactions, social network analysis could be used to identify higher education stakeholder networks (Vargas, Lawthom, Prowse, Randles, & Tzoulas, 2019). Academic conferences that include engagement with external stakeholders are opportunities for knowledge exchange that help to influence organisational change in higher education institutions regarding sustainable development (Berchin et al., 2018). External pressure is critical when local stakeholders' actions for sustainable development are supported by national policies (Cooper et al., 2014). Therefore, minimising external barriers supported by national policy frameworks create new opportunities for universities' to achieve organisational change towards sustainable development (Vargas, Lawthom, Prowse, Randles, & Tzoulas, 2019) . In addition, stakeholder participation

and partnerships are central to capacity building and knowledge co-creation that drive institutionalisation and systemic change when addressing complex challenges (Glasbergen, 2007). One of the reasons for this is that strategic aims are better developed and implemented with the use of the collective intelligence of internal and external stakeholder (Secundo et al., 2016). Also, the development of universities' third mission (i.e. regional development and social engagement) requires stakeholder participation (Secundo et al., 2016). Therefore, external stakeholder participation is crucial for organisational change towards sustainable development in higher education institutions (Vargas, Lawthom, Prowse, Randles, & Tzoulas, 2019).

Different innovative methods could lead to different transformational change in HERE. The INTEGRAAL Meta-Method is one of them. The INTEGRAAL respond to the growing need for tools and approaches to the challenges posed by the SD paradigm (Da Cunha et al., 2011). This method could able to explain the implementation and evaluation of sustainable development in HERE or organisations. INTEGRAAL Meta-Method refers to assigning social choice and values to desirable or appropriate actions to the evaluation. The role of financial and governance issues to innovation and education in implementing sustainable development in organisations and particularly in higher education institutions needs further research. However, for this thesis work, we decided to establish the physical structure of the sustainable university campus and teaching programmers. We delimited our field of study to the evaluation context of the teaching program and the university campus level sustainability that exercised at UVSQ and university of Paris Saclay in France.

The university campus is a segment of the city and a part of the city (Thesis Mariana Bittencourt,2017). It has significance roles of economic, social and environmental spheres to create a better future and knowledge economy and society for facing the new challenges of education, sustainability and innovation. In the past 15 years, university campuses have focused their efforts to confront the challenges of sustainability (Promoting education for sustainable development, Effective learning environments, equitable education, care of handicap and green campus facilities i.e, Green building, green transportation, climate change, energy consumption, natural resource depletion, and environmental crises). HERE have become testing grounds for new approaches to living, for new ideas about how we utilize the natural bounty of our planet, and for new initiatives about how forge a better, more sustainable future. This development has created new avenues for interdisciplinary research and study, created new opportunities for constructive social networking, and opened up new learning and teaching paths in the realms of art, science, and business to the new challenges education, sustainability and innovation. The HERE have their environmental impacts related to distinct scales, cities, neighborhood, buildings and users, Water consumption, waste management, energy use, pollution and GHG emissions are classic environmental impacts related to the towns, community, and buildings. Lack of information, communication, education, and awareness are related to the users' environmental implications.

In ordinary economic analysis, education is seen as a creation process in which *inputs* (e.g., students, teachers, and textbooks) are united to yield desired *outputs* (e.g., student learning) within the education sector, and larger societal outcomes outside the sector (e.g., increased earnings in the workplace or greater social equality), under the prevailing educational technology (encompassing pedagogy, curriculum, and school organization) and input prices (Harris, 2014.) .Besides, Sustainability assessment tools are considered to play a vital role in strategies to reorient universities towards sustainability in a systematic way (Li, Gu, & Liu, 2018). However, strategic selections of the main existing assessment tools may be inappropriate from economic, environmental and social perspectives (ibid, 2018). The first debates about sustainability focused

on the adoption of critical thinking based in the dynamic equilibrium between the economic, social and environmental spheres to create a better future (Elkington, 1998; Capozucca and Sarni, 2012; Kumar et al., 2015; Shnayder et al., 2016). Generally, the values of the evaluator are often reproduced in some of the definitions of evaluation which have emerged, definitions that have also been influenced by the context in which the evaluator operated (Bettencourt, 2017). Gronlund (1976), influenced by Tyler's goal-based conception of evaluation, described it as "the systematic process of determining the extent to which instructional objectives are achieved". Cronbach (Cronbach et al., 1980), through reflection on the wider field of evaluation and influenced by his view of evaluators as educators, defined evaluation as "an examination conducted to assist in improving a programme and other programmes having the same general purpose". The purpose(s) of any scheme of evaluation often vary according to the aims, views and beliefs of the person or persons making the evaluation (Bettencourt, 2017). Experience has shown it is impossible to make choices in the political world of social programming without values becoming important in choices regarding evaluative criteria, performance standards, or criteria weightings (Shadish et al., 1991).

As presented previously sections, the assessment of the SD in the higher education (both in teaching programmes and campus level sustainability) has many aspects. In the context of the AASHE STARS Framework sustainability assessment is assured by the 'Academics,' 'Engagement,' 'Operations,' and 'Planning and Administration' aspects. For the French EVVADES framework, is assured by the 'Strategy and Governance,' 'Training and Teaching,' 'Research,' 'Society and Territory', and 'Environmental Aspects.' Besides, in education the term evaluation is often used interchangeably with assessment, particularly in North America. While assessment is primarily concerned with the measurement of student performance, evaluation is generally understood to refer to the process of obtaining information about a course or programme of teaching for subsequent judgement and decision-making (Newble & Cannon, 1994). Mehrens (1991) identified two of the purposes of assessment as:

1. To evaluate the teaching methods used;
2. To evaluate the effectiveness of the course.

Assessment can, therefore, be looked upon as a subset of evaluation, its results potentially being used as source of information about the programme. Indeed student gain by testing is a widely used evaluation method, although it requires student testing both pre- and post-course (Goldie, 2006). In my point of view, for best exercise of university sustainability, we need to implementation **Task on "Build a Collective Learning Process"**. This means to determine the key decision, evaluation & communication challenges and, more specifically, to plan, design, "construct" in social process terms, and maintain a multi-event "deliberation forum" facilitating learning & action. Formally, this can be seen as 'Step One', the task of identifying collectively the policy or strategy challenge to be addressed. Although this can have a quite precise outcome at a moment in time (e.g., agreement to focus on quality education at a regional level/scale), the agreement around "our common problem" is merely a pointer to the deeper challenge of building an ongoing collective learning process for the individuals and stakeholder groups concerned. Within this overarching concept, all other task types contribute to building up and maintaining the collective learning process. This is called a multi-stakeholder evaluation method. But here, we transform the actors in terms of ePLANETe galleries related to education: Forest of Broceliande, Yggdrasil, **kerDST** (Deliberation matrix and representation grid, K4U), Kiosk Indicators, Methods and Tools, Virtual Gardens, FoodBasket, Ideas and Actions, Cycle and Cascades, Ideas and Actions, People Profile, Communities of people, Partners, Newsreels, Babel Gardens As the Worksite, KRR (KerBabel Representation Rack), DM(Deliberation Matrix), K4U(KerBabel for You) are

tools for the sustainability evaluation of the university's campus and teaching programs, we will limit the following performance issues, and we will select the candidate indicators related to the sustainability of university's campus level and teaching programs.

The GTDL teaching programme and campus level sustainability as our case study:

Even if the case study methods remain a controversial approach to perform the data collection, they are globally recognized in the social science studies for a deep analysis of the social behavior and complex issues (Zainal, 2007). The case study is recognized as a research method and emerged to answer the limitations of the quantitative methods (Thesis Mariana Bittencourt, 2017). Through case study methods, a researcher can surpass the quantitative statistical numbers and understand the behavioral conditions found in the actor's perspective (ibid, 2017). By including both quantitative and qualitative data, case study assists in explaining the process and outcome of a phenomenon by full observation, reconstruction and analysis of the cases under investigation (Tellis, 1997). Yin (1984) presented three categories of case study: exploratory, descriptive and explanatory. The exploratory case study explores any phenomenon in the data which serves as a point of interest to the researcher. Descriptive case studies set to characterize the natural phenomena that take place within the data in question. Moreover, the explanatory case study analyzes the data closely both at a surface and deep level to explain the phenomena in the data. The case study of *GTDL teaching programme and campus level sustainability* are characterized as an exploratory and descriptive case of study. Inside the case study research, Yin (1984) determines three important questions to be answered: (1) How to define the case "being" studied? (2) How to determine the relevant data to be collected? And (3) what do to with the data, once collected?

For Bessire (1999, pg.131) "*the evaluation of any reality is an act of judgment that aims to confer value.*" In this way, the objective of the evaluation of the *GTDL teaching programme and campus level sustainability* at the university Paris Saclay is to judge the performance of its teaching and sustainability strategy by giving value to this performance. This assessment focuses on results achieved for learning. For Argyris (1993) the type of evaluation for learning is similar to the reflexive positioning that an organization exercises over its own functioning in order to acquire "*knowledge for action*". For the evaluation, we took a basis the campus level sustainability and teaching programs evaluation report of university Paris Saclay's for the field study determined, to define our two case studies. After determining our case study, we needed to determine which data are critical to the assessment. We collected information from the Meta data and reports of the university paris-saclay. Furthermore, we collected information from previous the thesis reports and the other complementary projects of the teaching programs evaluation reports; campus level sustainability description report, meetings report; and project presentation documents.

Definition of our challenging scales:

As stated by Hadji (1989), before to evaluate something it is important to reflect on the ideal situation desired. This ideal situation in our case studies are the sustainable university campus and teaching program, inserted in the initiatives for personal behavior change, Integrate sustainability into curricula, Embrace cross-disciplinary collaboration, Transform campus into a portal or living lab, Support economic development and service across the state, Demonstrate responsible stewardship, Accelerate path from idea to impact those are to be integrated and connected into a sustainable community.

As a learning institution, University Paris Saclay has both the opportunity and the responsibility to educate the campus community about sustainability issues, from healthy lifestyle decisions to Sustainable development goal4, Sustainability strategies' of Higher Education, Globalization, Promoting education for sustainable development, Effective learning environments, Sustainable or Green Campus i.e. green building, green transportation, energy conservation and campus preservation etc, Supporting equitable access to higher education, Building capacities, Empowerment, Technology facilitation mechanism for building effective partnerships for education. By doing so, University Paris Saclay will empower people to understand the impacts of their actions here at the University Paris Saclay and outside, as well as in their homes, cities, and communities throughout their careers and their lives. Today, University Paris Saclay has a robust community of students, staff, and faculty engaged in sustainability-related teaching, research, and operational improvements. As we consider the impacts of individual behavior in relation to our sustainability goals for the University— as well as the need for increasingly sustainable behavior on a global scale — we will strive to ensure that all who pass through University Paris Saclay are aware of the positive and negative repercussions of their actions. The University Paris Saclay has committed to prepare students for today and tomorrow challenges of education, sustainability and innovation by integrating sustainability into courses and curricula, thus enabling students to use sustainability as a lens throughout their education and careers. We believe that sustainability should not be one discipline among many that a student may choose to pursue, but rather a fundamental building block for all of the learning that takes place on University Paris Saclay campus. Besides, the faculty and staff should be supported with a range of professional development opportunities that emphasize systems thinking, which enables employees to understand the impacts of one action or behavior on other campus units, the University as a whole, and beyond. ComUE "Université Paris-Saclay" is already offers a wide variety of classes and rich Master's degree programs of study focused on various components of sustainability and incorporating sustainability themes into their curricula, with with more than 45 mentions and over 350 courses for 9,000 registered students. In the doctoral program exist **20** écoles Doctorales, **5 400** doctorants dont **43%** étrangers. In three years, the number of applicants from 44,000 to 96,000, of which 40% are newly arrived foreigners, guarantee of the development of international visibility. Furthermore, the University Paris-Saclay looks forward to further integrating sustainability into orientation programs, professional development, and other extracurricular activities. An emphasis on education about sustainability, both in the classroom and beyond it, was one of the requests heard most frequently from faculty, students, staff, and administrators throughout the process of developing this Plan. Advancing the University's ambitious sustainability goals in teaching, research, and practice will require new organizational structures and partnerships comprised of students, staff, faculty, and researchers from all corners of campus. These interdisciplinary efforts will help us to approach sustainability challenges from a whole-system perspective and to better understand how various disciplines can contribute to new approaches and solutions. The University Paris Saclay has taken initiative to create new partnerships, both internally and externally, to support interdisciplinary efforts and advance innovative, entrepreneurial technologies and solutions. The Strategic Research Initiatives (IRS) are inter-institution research projects accredited by Université Paris Saclay that is working as platform for partnership. These initiatives help laboratories combine forces to address high-level science and technology issues and are developed in conjunction with existing projects. It is through the IRSs, in part, that the joint research strategy set by Université Paris Saclay's members is to be implemented. They will facilitate development of knowledge and expertise, often in collaboration with industrial and other partners. A number of interdisciplinary IRS efforts have already seen great success at

Université Paris Saclay, including in the field of Life sciences²⁰⁶, Chemistry, environment, materials and energy²⁰⁷, Physics, mathematics, and information and communication technology²⁰⁸. It is important to view these initiatives as the first steps in a much further-reaching trend to bring together students, faculty, and practitioners with a diversity of perspectives and experience.

We see these new and expanded partnerships and new solutions driven by creative and multidisciplinary thinking as key to many of the goals identified in the Sustainability Plan. We will depend upon these new teams to find opportunities to utilize the University as a test bed for new technologies and practices and to develop new financing mechanisms and policy measures to support sustainability as a core component of UPSaclay's culture. These teams will also be needed to advance campus-wide education and awareness efforts

The demand of knowledge economy and society, we can make our campus a living lab or knowledge platform where sustainability is part of daily life for our community, both inside and outside the classroom, and new ideas are integrated into our buildings, infrastructure, and business practices. To truly insert sustainability into the DNA of the University, we can transform our campus, our classrooms, and our offices into a living laboratory or a virtual portal where sustainability informs our teaching, design standards, and operations decisions. Every employee, student, graduate, and visitor can be exposed to sustainability concepts via living laboratory or a virtual portal. i.e. SATT Paris-Saclay, edupronet (Experimental platforms at the best European or even global level), e-campus. Inception, PluginLabs,

The University Paris Saclay is already engaged to a number of highly innovative sustainability features. However, the cutting-edge technologies and strategies employed in infrastructure and building systems are often hidden from view. As a result, few members of our community are aware of them. There are many opportunities to regard the campus as an educational tool, enabling students, staff, faculty, and visitors to influence and learn from the projects around them. Incorporating more transparency into University decision-making structures will also provide learning opportunities.

May be in the future, The University Paris Saclay will be a testing ground for sustainability. Individuals exposed to the University will understand that the campus is on the leading edge of new ideas, strategies, and approaches. The program offerings, effective learning environment, building standards, and business practices should constantly adapt and evolve, incorporating new best practices and technologies, and responding to the changing needs of the world. These efforts

²⁰⁶ 3D - CHROME (3D CHROmosome Organization), BioTherAlliance, NUTRIPERSO, SySABCD (SYStèmes Analytiques pour les Biomarqueurs et la Chimie Durable), BME (BioMedical Engineering), BRAINSCOPEs, B2SRI (Biologie des Systèmes et Synthétique Research Initiative), NanoTheRad. For more information : <https://www.universite-paris-saclay.fr/en/strategic-research-initiatives-irs>

²⁰⁷ ACE - ICSEN (Adaptation aux Changements Environnementaux - Institut Climat Société Environnement), BIOPROBE, FAPS (Fabrication Additive Paris-Saclay), ISC2D (Institut des Sciences Catalytiques pour la Chimie Durable), MOMENTOM (MOlecules and Materials for the ENergy of TOMorrow), NAN'EAU, PhyChiM3. For more information : <https://www.universite-paris-saclay.fr/en/strategic-research-initiatives-irs>

²⁰⁸ B5GI (Beyond 5G Initiative), CDS2.0 (Center for Data Science), iCODE (Institute for Control and Decision), IQUPS (Ingénierie Quantique Université Paris-Saclay), Psi 2 (Paris-Saclay International Programs for Physical Sciences and their Interfaces), SPACEOBS, SRI (Spintronics Research Initiative), SYDYN (Synergy for Ultrafast Dynamics in Matter). For more information : <https://www.universite-paris-saclay.fr/en/strategic-research-initiatives-irs>

should be clearly communicated and enable community to live, study, and work in a setting that embraces innovation and teaches lessons that can utilize at the University and beyond.

The social and economic elements of sustainability encompassing diversity, public health, quality of life, affordability, and accessibility are areas where we feel the University can focus service efforts. The University is dedicated to serving the people of our state by providing our residents an affordable, world-class education, providing a wide range of health and social services, and serving as an engine of economic activity in respect to economic benefits to the state. The university Saclay committed to support cutting edge students, staff, and faculty in outreach, examine the impacts of supply chains, and collaborate with industry and other partners to accelerate the transfer of ideas to practice for service efforts across national and international level and apply skills and knowledge to assist economic development and social entrepreneurship in communities. Considering that sustainability is a societal state (Pope et al., 2004) with features designated by performance issues, when assessing the sustainability of the university campus level and teaching program, we had to take in consideration the performance issues of education, sustainability and innovation in the campus level, achievability of the teaching programs the from a micro-scale to a macro-scale.

Definition of an evaluation:

Once we defined the field study, the case study, and the ideal situation of the sustainability in the University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*. We still needed to solve the problem of the evaluation. After analyzing the main requirements of the evaluation method desired (i.e., multi-criteria decision-making analysis and actors' participation) and the main existing methods analyzed (i.e., LEED, HQE, BREAAAM, EVVADES, STARS and B4U) we finished for concluding that a new assessment tool was required to measure the strategy performance of The University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*.

As we were confronted with the complexity, a multi-criteria decision-making analysis was recommended. Our goal with this new assessment tool was to help stakeholders to learn about the problem situation. The problem, in our case is the University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*. In addition, the problem is also the nonconformity of these establishments to the new challenges of sustainable development agenda (i.e., as for instance the 17 SDGs of the UN) and to the digital transition. Through the implementation of our tool, we were expecting to propose some recommendations and to support the stakeholders to achieve their goals.

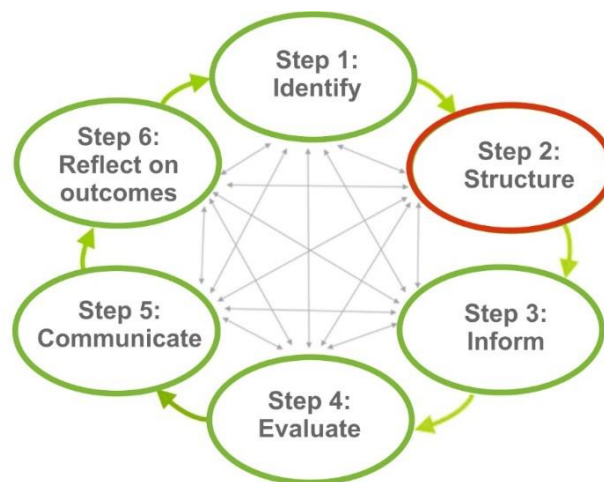
The participative aspect of our assessment might allow the various groups of stakeholders to establish an environment of trust between the various actors and obtaining some legitimacy and acceptability, regarding both, the decision-making process and the resulting decision (Froger, 2005). The participation was privileged in many moments of the decision process, as when mobilizing and choosing the indicators candidate for the new tool, or when giving the values to the indicators during the assessment.

We will validate our assessment tool with the case study selected, and at the same time, we will assess the performance strategy of the University Paris Saclay's campus and teaching level. i.e. *GTDL teaching programme* toward a SD.

5.6.5.2. Step 2 : Structuring the problem

Goal: Defining the actors' categories and the performance issues through an iterative process of the documentation and the appropriation of the problem studied, based on the consultation of the actors concerned (Thesis Mariana Bittencourt, 2017). This step resembles to the second step of the INTEGRAAL framework that presented in the Figure 5.16.

Figure 5. 13: Step 2 of the INTEGRAAL framework



Methodology of Literature review:

To conduct our literature review (Thesis Mariana Bittencourt, 2017), we followed the methodology proposed by Arlene (2014):

- **Adopting research questions:** It is essential to state precisely the main question that will guide the review. To our study, the predefined research's questions were « how can we improve the quality performance of university teaching programs and campus level innovative activities toward sustainable development? » and « Did the 'University Paris Saclay's campus and teaching level sustainability' practice process succeed? » It is noted to highlight here that an extensive 'pre-literature review' was held to precise the research question to avoid the risk of the generality;
- **Selecting bibliographic or article databases, Websites and other sources:** For covering all the research themes, an extended list of articles from recognized platforms as 'Science Direct', 'Elsevier', and other channels were consulted;
- **Choosing the search terms:** As our research subject encompasses seven main elements - buildings, urban space, universities, assessments, global social responsibility, sustainable development, sustainability - linear researches were conducted for each element but also the

interrelation between these themes, for instance: sustainable buildings, sustainability in the urban space, or university buildings;

- **Employing practical screening criteria:** Preliminary literature review might result in several articles, but only a few articles are really relevant. Some criteria of inclusion and exclusion of the review were set. We included in our scientific review works in French and English. The source was also a factor of exclusion and inclusion in the sense that just reliable works were considered;
- **Applying methodological screening criteria:** Includes criteria for assessing the adequacy of a study's coverage and its scientific quality;
- **Doing the review:** Includes the help of a standardized form for abstracting information from articles;
- **Synthesizing the results:** Interpretations of the articles analyzed.

Several laws, regulations, and norms were also included in our literature review, as the idexparis-saclay evaluation Report 2015, 2017, Rapport Stratégique (Novembre 2017) **Modèle UNIVERSITÉ PARIS-SACLAY Cible** (Lettre intention UPSaclay Synthèse(2013) ex-IDD M1 et M2 OVSQ-UVSQ, arrete-d-accreditation-definitif-comue.and the Energy Transition Law for the Green Growth. We also cited some reports, mainly from the UVSQ & UPSaclay regarding on teaching, research, innovation and international dimension.

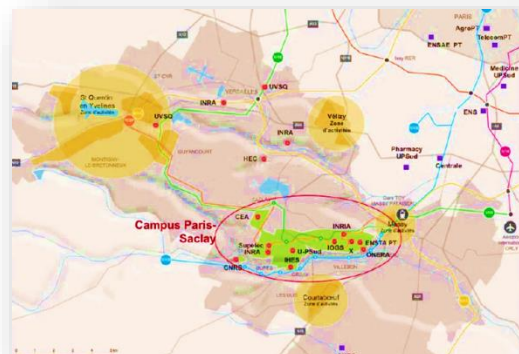
Contextual Strategical Structuring description of University Paris Saclay to the "Sustainable University i.e. Campus and Teaching level"

All over the world, technological and economic dynamism relies on clusters promoting interactions between actors of fundamental and applied research and large and small companies, generally organized around a leading research university (IDEX Paris-Saclay evaluation report, 2015). In order to strengthen relationships between the industry and University Paris-Saclay we are organizing large scale Business conventions. The first one, on Big Data, proved the potential of the initiative with 550 attendees (with a 50/50 split between academics and industry representatives) and panels on topics such as personal data protection, project funding, data science and domain specifics in health, energy, marketing and transport applications as well as a vast exhibition area.

In a similar way, the "Université Paris-Saclay" academic project is at the heart of a major transformation of the area, at the crossroads of several public policies with strong urban and economic dimensions (ibid,2015). As such it appears as one central element of an overall effort to promote dialogue and cross-fertilization, both within industry and between industry and academia, and to improve urban quality and accessibility within a City-Campus (IDEX PIA1, 2015). Paris-Saclay is the grandest of several mega-universities being funded across France that are designed to encourage world-class research which can be quickly applied to the country's high-tech manufacturing and service sector. That goal is most likely to be achieved by the close cooperation of students, academics, researchers and industry; (Dominique Vernay, 2015). "Together they can do things that they cannot do on their own,"²⁰⁹

²⁰⁹ Dominique Vernay, the ex-president of Paris-Saclay talks to Jack Grove (Jack Grove covers careers in higher education, in particular matters relating to early career academics and PhD students, for *Times Higher Education*) about why 19 French institutions are stronger as one

Since the 1950s, in successive waves, universities, « grandes écoles » and major public research centers have flocked to the area, as well as many technology companies, such as Renault, PSA, Air Liquide, Thalès and Alcatel-Lucent (IDEX PIA1, 2015). Today, 15% of French research is concentrated within Université Paris-Saclay and its direct environment, both public and private (ibid,2015). In 2013, the MIT Technology Review ranked Paris-Saclay among the top 8 of world innovation clusters for its estimated development potential (IDEX Paris-Saclay evaluation report, 2015). The following institution : AgroParisTech, Télécom ParisTech, ENSAE ParisTech, ENS Cachan, Centrale, CNRS Marcoussis, UPSud/Pharmacy, are moving to the Campus Paris-Saclay (green area) from 2016 (ENSAE) to 2021 (UPSud faculty of Pharmacy). The gray colored area represents the territory of the Paris-Saclay “Operation d’intérêt national” (OIN)²¹⁰.



IDEX Paris-Saclay evaluation report, 2015-2017, Close to Paris, the Paris-Saclay territory (cf Figure 1 above) is endowed with key assets to meet the new challenges of education, sustainability, innovation and knowledge economy:

- Academic excellence and the reputation of its higher education institutions;
- Strength of its industrial base with major economic areas (Courtaboeuf, Vélizy-Villacoublay, Saint-Quentin-en-Yvelines, Massy);
- Exceptional concentration of research and development activities in strategic sectors including energy, mobility, ICTs, healthcare, aerospace, defence and security.
- The Saclay Plateau and the associated business clusters represent a knowledge economy and 350,000 jobs. They form an attractive technological ecosystem, bringing together the conditions needed to draw companies: stable investment conditions, a highly skilled employment basin, the presence of world-leading players and an attractive real estate offer.

By January 2030, create a leading higher education and research institution “Université Paris-Saclay (UPSAclay)” with specifically designed governance on new challenges of education, sustainability and innovation, able to take the leadership of the knowledge society driven transformation towards the university. Now my study question is *Has the "Sustainable University i.e. Campus and Teaching level " been*

²¹⁰ IDEX Paris-Saclay evaluation report, 2015-2017

created or is it in the process of being created? We can get the answer of this question, we should review the strategies of (UPSaclay) regarding on Campus and Teaching level

- Education and Research strategy of UPSaclay for facing the new challenging of sustainability
- Innovation strategy:

3.3 Identify and structure the actors

Before starting the participatory process, it is necessary to identify all the actors involved and to present a pragmatic classification by categories (Thesis Mariana Bittencourt,2017). In a second moment, we will select the actors that will be included as participants in the study. In a multi-criteria evaluation participatory approach, the number of actors must remain small enough to enable deliberation (ibid, 2017). The kerDST framework for appraisal of a situation and of options for action is organised as a multi-actor multi-criteria ‘matrix’ of judgements (O’Connor, Small, & Wedderburn, 2010) . And so, getting to such a representation of a “social choice” problem requires that stakeholder categories, performance criteria and options for comparison/action be specified. The identification of these categories can, in principle, be carried out through any mix of stakeholder deliberation, discourse analysis and other expert inputs to typologies (ibid, 2010). However, comprehensive typologies with subclasses can be unwieldy. In practice, and in line with the discursive SA considerations mentioned previously, it is likely that simplified lists of stakeholder classes, performance concerns will be appropriate, as a function of context. Similar remarks hold for the objects of evaluation. For example, a great variety of policy options might be considered across a region, but only a few will have ‘generic’ pertinence everywhere, and many will be site-specific in their significance Table 5. 4 presents the categories of actors and the stakeholders group which they belong to. Taking as reference the studies about the CSR reporting (e.g., Faucheux and Nicolaï, 2004; O’Connor and Spangenberg, 2008) we divided our actors into three main groups: internal stakeholders, traditional external stakeholders, and external extended stakeholders.

Table 5. 8: Stakeholders group and actor’s categories

STAKEHOLDERS GROUP	CATEGORIES OF ACTORS
INTERNAL STAKEHOLDERS	Partner universities(Consortium i.e UVSQ); Steering committee(Representatives of Faculties, with Member universities until 2025, Schools, NROs - each category having an equal weight); Academic senate(60 to 80 members- Represents the academic community); Strategic advisory board(External personalities- Provides strategic advice and recommendations to the Board); Technical committee(Representation of the staff of the university- Provides advice and recommendation to the Board on working conditions; University Dean, Program Director , and the director of property assets; VP teaching, research, business relation and innovation, and international relation; campus Health and Safety representative , Project Director and representatives of REEDS
TRADITIONAL EXTERNAL STAKEHOLDERS	Site workers of the universities to the sustainable practices; Final users (i.e., researchers, students, professors, staffs). Ministry of education; Local community; <i>Ile-de-France</i> Department
EXTERNAL EXTENDED STAKEHOLDERS	Various Association concerning the campus and teaching level sustainability

Source: Thesis Mariana Bittencourt,2017

We defined that internal stakeholders are all the categories of actors that were directly involved with the best practices of University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*, in other words, everyone that participate in the planning, the construction, and the management of the sustainability activities. The traditional external stakeholders represent the sustainability practices partners of the university and everyone that contributed indirectly, and that is affected by the best practices. External extended stakeholders all the category of actors that played a role in collaborating and regulating (Thesis Mariana Bittencourt,2017).

Discussion with the actors:

We decided to select the "Consortium" of university Paris Saclay as UVSQ, a group of actors to participate in the discussions. Two actors of this group participated in the debates section: Project Director of REEDS and the Program director of GTDL teaching programme of the UPSaclay during initial initiatives stage implementation of sustainability activities in UPSaclay. For the lack of time and facilities we didn't connect the others actor concerning on Steering committee(Representatives of Faculties, with Member universities until 2025, Schools, NROs - each category having an equal weight); Academic senate(60 to 80 members- Represents the academic community); Strategic advisory board(External personalities- Provides strategic advice and recommendations to the Board); Technical committee(Representation of the staff of the university- Provides advice and recommendation to the Board on working conditions; University Dean and the director of property assets; VP teaching, research, business relation and innovation, and international relation; campus Health and Safety representative. But we got their dialogs, opinions and assessment result from the IDEX Paris-Saclay evaluation report 2015 and 2017 regarding on the University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*, that has substitute, complementary and alternative way to gathering revise opinions of the other actors in our study

3.5 Identifying the performance issues

We took the B4U tool as a reference method to structure our new tool. As already mentioned, we kept the 5 Ps structure because it is an important input of the B4U. Thereon, we made a relevance assessment of the B4U performance issues to answer to our research questions on University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*. Subsequently, we chose to the integrate performance issues and indicators that respond to the integrated approach of the University Paris Saclay's campus and teaching level sustainability i.e. *GTDL teaching programme*. During this moment we tried to answer the question: "What are the strategical objectives of sustainability process of a university campus and teaching program?" The literature review resulted in the identification of the performance issues. In a first moment, all the sustainable performance issues were identified. We took into consideration that the performance issues of a university also encompass its connection with the future challenges of education, innovation an. We determined as a key question here: « What are the sustainable performance issues of the university regarding on campus and teaching level?

In **Thesis Mariana Bittencourt(2017)**, The evaluation of our study case with the B4U tool for the identification of the central unintelligibility related to the B4U sub-goals, We have identified a total of 31 performance issues for our research problem after completed the literature review and the discussion with the actors (see Table 5.9). The performance issues were divided in the 5P's categories (Thesis Mariana Bittencourt,2017):

Table 5. 9: Justification of our approach according to the 17 SDGs of UN.

TOP-GOALS SDG UN	PEOPLE (P1)	PLANET (P2)	PROFIT (P3)	PROCESS (P4)	PROPAGATION (P5)
SDG1 - NO POVERTY					
SDG2 - ZERO HUNGER					
SDG3 - GOOD HEALTH AND WELL- BEING	Health and security, Indoor environmental quality, Interior air quality and temperature control, Comfort				
SDG4 - QUALITY EDUCATION				Sustainable teaching and research	
SDG5 - GENDER EQUALITY					
SDG6 - CLEAN WATER AND SANITATION		Water		Water and energy management	
SDG7 - AFFORDABLE AND CLEAN ENERGY		Energy	Total cost saving for the end users, Costs	Water and energy management	
SDG8 - DECENT WORK AND ECONOMIC GROWTH	Work conditions				
SDG9 - INDUSTRY, INNOVATION, AND INFRASTRUCTURE			Creating local value		Innovation characteristics, Complexity, Relative advantage
SDG10 - REDUCED INEQUALITIES	Social justice				

Justification of our approach according to the 17 SDGs of UN (Continuation)

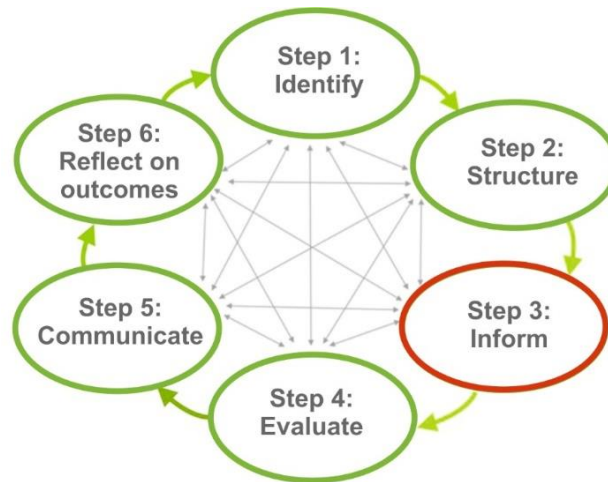
TOP-GOALS SDG UN	PEOPLE (P1)	PLANET (P2)	PROFIT (P3)	PROCESS (P4)	PROPAGATION (P5)
SDG11 - SUSTAINABLE CITIES AND COMMUNITIES	Land design for sustainable urban development, Ensuring a livable area, Promotion of a feeling of community/home, Pollutants emissions into the atmosphere			Ability to bring about change	Sustainable sites, Campus engagement, Mimetic processes
SDG12 - RESPONSIBLE CONSUMPTION AND PRODUCTION		Waste, Materials, and Resources	Adaptability and flexibility, Constructive choice for the accessibility during maintenance works, Time optimization		Maturity of the process
SDG13 - CLIMATE ACTION	Climate system, Pollutants emissions into the atmosphere				
SDG14 - LIFE BELOW WATER					
SDG15 - LIFE ON LAND		Biodiversity, Soil			
SDG16 - PEACE, JUSTICE, AND STRONG INSTITUTIONS					
SDG17 - PARTNERSHIPS FOR THE GOALS				Governance model, Strategy, Public engagement	Dissemination, Standards evolution

SOURCE : Thesis of Marina Bittencourt(2017)

5.6.5.3. STEP 3: Representing the system

Goal: The goal of this step is to identify and mobilize the indicators from the various sources to represent the system. In other words, it consists of informing about the problem of the campus renovation process performance of the 'Aile Sud' building through a catalog of indicators that represent the performance issues defined previously, and the discussion with the actors(Thesis Mariana Bittencourt,2017). This step resembles to the third step of the INTEGRAAL framework that is presented in Figure 5.14.

Figure 5. 14: Step 3 of the INTEGRAAL framework



Making an inventory of tools and data available to represent the system

The objectives of the literature review conducted during the Step 2 should be to mark a list of the tools available to characterise the system. There is no specific methodology for this inventory, but an arrangement may be needed by category of activity, spatial scale, or field of study. From the problematic statement of research, we defined the performance issues (i.e., the main goals or aspects) that are significant to the decision-making process. In this stage, we can use the key performance indicators (KPI)²¹¹ to measure this performance issues. The success can be defined as the achievement of an operational goal or the progress toward the strategic goals research (Thesis Mariana Bittencourt, 2017). According to the type, the KPI can be quantitative or qualitative. Quantitative in the sense that it can be measured by giving a value, or qualitative, by giving an adjective without scale (Cabeza et al., 2015). After this, we analyzed further documentation, as the scientific papers, norms, technical reports, and regulations, as the ADEME, OECD, UN, CPU, Eurofound, European Commission, UNESCO reports, AFNOR norms, and RT 2012 (ibid, 2017).

Recall the Chapter 3 and 4 that we have already discussed and used the EPLANETe Blue platform to perform the Step 3 and 4 of the INTEGRAAL framework. Initially, we created in the 'Gallery of Theories, Tools, and Terrains' a profile of each method of the KPI found in the literature review. All the KPIs that were not grouped in a method or tool were placed together in a group called 'literature review' (Thesis ibid, 2017). Each tool is composed of a 'Tool or Method' name, acronym, description, category of tools, detailed description, and scale and scope. Each method or tool has a crosslink with an indicator from the KIKs gallery. The KIKs (Kerbabel™ Indicators Kiosks) Gallery where is existing a collection of Indicators in various contexts of interest to 'User Communities' in ePLANETe. We added a list of indicators that we found in the literature (Raharinirina and O'Connor, 2010). The KIK is a system which allows the cataloging of quantitative and qualitative indicators, containing a maximum of information about the indicators (ibid, 2017). To insert the indicators in the KIK Gallery of the 'Sustainable Campus', which is the

²¹¹ The KPI are "performance measurement that evaluates the success of a particular activity" (Cabeza et al., 2015, pg. 820).

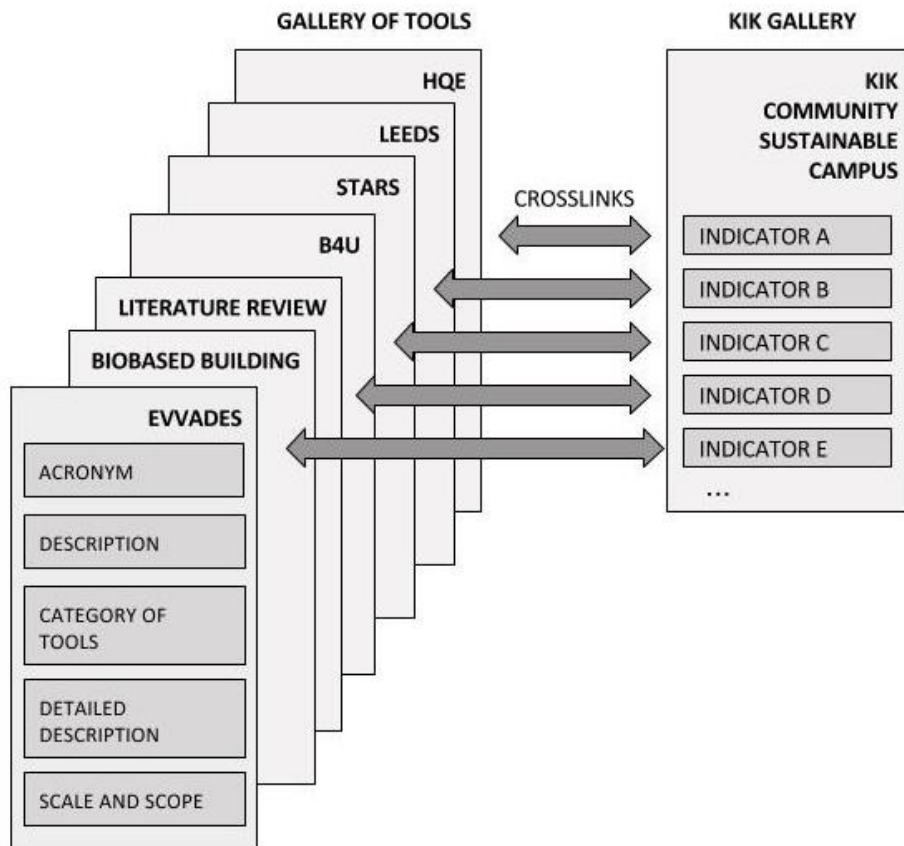
name of the community and the KIK that we have been working for the ‘Aile Sud’ building evaluation, it was necessary to fill some general information about the concept of the indicator, the scientific profile, the scope and interpretation, and the information source (ibid,2017). This relation between both galleries of the ‘Doorway CAMELOT’ was explained in Figure.

Table 5. 10: KPI’s data inside the KIK Gallery of the ePLANETe Blue

KNOWLEDGE PERFORMANCE INDICATORS INSIDE A KIK COMMUNITY:
<ul style="list-style-type: none"> • CONCEPT OF THE INDICATOR: The KIK to which the indicator belongs, Community, Name, an intuitive and convenient Acronym and a Non-Technical Explanation of the object or attribute. • SCIENTIFIC PROFILE: Specification about the Character of the Information (e.g., qualitative or quantitative), Unit of Measure, Qualitative Convention (e.g., high/medium/low, Red/Green, Present/Absent), and Data Set Charter (e.g., a unique object/value or a data set). • SCOPE AND INTERPRETATION: The Scope states the coverage of the information (e.g., the geographical or systems range, or the population covered of the information); and the Interpretation explains the relevant range of measurement (and limits to scope) and/or the meaning attached to qualitative descriptive conventions. • INFORMATION SOURCE AND STATUS: Institutional Sources, Scientific Sources, Reference Terrains, and Other Sources Types. • INDEPENDENT USE OF PRE-EXISTING INFORMATION: The Source Analytical Conventions, which specifies the pre-existing situation(s) in which the indicator appears as an input or output of analytical systems (e.g., data sets, variables in algorithms and models) in analysis and representation; the Exploitation for Evaluations Operations, that determines the pre-existing situation(s) in which the indicator is mobilized as a component in a normative evaluation procedure (multi-criteria or other); and the Existing Visualization, that specifies the way(s) that the indicator is portrayed in a graph, on a map, or within a 2D or 3D virtual reality of a pre-existing representation. • KNOWLEDGE QUALITY ASSESSMENT: K Status, that determines whether the information is primarily empirical or conceptual in character; KQA issues, that specifies in general terms the knowledge quality (KQA) issues associated with the indicator; and the NUSAP Profile, which is provided to characterize the knowledge quality issues associated with the indicator. • SCALE OF THE DESCRIPTION: Observation Scale, that specifies the organizational scale at which the object or attribute is described; Component Levels, that should signal relevant ‘inferior’ organizational levels allowing a multi-scale interpretation; and Higher Levels (e.g Social, Governance, Economic and Environment).

Source: Thesis Mariana Bittencourt(2017)

Figure 5. 15: Elements of each ePLANETe’s Gallery and the ‘crosslink’ between indicator of a KIK community and methods and tools



Source: Bittencourt ,2017

Relevance indicators for the problem studied:

After finishing our exhaustive indicator’s inventory, we used the Kerbel Representation Rack (KRR) to select the indicators that are pertinent to our case study(*ibid*,2017). The KRR permitted us to construction the variety of existing representations of the sustainable university campus that is situated in the EPLANETe platform, inside the ‘Gallery of Deliberation Support Tools’ (DST), and inside the ‘Doorway CAMELOT’. The purpose of the KRR is to assemble the numerous systems of knowledge related with distinct actors (i.e., scientists, experts, associations, environmental justice organizations). This knowledge comes from dissimilar theoretical approaches (i.e., scientific, vernacular or other), tools (i.e., analysis, modeling) or theories. The technique offers to the actors, who are ‘knowledge carriers’, the opening to place and obvious the significance of their knowledge about the situation. Moreover, it provides an opportunity for the ‘knowledge carriers’ to situate their knowledge, evaluating its relevance, in relation to the way in which the representation of the problematic studied is constructed (Gassama, 2016).

The KRR consists of four axes (Bittencourt, 2017) :

- The first axis is constituted by the ‘knowledge carriers’ or any individual or category of person or organization that carries a set of knowledge about the sustainable university building. For our case study, we were the ‘knowledge carrier’ and any external actor participates directly of this

KRR part;

- The second axis, which is that of the conceptual approaches/Tools/Theories, makes possible to identify, through the analysis of academic works and expert reports, but also, through links with the field actors; all forms of knowledge production mobilized to represent the sustainable university building. We selected six methods to represent the assessment for our case study (i.e., EVVADES, HQE, LEED, B4U, STARS, Bio-based building; and the C4U literature review¹⁷³);
- The third axis identifies the situations to be compared according to the scenarios;
- The fourth axis defines the criteria for comparison, in other words, the sub-goals selected to evaluate the main objectives of our case study.

In our case, the 'knowledge carriers' participated in the relevance evaluation of each indicator for each cross-tabulation of values on the four proposed axes (ibid, 2017).

5.7. Quality Evaluation GTDL teaching programme

The mention "Territory Management and Local Development" aims to train professionals to the new challenges of the territories and their dynamics. A territory is the product of space and power. This physical perimeter is the subject of a social construction that can refer to administrative divisions, physical perimeters, socio-technical, economic configurations (organization of production systems, circulation of products ...), ecological ... public and private actors with sometimes contradictory positions and interests, subject to ever-changing forms of regulation (political-administrative decentralization, but also decentralization of energy management and distribution systems, urbanization, globalization, etc.) and more levels (multi-scalar dimension).

It is therefore a complex dynamic that requires transversal and multidisciplinary skills, in order to understand the accelerated interaction logic between human activities and terrestrial environments, to think about change and action on a whole series of issues. which need to put into perspective the links between companies, technologies and the environment: local territory-atmosphere interaction; food for the territories, short and local sectors; producer communities, for example energy; development of local services; concept of ecosystem services; introduction of ecological cycles in production systems; innovation

In fields as diverse as agriculture and food, energy, mobility, urban planning, biodiversity and the environment, innovative actions and experiments aiming at building the sustainability and resilience of territories. The purpose of this mention is to equip students with the necessary skills to analyze and anticipate, sensitize, train and mobilize the actors around adaptive and innovative collective strategies. The aim is to provide them with frameworks for evaluating relevant actions, to enable them to think about the ways of building agreements, regulations and policies by integrating the conditions of transition.

The courses of the GTDL mention, each with its specificity in disciplinary and interdisciplinary terms, directly address the needs of applied skills strongly felt by governance bodies, companies, researchers ... For example, training competent environmental managers, from a perspective of sustainable development, directly adapted to the needs of the territory (Agenda 21, evaluation of governance issues, communication strategy) and those of the company (issues of foresight, quality of the product and services, corporate social responsibility, etc.).

Graduates of the GTDL Specialization will be specialists, with a multi-inter-transdisciplinary training, communicators able to analyze the territorial, environmental and local development issues in their various components (understanding of physical phenomena, analysis economic, social, territorial, legal and political impacts). It is therefore a question of training professionals in the various methods of analysis (institutional, discursive, quantitative, analytical, etc.) and, to evaluation and communication procedures adapted to the worlds of territorial development (planning issues, obligations regulations, budget arbitrations, etc.) and public policy worlds. This training meets the needs of the job market through the establishment of strong partnerships with the State and local authorities, as well as with the private sector and associations.

5.7.1. Presentation of the auto-evaluation process: The Strategic performance of the training program

We propose an original way of assessing the performance of the use of ePLANETe.blue in the teaching programmes at UVSQ and Paris Saclay using the Deliberation Matrix (see section 5.9). This auto-evaluation has been developed through discussions with Jean-Marc Douguet, head of M2 MEDIATION and of Mention GTDL. The three axes of the Deliberation Matrix applied to this auto-evaluation are:

- The four PERSPECTIVES: (A) Research / Means; (B) Research / Objects; (C) Education / Means, (D) Education / Objects.
- Performance ISSUES (built using crossings of the triangle: Education, Sustainable development and Innovation): (1) Towards inclusive and equitable quality education and long-life learning for all (2) Promoting education for sustainable development, (3) Transformation of education landscape: (4) Sustainability of Higher Education, (5) Sustainable Development goals (17 goals), (6) Building capacities, Empowerment, (7) Improving learning processes and outcomes, (8) Green Economy, (9) Technology facilitation mechanism for building effective partnerships for education (see Section 5.3).
- The OBJECTS TO COMPARE are organized around four themes: Mention GTDL, M2 MEDIATION and M2 ECO-INNOVATION.

To make a judgment, for example, about PERSPECTIVE 1 / OBJET A COMPARER 1 / ISSUE 1, it is necessary to select from 1 to 5 indicators, to assign a value, a subjective weight and, if possible, a comment. The value proposed are (See Figure below):

- "Dark green" for "Strongly in Favour"
- "Green" for "Favourable"
- "red" for "Poor"
- "Orange" for "Medium"
- "white" for "Do not know"
- "blue" for "Not Applicable".

Table 5. 11: Presentation of indicators baskets in the Deliberation Matrix

Mention GTDL	M2 MEDIATION	M2 ECONOVING	Education/. <input checked="" type="checkbox"/>	Education/. <input checked="" type="checkbox"/>	Research/M.. <input checked="" type="checkbox"/>	Research/O.. <input checked="" type="checkbox"/>																																				
Quality Ed.. <input checked="" type="checkbox"/>	Switch to view <table border="1"> <thead> <tr> <th>Indicator</th> <th>Judgement</th> <th>Weak</th> <th>Medium</th> <th>Strong</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>Doorway TALIESIN</td> <td>X + Medium</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td>0</td> </tr> <tr> <td>Gallery Broceliande</td> <td>X + Strong</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td>0</td> </tr> <tr> <td>Gallery Yggdrasil</td> <td>X + Strong</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td>0</td> </tr> </tbody> </table>			Indicator	Judgement	Weak	Medium	Strong	Weight	Doorway TALIESIN	X + Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Gallery Broceliande	X + Strong	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Gallery Yggdrasil	X + Strong	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Switch to edit	Switch to edit	Switch to edit												
Indicator	Judgement	Weak	Medium	Strong	Weight																																					
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Gallery Yggdrasil	X + Strong	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0																																					
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To be more explicit about the evaluation process, the choice of indicators that are used to express one's judgment can be quantitative or qualitative indicators. The indicator is taken in its broad sense, that is to say, every bit of knowledge associated with the PERSPECTIVE that has an interest in expressing its judgment. Here, it is not the quantification or the qualification of the indicator that matters, but it is the meaning that it allows to provide the judgment issued.

Object to compare (research/means) 1/issue 1				
Indicators	Value	Subjective Weight	Comment	Jugment
Indicator 1 ²		15%	Lié au transport routier /Linked to road transport	
Indicator 2		15%	DCO < 125 mg/l	
Indicator 3		15%	Diversité des espèces	
Indicator 4 ²		20%	Baisse 10%	
Indicator 5 ²		35%		

For a specific PERSPECTIVE, the results of the evaluation for all the Objects to compare and the stakes (or "slice" of the matrix) will be presented, at the first level of interpretation, in the following form:

	Object to compare 1	Object to compare 2	Object to compare 3	Object to compare 4	Object to compare 5
ISSUE 1					
ISSUE 2					
ISSUE 3					
....					

Other categories of actors will also have a "slice" of matrix. At the second level of interpretation, we will be able to identify, for all PERSPECTIVE / Objects to compare / ISSUES crossings, the indicators, the arguments used to make the judgments (see the first table on how to compose a judgment).

The analysis of the results can be done as follows. For the Object to Compare 1, we obtain the following judgments at the first level of interpretation:

	PERSPECTIVE 1	PERSPECTIVE 2	PERSPECTIVE 3	PERSPECTIVE 4	PERSPECTIVE 5
ISSUE 1					
ISSUE 2					
ISSUE 3					
....					

We will also be able to access the second level, we will be able to identify for all PERSPECTIVE / ISSUE crossings, indicators, arguments that were used to make the judgment

5.7.2. Outputs of the Quality Evaluation Process:

Two outputs of this auto-evaluation are presented below: Mention GTDL and M2 MEDIATION. The general view of the results of the auto-evaluation are a multicoloured picture, respectively for Mention GTRL and for M2 MEDIATION. For the detail discussion, see table below 5.12

Table 5. 12: Auto-evaluation respectively for Mention GTRL and for M2 MEDIATION

Mention GTDL	M2 MEDIATION	M2 ECONOVING	Education/... <input checked="" type="checkbox"/>	Education/... <input checked="" type="checkbox"/>	Research/M... <input checked="" type="checkbox"/>	Research/O... <input checked="" type="checkbox"/>
			Switch to edit	Switch to edit	Switch to edit	Switch to edit
Quality Ed... <input checked="" type="checkbox"/>						
Promoting SD <input checked="" type="checkbox"/>						
Transforma... <input checked="" type="checkbox"/>						
SD_Strateg... <input checked="" type="checkbox"/>						
Sustainabl... <input checked="" type="checkbox"/>						
Building c... <input checked="" type="checkbox"/>						
Improving ... <input checked="" type="checkbox"/>						
Green econ... <input checked="" type="checkbox"/>						
Technology... <input checked="" type="checkbox"/>						

Table 5. 13: Auto-evaluation respectively for education and knowledge economy

Education and Knowledge Economy

Mention GTDL	M2 MEDIATION	M2 ECONOVING	Education/... <input checked="" type="checkbox"/>	Education/... <input checked="" type="checkbox"/>	Research/M... <input checked="" type="checkbox"/>	Research/O... <input checked="" type="checkbox"/>
			Switch to edit	Switch to edit	Switch to edit	Switch to edit
Quality Ed... <input checked="" type="checkbox"/>						
Promoting SD <input checked="" type="checkbox"/>						
Transforma... <input checked="" type="checkbox"/>						
SD_Strateg... <input checked="" type="checkbox"/>						
Sustainabl... <input checked="" type="checkbox"/>						
Building c... <input checked="" type="checkbox"/>						
Improving ... <input checked="" type="checkbox"/>						
Green econ... <input checked="" type="checkbox"/>						
Technology... <input checked="" type="checkbox"/>						

Table: Interpretation of the auto-evaluation of the performance of the use of ePLANETe.blue in the mention GTDL and to M2 MEDIATION

Issues		Mention GTDL	M2 MEDIATION
Towards inclusive and equitable quality education and long-life learning for all	Ed/M	<p>The doorways TALIESIN offers an opportunity for a variety of users to access online resources. Users can be students within the GTDL, the University of Paris Saclay, but also in the partner institutions or for a wide audience.</p> <p>Resources are available in the form of training programmes (within the Yggdrasil Gallery) and educational materials (within the Brocéliande Gallery). Improvements are required to allow smoother navigation in DOORWAY TALIESIN.</p>	<p>The doorways TALIESIN offers an opportunity for a variety of users to access online resources. Users can be students within the M2 MEDIATION, the Université Versailles Saint-Quentin-en-Yvelines, but also in the partner institutions or for a wide audience.</p> <p>Resources are available in the form of training programmes (within the Yggdrasil Gallery) and educational materials (within the Brocéliande Gallery). Improvements are required to allow smoother navigation in DOORWAY TALIESIN.</p>
	Ed/O	<p>The question of forms of learning (social, collaborative, cooperative...) for various audiences and its quality are the subject of a teaching unit within the master 1 GETEDEL0: EU "NTIC and learning environmental issues".</p>	<p>The question of forms of learning (social, collaborative, cooperative...) for various audiences and its quality are the subject of a teaching unit within the master 1 SETE: EU "NTIC and learning environmental issues".</p>
	R/M	N.A.	N.A.
	R/O	N.A.	N.A.
Promoting education for sustainable development	Ed/M	<p>The platform, as a whole, deals with the problems of environment, sustainable development and ecological economy. DOORWAYS are the privileged entry points for accessing methods, tools, examples, feedback on experiences, educational materials. These doorways are:</p> <ul style="list-style-type: none"> • Virtual Eco-innovation Fairground (the Economic Dimension): Situating economic activity in its biosphere context and developing capacities for imagining and assessing innovations responding to the multiple performance challenges of sustainability (People, Planet, Process...). Situating eco-innovations as projects anchored in their territories, relative to challenges of CSR (corporate social responsibility) and governance towards a 'greener' or 'circular' economy. The term Fairground connotes 'trade fair' and also fun park, science park and so on. • TALIESIN— Building Knowledge Partnerships for Sustainability. The ePLANETe is an on-line "Collaborative Platform" that seeks to support a broad variety of forms of 	<p>The platform, as a whole, deals with the problems of environment, sustainable development and ecological economy. DOORWAYS are the privileged entry points for accessing methods, tools, examples, feedback on experiences, educational materials</p> <p>These doorways are :</p> <ul style="list-style-type: none"> • Virtual Eco-innovation Fairground (the Economic Dimension): Situating economic activity in its biosphere context and developing capacities for imagining and assessing innovations responding to the multiple performance challenges of sustainability (People, Planet, Process...). Situating eco-innovations as projects anchored in their territories, relative to challenges of CSR (corporate social responsibility) and governance towards a 'greener' or 'circular' economy. The term Fairground connotes 'trade fair' and also fun park, science park and so on. • TALIESIN— Building Knowledge Partnerships for Sustainability. The ePLANETe is an on-line "Collaborative Platform" that seeks

	<p>learning, and of sharing of resources for learning, always with the accent on community and conviviality. In a local/global perspective, it seeks, to incite new experiments in collaborative learning, social networking and knowledge sharing concerning the biosphere and sustainability, and to offer tools supporting debate and deliberation addressing social, political, technological, economic and environmental dimensions of sustainability.</p> <ul style="list-style-type: none"> • CAMELOT — Justice & Environment (the Political Dimension): Initiation to the world of conflicts associated with inequitable access to environmental resources & services and thus, to the “problem of social choice” in its practical and theoretical dimensions and, to the theme of ‘unequal ecological (as well as economic) distribution’. Tools and opportunities for use of ‘deliberation support tools’ for multi-criteria multi-stakeholder evaluations seeking understanding and (where possible) inclusive solutions to situations of conflict. • MERLIN — Accent on our Being-in-Nature (the Environmental Dimension). Understanding our place in Nature in terms of local biodiversity, food sources, ecosystem functions and biosphere cycles (water, carbon, nitrogen...), and on to green accounting and ecological economics models 	<p>to support a broad variety of forms of learning, and of sharing of resources for learning, always with the accent on community and conviviality. In a local/global perspective, it seeks, to incite new experiments in collaborative learning, social networking and knowledge sharing concerning the biosphere and sustainability, and to offer tools supporting debate and deliberation addressing social, political, technological, economic and environmental dimensions of sustainability.</p> <ul style="list-style-type: none"> • CAMELOT — Justice & Environment (the Political Dimension): Initiation to the world of conflicts associated with inequitable access to environmental resources & services and thus, to the “problem of social choice” in its practical and theoretical dimensions and, to the theme of ‘unequal ecological (as well as economic) distribution’. Tools and opportunities for use of ‘deliberation support tools’ for multi-criteria multi-stakeholder evaluations seeking understanding and (where possible) inclusive solutions to situations of conflict. • MERLIN — Accent on our Being-in-Nature (the Environmental Dimension). Understanding our place in Nature in terms of local biodiversity, food sources, ecosystem functions and biosphere cycles (water, carbon, nitrogen...), and on to green accounting and ecological economics models
Ed/O	<p>In the context of the GTDL, three Masters 2 are proposed to study, each in its own way, the challenges of sustainability:</p> <ul style="list-style-type: none"> • M2 AEGR ("economic analysis and risk governance"): the objective and originality of this master is to train specialists in management and control of risks for sustainable development and the ecological and energy transition • M2 GTES: this course is intended to acquire skills in the management of the ecological transition projects of the territories in order to meet strong durability objectives • M2 DYNPED: this course aims at mastering a research methodology adapted to development issues in emerging and southern countries. 	<p>The programs of M2 MEDIATIONS (multimedia mediations of environmental knowledge. Partnerships for sustainable development) was focused on sustainable development issues. All the teaching units were related to this topic.</p> <p>The teaching units selected here are the ones that presented specific aspects of conceptual and pedagogical approaches to sustainable development.</p>
R/M	As part of the construction of the Université Paris Saclay, a laboratory	In the framework of the development of a strategy of sustainable

	R/O	of excellence was established: LABEX BASC (biodiversity, agriculture and food, society and climate) as well as a school BASE (Bioversité, agriculture and food, society and Environment) grouping different mentions around these themes, including GTDL. These institutional structures have helped to analyse environmental issues and promote sustainable development strategies	development at the University of Versailles Saint-Quentin-en-Yvelines, an Observatory of the environment and climate and a training programme of fifteen training on the environmental, territorial and economic sciences were created. The master 2 MEDIATIONS is one of these programs. Within the framework of the United Nations regional education network, RCEs aspires to translate global objectives into the context of the local communities in which they operate. Upon the completion of the Decade of education for sustainable development in 2014, RCEs are committed to further generating, accelerating and mainstreaming education for sustainable development by implementing the global action programme (GAP) on ESD, and contributing to the realization of the sustainable development goals (SDGs). The Paris Seine NCE was built to develop such a strategy.
Transformation of education landscape : Supporting equitable access to higher education/	Ed/M	In the framework of the master 1, in particular, innovative pedagogical activities are proposed: collective project, use of tools from communication and information technologies, collaborative learning approach mobilising an image wall Interactive. The objective of these approaches is to evolve the pedagogical practices by inserting themselves into the digital society and knowledge.	As part of the M2 MEDIATIONS, different experiments were carried out to develop the use of information and communication technology in the pedagogical framework: support of online courses, restitution of symposiums, construction of virtual gardens of biodiversity, of food baskets...
	Ed/O	A return of experience and questions about these practices are offered in the framework of a teaching unit "NTIC & learning" and in the framework of online pedagogical support, especially on the question of the quality of knowledge.	A return of experience and questions about these practices are offered in the framework of a teaching unit "NTIC & learning" and in the framework of online pedagogical support, especially on the question of the quality of knowledge.
	R/M	In the framework of research project (ALARM, evaluation of the future of the Rambouillet domain...), pedagogical activities have been associated with research approaches	In the framework of research project (ALARM, evaluation of the future of the Rambouillet domain...), pedagogical activities have been associated with research approaches
	R/O	N.A.	N.A.
Sustainability of Higher Education	Ed/M	As part of the training program on performance evaluation issues, a presentation of the thesis work of Mariana BITTENCOURT and Mathias Bouckaert is made. Their thesis focuses on evaluating the performance of sustainable campuses, with different systems of indicators (EVADES, R4U...). The results of this work are presented in the courses on integrated assessment approaches.	Within the framework of training program m2 MEDIATIONS, a work to evaluate the performance of the building South Wing of the national Bergerie (which hosted the International Center of REEDS) using the system of indicators EVADES. The results of this work are presented in the courses on integrated assessment and indicator systems.
	Ed/O		
	R/M		
	R/O		
Sustainable	Ed/M	Objective 17 "revitalize revitalize the global partnership for	Objective 17 "revitalize revitalize the global partnership for sustainable

Development goals		sustainable development" is at the heart of GTDL.. It is about creating partnerships around knowledge, with all the actors of the society – territories, private companies, NGOs, activities, students, experts and researchers....)	development" is at the heart of GTDL.. It is about creating partnerships around knowledge, with all the actors of the society – territories, private companies, NGOs, activities, students, experts and researchers....)
	Ed/O	Différents domaines d'application sont proposés et sont en lien avec les objectifs 7 (Ensure access to affordable, reliable, sustainable and modern energy for all), 10 (Reduce inequality within and among countries), 11 (Make cities and human settlements inclusive, safe, resilient and sustainable), 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss) et 16 (Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels)	Différents domaines d'application sont proposés et sont en lien avec les objectifs 7 (Ensure access to affordable, reliable, sustainable and modern energy for all), 13 (Take urgent action to combat climate change and its impacts), 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development), 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss).
	R/M	N.A.	N.A.
	R/O	N.A.	N.A.
Building capacities, Empowerment	Ed/M	The DOORWAY TALIESIN is designed to provide access to online learning materials and training programs related to sustainable development issues. Trainings have been conceived in the framework of the EJOLT project, to train local actors in the challenges of environmental injustice problems.	The DOORWAY TALIESIN is designed to provide access to online learning materials and training programs related to sustainable development issues. Trainings have been conceived in the framework of the EJOLT project, to train local actors in the challenges of environmental injustice problems.
	Ed/O	The DOORWAY TOUTATIS gathers a set of forms of communities, within or outside the use of ePLANETe. These communities are mobilized in a range of activities, ranging from information, education, training and assistance to deliberation (DOORWAY CAMELOT)	The DOORWAY TOUTATIS gathers a set of forms of communities, within or outside the use of ePLANETe. These communities are mobilized in a range of activities, ranging from information, education, training and assistance to deliberation (DOORWAY CAMELOT)
	R/M	The ePLANETe platform has been identified as an opportunity to strengthen the capacities of different local communities at the international level, including on evaluation issues (use of the deliberation matrix, the Gallery Brocéliande...)	The ePLANETe platform has been identified as an opportunity to strengthen the capacities of different local communities at the international level, including on evaluation issues (use of the deliberation matrix, the Gallery Brocéliande...)
	R/O	N.A.	N.A.
Improving learning processes and outcomes	Ed/M	Whether in the framework of project leads, research project, internship report or research report, the students are led to mobilize a set of tools, approaches for analysing environmental issues and development Sustainable.	A set of educational materials have been developed on different environmental areas (biodiversity, agriculture, coastal areas) and on methods for analysing environmental problems. These educational kits are designed to improve the grip of educational materials.

		Within ePLANETe, the DOORWAYS MERLIN offers opportunities to discover problems (virtual gardens of biodiversity, FoodBaskets on the question of food, cycles and Cascades on systemic approaches) and CAMELOT (on the steps environmental integrated assessment)	Within ePLANETe, the DOORWAYS MERLIN offers opportunities to discover problems (virtual gardens of biodiversity, FoodBaskets on the question of food) and CAMELOT (on the approaches of integrated environmental assessment)
	Ed/O	Within the framework of the master 2 MEDIATIONS, a teaching unit, on "NTIC and apprenticeship" is specifically geared towards mobilizing tools from information and communication technology to improve learning processes and mediation of environmental knowledge and sustainable development.	Within the framework of the master 2 MEDIATIONS, teaching units, on "NTIC and learning as well" multimedia mediation "are specifically geared towards mobilizing the tools of information and communication technology for improve the processes of learning and mediation of environmental knowledge and sustainable development.
	R/M	The AGREGA project (ANR project on the supply of aggregates in Ile de France) has developed tools to promote learning processes, through the development of a role-play and its articulation with multi-agent modeling and Kerbabel matrix of deliberation. The articulation of these three tools allows the development of an integrated analysis of the stakes of the supply of aggregates for the construction of the greater Paris and the development of a collaborative learning.	N.A.
	R/O	N.A.	N.A.
Green Economy	Ed/M	The procedures for analysing forms of circularities in economic activities and in natural environments are organized within the Gallery "forest of Brocéliande". It organizes a set of tools to document the forms of circularity: systemic analysis within the Gallery cycles and Cascades, in particular, or through systems of performance analysis of a system (System K4U) or evaluation criteria and multi-actors (matrix of deliberation)	The question of the economy is posed through different approaches addressed within the teaching units "indicators and sustainable development" for example.
	Ed/O	The concerns of the circular economy are within the proposal for the creation of a master 2 "approaches of circular economy" as part of the GTDL reference. The question of the insertion of economic activities in the cycles of the biosphere is already addressed in the teaching unit "Introduction to major cycles of the biosphere" in master 1.	The question of forms of circularity has been studied in the framework of research projects (dragonfly – on phytoremediation; RS4E on circularity in the energy field)
	R/M	As part of the AGREGA research project, the forms of circularity have been studied and have been the subject of a diversity of pedagogical activities: circularity of the material through the secondary circuits (for reuse and recycling of materials deconstruction of buildings and roads) and the insertion of economic activities into the cycles of the	N.A.
	R/O		N.A.

		biosphere.	
Technology facilitation mechanism for building effective partnerships for education	Ed/M	The construction of the ePLANETe platform was built with the aim of creating and strengthening partners around knowledge, especially in the field of education. This was done through the construction of entry point in problematic (the DOORWAYS, for the education it is DOORWAY TALIESIN), of discovery and learning paths (Gallery forest of Brocéliande for example), of the navigation between different galleries or knowledge bits, but also by tools specially built to mobilize a diversity of forms of knowledge (for example, the Gallery cycles and Cascades) and dialogue between the actors (Galerie matrix of deliberation)	The construction of the ePLANETe platform was built with the aim of creating and strengthening partners around knowledge, especially in the field of education. This was done through the construction of entry point in problematic (the DOORWAYS, for the education it is DOORWAY TALIESIN), of discovery and learning paths (Gallery forest of Brocéliande for example), of the navigation between different galleries or knowledge bits, but also by tools specially built to mobilize a diversity of forms of knowledge (for example, the Gallery "kiosk to indicators" or "virtual gardens of biodiversity") and dialogue between the actors (Galerie matrix de deliberation).
	Ed/O	Different lessons have specifically spoken of the important role of technology facilitating the construction of partnerships around knowledge (EU "ICT and learning").	Different lessons have specifically spoken of the important role of technology facilitating the construction of partnerships around knowledge (EU "ICT and learning") and knowledge mediation (EU "multimedia mediation") and dialogue between actors (EU 'deliberation matrix '...)
	R/M	The thesis of Ashiquer Rahman proposes a synthesis of various experiments carried out in the field of higher education, through the use of the platform ePLANETe.	N.A.
	R/O		N.A.

CHAPTER 6: MOBILISING COMMUNITIES OF KNOWLEDGE IN AN EVALUATION PROCESS OF SUSTAINABLE CAMPUS

In this chapter, we seek to show how current expansions in ICT for “social networking” can be made the basis for large-scale collaborative learning, reputation and accountability, supporting the co-construction of social solidarities around the purposes and practices of “sustainable campuses”.

Sustainable development (SD) is, for our purposes, the challenge of cooperative engagement to invest in the creation of durable reciprocally linked social, economic and ecological systems. As a ‘model’ of societal opportunities, SD responds to declared ‘risks’ of futures with waning ecological (as well as economic) inequalities, with a systemic and normative orientation marked by two originalities:

- (1) Constructing ecological solidarities, via eco-innovation as engaging the shift from a ‘predatory’ to a more ‘circular’ model of economic value creation and transmission; and
- (2) Constructing social solidarities, engaging the shift from ‘dual’ societal structures (e.g., formal/informal; capitalist/proletariat; high wage North/low wage South) to more reciprocal models of partnership in value creation and transmission.

Such a vision of “sustainability” as culture and governance for an inclusive and durable green economy is, of course, a utopia. Yet for many, as a cognitive and normative framework it orients action, provides reference points for evaluation, and (without necessarily taking desire for reality) inspires hope.

In correlation with this utopian vision, the two decades since the 1990s have been marked by a new societal demand for measuring the performance of the business sector relative to sustainable development goals. Corporate social responsibility (CSR) can, in this context, be framed as a call for, and acceptance of, a performance responsibility for multiple dimensions of solidarity. Stakeholder dialogues can be seen as a required condition for constructing and maintaining the societal and ecological solidarities wanted for a green economy. Information Technology (IT) can be considered as a new groundswell of cognitive, communicational and partnership opportunities that, under certain conditions, might be mobilised in support of sustainability.

6.1. Enlarging communities in the quality evaluation process

Following Faucheux et al. (2017) in order to evaluate Campus sustainability in a participatory approach, we exploit the KerDST as a springboard for a typology of multi-criteria multi-stakeholder evaluation frameworks and, more particularly, as a source of design concepts for an on-line social networking approach to collaborative evaluation.

One of the innovative features of KerDST, at the time of its development, was the priority that it gave to the interaction of people as participants in a « virtual » user community — more particularly, as members of a purposeful evaluation team linked by the Internet. This purpose is translated into corresponding design principles that included:

- Ease of independent multiple user accessibility on-line;
- The opportunity, as in a typical videogame, to act/contribute immediately – not required to

search elsewhere for data, not blocked by expertise requirements that are outside the user's competence...

- The visibility of the user's status as contributing members of a public deliberation process.

We do not discuss here the first point, whose 2006 solutions are now obsolete and which is resolved in the 2015 ePLANETe platform by a secured SSO (Single Sign On) process that privileges contemporary universal social network identification such as Gmail and Facebook.

The second and third precepts were, in the 2006 version of KerDST, expressed through several conventions. Most directly, there is the mechanism for a KerDST user, in Variation 'A', to select and communicate judgements at the 'cell' level by simple choice of a colour code. Thus, an experienced KerDST user, or a novice piloted by an advanced user, can contribute as a "stakeholder" in an evaluation in a matter of minutes. These cell-level colour signals are immediately visible to other users engaged in the same deliberation.

The principle of immediacy is equally strongly expressed in the procedure for compiling and communicating a "basket of indicators" (in Variations C and D). In fact, the KerDST users are invited to signal the inclusion of indicator concepts within each Deliberation Matrix "basket". That is, they are invited to signal the selection of "objects" that are presented in catalogues that are composed and managed by a Content Management System (the CMS Drupal), for the immediate communication of judgements. This means that the user is not required to search for data corresponding to the indicator, nor to verify/validate others' data. The contribution to the evaluation process is situated at the level of meta-data.

Obviously, these conventions in favour of the immediacy and visibility of user contributions — scoring by colour, and mobilisation of indicators as concepts — come at a cost. There is, for example, no possibility of "scoring" performance based on analytical algorithms calibrated by empirical data and agreed reference values. In this sense, there is a "trade-off" between immediacy and saliency of users' contributions, and the quantitative analytical/scientific anchoring of the evaluation.

Is this a high cost? Many procedures for careful empirically grounded evaluations (for higher education establishment performance as for many other domains) get terribly bogged down in the processes of data collection, management and exploitation. So, it may be that this "trade-off" is an inevitable one and, if it is, then the question is, what qualities of an evaluation are most essential (and, what qualities might reasonably be sacrificed) in terms of the purposes of the evaluation?

This is the core evaluation design question that this paper seeks to explore. We can argue for the adequacy or pertinence — or fitness — of an evaluation procedure, only with reference to a vision of its purposes. And, as we will see, there is not one single vision of the purpose(s) of evaluation of higher education and research performance; and nor is there one single vision of the utility of IT in social networking processes!

In order to introduce this question of evaluation purpose, let us return for a moment to the 2006 KerDST Deliberation Matrix. Cell by cell, as the deliberation process is pursued, the Deliberation Matrix becomes more colourful, each cell's colour profile being generated by the participants and/or by the indicator baskets composed for it. As the cells are filled in by the participants — with simple colours or composite

“baskets” of indicators, as the case may be — an overall impression of the evaluation outcome is obtained by appraising the colour patterns — from scenario to scenario, from actor to actor, from issue to issue. Reflecting on the pattern of judgements built up, the users/participants in the deliberation are encouraged to appreciate the pros & cons of each option (or the relative merits and deficiencies of each situation) not only from their own point of view but also as signalled by the other participants/stakeholders in the system.

The qualitative scoring and visualisation features are to be understood in the light of the declared purpose of KerDST. As the neologism DST itself makes clear (DELIBERATION SUPPORT TOOL, as opposed to the more established DSS, decision support system), the accent is on deliberation Support and not ‘decision’. As a general rule, the process of cell-by-cell piecewise judgement will not produce a clear conclusion about the ‘best’ option. It might, at best, permit partial rankings (with reference to any one of the performance bottom lines, or from any single stakeholder’s point of view, etc.). The principle role of the 3-D Deliberation Matrix array is not to signal the ‘best’ decision; rather it is to act as a deliberation support tool providing participants in the SA process with a common framework, with an opportunity of “collaborative learning” and, more particularly, with an opportunity for new insights into the tensions and dilemmas associated with decisions that cannot be justified as “the best” — neither along all the recognised performance criteria nor for all classes of stakeholders.

A central question for those engaged in “deliberation support” remains, what conventions are to be adopted (1) in relation to quantitative data and analytical conventions (models, maps, etc.) that aid the representation of the objects being appraised; (2) as regards the frameworks and algorithms for quantitative or qualitative “scoring” of an outcome (including comparison or different objects, institutions, scenarios or strategies, etc.); and (3) as regards procedures that may help structure a process of collaborative learning and public deliberation about the “complex” evaluation situations? (O’Connor 2011)

Table 6. 1: Structure a process of collaborative learning and public deliberation

DIMENSION OF STRUCTURE	METHODOLOGICAL REMARKS	CHECKLIST OF ROLES OF “ACTORS”
<p>(1) WHAT? The objects of evaluation attention</p>	<p>WHAT, WHERE and WHEN: Depending on the domain, the evaluation objects can have widely differing character: (institutions, strategies, actions...).</p> <ul style="list-style-type: none"> ◆ The evaluation objects may be classified in various ways, for example “options” (scenarios) for a given decision problem; or the “sites” of different institutions ◆ Appraisal might be conducted of the same topic at multiple scales, for example European, national and local scales of “circular economy” strategy ◆ Where evaluation is forward looking or periodic, the evaluation objects may be situated along a time line (e.g., annual performance appraisal). ◆ The evaluation objects may be considered as composed *** of many elements. 	<ul style="list-style-type: none"> ◆ [YES / NO] Contributing at a conceptual or component level*** to description of the evaluation objects. ◆ [YES / NO] Contributing empirical data for description of the evaluation objects. <p>*** For example, a business or public sector strategy might be considered as composed of many distinct Actions. And, some or all of the Actions might be composed of many individual items (e.g., Scientific Production at a university, might be composed as an ensemble of individual publications and products.</p>
<p>(2) WHY? The framing of</p>	<p>WHY: The framing of performance criteria (there performance issues) is intrinsically linked to the ways in</p>	<ul style="list-style-type: none"> ◆ [YES / NO] Contribution to defining the performance goals, sub-goals?

<p>the performance goals and challenges</p>	<p>which results are to be expressed or reported. Most often a hierarchy can be envisaged, engaging some or all of:</p> <ul style="list-style-type: none"> ◆ A single aggregate performance concept; ◆ A small number of “high level” performance criteria or concepts; ◆ The “composition” (bottom-up), or “decomposition” (top-down) of each high-level performance concept, into sub-goals or component performance considerations. 	<p><i>Note: most often, the mapping from “top-goals” to “sub-goals” is unique, in a “tree structure”. It can be permitted for a given “sub-goal” inform two or more top-goals; however this sort of many-to-many mapping is more commonly permitted at the level of operational indicators</i></p>
<p>(3) HOW? The type of indicators or other “signals” mobilised</p>	<p>HOW: For the purposes of typology with a view to on-line “digital” deliberation support tools, it is useful to distinguish:</p> <ul style="list-style-type: none"> ◆ Indicators in the ‘classical’ sense of system attributes (or ‘variables’) lending themselves to measurement or data... ◆ Any other sorts of “objects” that are catalogued specifically with a view to exploitation in an evaluation process; ◆ Any sort of “object” whatsoever that can be identified on the Internet, up to the scale of “all URLs on the internet”.*** <p><i>Examples of quasi-universal systems of objects that could plausibly be mobilised in participatory evaluation are (1) the pages in the Wikipedia; and (2) the videos in YouTube.</i></p>	<ul style="list-style-type: none"> ◆ [YES / NO] Identifying indicators potentially exploited? ◆ [YES / NO] Selecting indicators relative to performance goals? ◆ [YES / NO] Contributing empirical data for calibration of indicators and reference values? ◆ [YES / NO] Judgements contributing to formal evaluation outcomes? <p><i>NOTE: The judgements themselves can be expressed in different ways and with varying degrees of sophistication, including (i) qualitative signals such as a colour or score; (ii) textual comments; (iii) procedures of ‘weighting’ and aggregation of several signals into higher level judgements or scores.</i></p>
<p>(4) WHO? The different “actors” or stakeholders and their roles</p>	<p>WHO and by/for WHOM: There are, on the one hand, the “stakeholders” in the decision or other evaluation problem; and, on the other hand, the “participants” in the evaluation process itself. The mapping between the two may be explicit or fuzzy. As regards the participants, the variations can be situated along a continuum from one to all:</p> <ul style="list-style-type: none"> ◆ One expert or analysis team conducting the evaluation; ◆ A small number of “representatives”, one for each stakeholder class; ◆ A small number of members/representatives of each stakeholder class; ◆ An unlimited open community of participants, grouped by categories.... 	<ul style="list-style-type: none"> ◆ [YES / NO] Contribution to defining the classes of Stakeholders around the evaluation objects? ◆ [YES / NO] Contribution to choosing representatives and/or defining the perimeter of the User Community? ◆ [YES / NO] Participating in wider discussion and debate around the formal evaluation?

Source: O’Connor (2011)

For any business or sector, this “deal” or social contract cannot be established abstractly. The possibilities might however be explored by various sorts of dialogue and negotiation. As in the experience of a “peace process”, dialogue can — and often does — work to allow antagonistic parties to discover and formulate conditions for coexistence, for managing antagonisms and even for establishing alliances based on mutual respect. Dialogue process can provide the conditions for the emergence of new solidarities — sometimes expressed in terms of ‘win-win’ opportunities, sometimes expressed as agreements for concessions and compromises so as to avoid sterile and destructive conflicts.

This vision of the potential of stakeholder dialogue as a mechanism for partnership building is nonetheless tempered by recognition that absence of trust is often grounded in real historical conflicts, divergences of interests and power asymmetries and violence. Many examples may be found of situations where the invitation by powerful corporate or state actors to local communities for their “participation” in dialogue for the identification of impacts, performance issues, opportunities and conditions of societal acceptability of projects and programmes, finishes by being denounced as “window-dressing”, manipulation, fraud and deceit. We do not wish to gloss over the real difficulties that stand in the way of achieving ideals of a socially inclusive and durable green economy. But, we want to make suggestions to characterise the opportunity, and to frame CSR assessment and reporting in support of this opportunity.

6.1.1. The Structure of CSR Performance Appraisal and Reporting

Our purpose here is to discuss existing procedures for CSR performance appraisal and, on this basis, to present design features for a collaborative platform (1) composing “Sustainable Campus” appraisal as CSR performance profiles, and (2) developing a ‘rating’ of HERE by comparison of these profiles. O’Connor & Spangenberg (2008) have proposed a framework for structuring a “bottom-up/top-down” stakeholder dialogue process for CSR evaluation and communication that takes into account the differences between sites, profiles of business activity and relevant stakeholder groups, and bridges the gaps between site-level and higher levels of performance reporting. Their starting point was a practical question: What procedure for selection of indicators might provide for a satisfactory appraisal of CSR performance at site-level, and across a sector or other community of economic activities, relative to the diversity of performance issues and stakeholders?²¹² In general, raw material for CSR appraisal is not lacking. In any domain of business activity, there is a considerable diversity of sources of information and expertise potentially of value for obtaining “candidate indicators” for deployment in a CSR reporting process. For O’Connor & Spangenberg (ibid.), the most important sources are:

- Identification directly through a stakeholder consultation process;
- Appraisal of indicator concepts provided by sector associations, international agencies, etc.;
- Looking at information sets the company uses for purposes other than CSR reporting;
- Assessment of the indicator concepts identified or deployed at other sites.

What conventions might permit the actors of a CSR evaluation and reporting process to tap into this diversity, without the process becoming chaotic and unmanageable? O’Connor & Spangenberg (ibid.) suggest the need for a multi-tiered approach. They propose the use of a “standard set” of CSR performance issues to structure information management and communications with reference to the “four

²¹² These authors motivated their methodological suggestions by reference to a study carried out during 2002–2004 across sites in four different European countries for the European Aluminium Association. This work led to proposals to the EAA for an information management framework and a set of guidelines that will permit the efficient identification of a CSR indicator system responding to a range of communication needs at site or sector-wide level. The analyses were carried out by a team of researchers at the C3ED supported by the European Aluminium Association through the EAA “Aluminium for Future Generations” Programme, in two phases for which the principal reports are: Faucheux et al. (2002) and O’Connor et al. (2004), the respective “Phase One” and “Phase Two” Reports.

dimensions of sustainability” (financial/economic, social, environmental and political/institutional). In effect, CSR/sustainability assessment information is located at three levels, as shown in **TABLE 6.2** below.

Table 6. 2: Framework for Deliberative Sustainability Assessment

LEVEL	OUTCOME
Characterising “Sustainability”	Agreement about vision of “Sustainable Development” or “Governance for Sustainability” as the pursuit or achievement of a coevolution of interdependent systems respecting simultaneously multiple “bottom lines”.
Articulating relevant “Bottom Lines”: Sustaining of What, Why and for Whom?”	Agreement by Stakeholders on the set of Performance/Quality considerations that are affirmed as “Bottom Lines” for the specific policy situation or class of management challenges being addressed.
Proposing and Mobilising Baskets of Indicators of Quality or Performance	Consensus about baskets of appropriate indicators to be mobilised in each category of SA, as a function of issues, stakeholder diversity and the range of sites, scales and options under discussion.

Source: Frame & O’Connor (2010), adapted from O’Connor and Spangenberg (2008).

For these authors, the “standard set” of CSR performance categories, corresponding to the middle row of Table 3, has several important roles to play:

- It works as a bridge between “bottom-up” and “top-down” perspectives, allowing stakeholders at site level (including company management) to see how their particular concerns are examples of categories of social responsibility addressed by the international community, and vice versa;
- It helps to build a common understanding within and between stakeholder groups, about CSR reporting objectives;
- It helps to focus discussion and achieve a consensus about appropriate indicators in each category of CSR reporting.

A stakeholder dialogue process for making a company or site-level CSR assessment might, in this perspective, have for its goal to select indicators allowing each category of stakeholders to arrive at a judgement relative to each CSR performance criterion. O’Connor & Spangenberg (2008) thus suggest the procedure of inviting stakeholders — or representatives from each category of stakeholder — to work together to select, with reference to each CSR performance issue, a “basket” of indicators from amongst the candidate indicators. In other words, to “fill in the cells of a CSR Evaluation Matrix” (ibid.)²¹³. To implement such a procedure, obviously the range of objects to be appraised (e.g., HER sites, strategies, scenarios, etc.), the spectrum of performance issues, and the range of stakeholder categories, must all somehow be established. What guidance can be provided for these requirements of “building the problem”?

²¹³ For O’Connor & Spangenberg,, the catalogue of “candidate indicators” may be open. If participants find the available lists of candidate indicators insufficient to cover their concerns, new indicator suggestions can be made to complement the existing ones, in an iterative process. Based on the selection of indicators, an overall judgement is put forward, by each category of stakeholders, for each of the performance issues being considered. An early example of this approach is provided by Chamaret et al. (2007), which, for organisation and communication of the CSR evaluation, made use of the 2006 version of the kerDST online deliberation support tool.

6.1.2. Who are the Stakeholders in CSR Performance Appraisal?

In the multi-stakeholder evaluation process, the interfacing of different stakeholders' contributions permits (1) a "balanced" selection of CSR indicators judged pertinent by the spectrum of stakeholders involved; and (2) a confrontation of judgements across the spectrum of stakeholders. Following Faucheux & Nicolai (2003, 2004a, 2004b), we can consider that the stakeholders in a typical CSR appraisal situation will include:

- The internal stakeholders (including employees, company management and non-staff shareholders, all having direct economic interests in the company);
- The 'external' stakeholders as **TRADITIONALLY** identified business partners (suppliers, customers, banks, etc., all having direct commercial importance to the company);
- The broader external stakeholders as discourse partners (NGOs, associations, partner companies, local authorities, all having an interest in, or claims about business performance, and therefore having an indirect significance for commercial success).

In below Figure ²¹⁴ gives a breakdown of some of the major sub-categories of the "traditional" and "extended" external stakeholders in CSR.

As O'Connor & Spangenberg (2008) have commented, this distinction between 'traditional' external stakeholders and the 'extended' or 'broader' stakeholder set is correlated with the two sides of the "social contract" requirement, confronting the different interests and preoccupations of (a) those stakeholders who are of interest to the company as distinct from (b) those who, from the outside (including civil society at large), assert a moral claim on the company. In the same vein, it can be useful to separate out governance agencies as a distinct stakeholder category, in view of their specific responsibilities for "setting the rules" including the resolution of any conflicts within and between stakeholder groups.

6.1.3. What are the Objects of CSR Evaluation?

It has become commonplace to frame sustainability, and hence CSR as a sustainability commitment of business, in terms of a "triple bottom line", that is, the simultaneous respect for (or satisfaction of) quality/performance goals for each of the economic, wider social, and biophysical "spheres" of activity. The meaning of this triple bottom line can be sharpened by a focus on the different system dimensions of business activity, broadening out from (i) the goods and services that are the objects of commercial transactions, to (ii) a vision of the wider life cycle with its "external" social and environmental impacts; and (iii) the wider tissue of society whose dynamics — including the interplay of beliefs, ideologies and social values — will determine the societal acceptability and acceptance of the defined business activity.

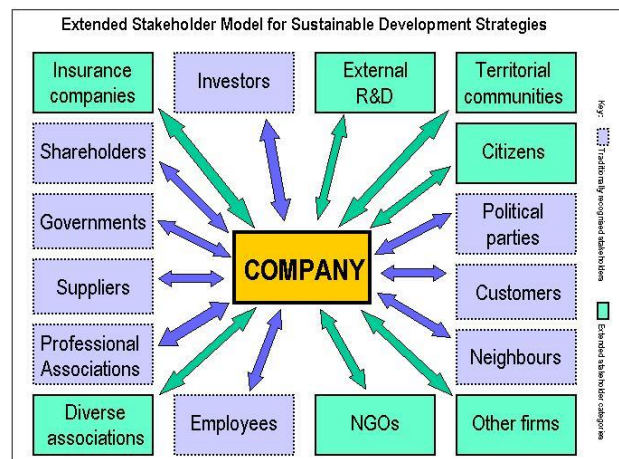


Table 6. 3: Societal acceptability and acceptance of the defined business activity

Dimensions of Business Quality	Status of Stakeholder Groups
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²¹⁴ Source: Faucheux, Hue, Nicolai, & O'Connor (2002), Integration of the Social Dimension of Sustainable Development in Enterprise Strategies within the Aluminium Industry, Full Final Report (Phase One), Research Report prepared by the C3ED for a study supported by the European Aluminium Association through the EAA "Aluminium for Future Generations" Programme, France, June. It is retaken in O'Connor & Spangenberg (2008).

<p>QUALITY OF THE PRODUCTS & SERVICES of the sector. This refers to the outputs intentionally produced with a view to supply and sale (the sphere of exchange value) and, by corollary, to the quality of relations with the actors directly engaged by the creation and use of these products/services.</p>	<p><i>The actors directly engaged by the creation and use of the products/services are, first of all the “INTERNAL” stakeholders (workers & management, shareholders...); and, then the “TRADITIONAL” EXTERNAL stakeholders (e.g., suppliers, transport operators); and the customers, buyers, users and consumers of the goods/services).</i></p>
<p>THE EXTERNAL EFFECTS of the production-supply-consumption activities in the environmental and wider social spheres. These “environmental and social impacts” can be seen, from biophysical and social sciences standpoints, as the more-or-less necessary conditions of the defined production/supply activities. They may have a pronounced territorial profile (local – regional – global...).</p>	<p><i>Judgements as to the “acceptability” or not of the “external” environmental and social impacts of a firm’s or sector’s production/supply activity, engage the category of “EXTENDED” EXTERNAL STAKEHOLDERS and, in consequence, the category of “GOVERNANCE” STAKEHOLDERS with responsibilities for regulation and conflict management. There may also be “external” economic impacts of relevance to “INTERNAL” and “TRADITIONAL” EXTERNAL stakeholders.</i></p>
<p>THE COMPATIBILITY, OR NOT, IN TERMS OF SOCIAL VALUES, between the strategy and vision communicated by the business activity and, the “values” and visions of society expressed by people as actors in society around and “outside” the business itself.</p>	<p><i>The question of the “legitimacy” or not of such and such a business activity (characterised by, its production/supply activity and the associated “external effects”) can be raised by INTERNAL and “TRADITIONAL” EXTERNAL STAKEHOLDERS. It is, by presumption, raised by the “EXTENDED” EXTERNAL STAKEHOLDERS to the extent that they do not declare “shared value(s)” with the business. The questions of compromise or conflict management (arbitration over “values”) are then, by definition, the preoccupation of “GOVERNANCE” agencies.</i></p>

6.1.4. Quality-Performance Considerations for CSR Evaluation

In a full approach to business performance, it is necessary to factor in these three dimensions of business activity, in both descriptive and normative terms. The question of the quality criteria and the “justifications” that might prevail for a business activity is complex and is a matter of very contrasting opinions, in theory and in practice, across societies and at different moments in time. We address this question only in a specific sense, that of the contemporary normative reference of a “green, sustainable and inclusive economy”. The articulation of such a framework for characterising, specifically, the quality of a higher education and research establishment relative to sustainability criteria, will then be our concern in next Section.

Recall, from previous above, the need for articulating a set of **BOTTOM LINES**, “**Sustaining of What, Why and for Whom?**,” that can be employed as a common framework in multi-stakeholder evaluation. So let us look briefly at the different facets of CSR and “sustainability”, as they relate to the three dimensions of business activity presented just above. The methodological principle for a socially robust evaluation framework, is to obtain (tacit or active) agreement by stakeholders on the set of Performance/Quality considerations that are to be applied as “Bottom Lines” for the specific policy situation or class of management challenges being addressed — in this case, higher education and research.

The “triple bottom line” is not just a set of performance indicators across three separate domains — the economic, environmental and societal domains; rather it refers to the principle of a durable coexistence or coevolution of biophysical capacities and of societal qualities (including politics and culture) with a viable commercial activity (the sphere of exchange value). So we can start with a characterisation of quality for each of the three spheres but, we must also address explicitly the synergy (or not) in sustainability terms of

performance across the spheres. Having a CSR strategy means, in these terms, framing the business (or entire sector) as a competent and responsible actor for sustainability.²¹⁵

The ‘ethical’ dimension of business consists, in simple terms, of the articulation of the different principles that may underlie operational criteria. We can thus consider the spectrum of HERE strategies as being, from one perspective or another, candidates as *ethically principled actions* — meaning that, they satisfy or respond to particular criteria of good or sound practice that are suggested by members of the community (cf., Fleming 2003). Below Table gives, in these terms, our suggestion for a two-tier compilation of sustainability ‘ethical bottom lines’ for HERE that is, the normative precepts for a “Sustainable Campus”.²¹⁶

²¹⁵ To the extent that a business operation seeks consciously to establish its viability and legitimacy by simultaneous reference to the multiple quality concepts and criteria within this complex space, it is (one way or another) identifiable as a social/societal entrepreneur.

²¹⁶ The ‘Ethical Bottom Lines’ checklist concept as exploited here, was developed in O’Connor (2003) with reference to stewardship of radioactive wastes (see also Chamaret & O’Connor 2005). A published version of the application to radioactive site stewardship is found in O’Connor (2009) and, in French, abridged in Faucheux & O’Connor (2015). Many other two-tiered multi-criteria evaluation frameworks can be considered as comparable formulations of sustainability “ethical bottom lines”. Some examples for HER appraisal that, in different ways have informed our formulation are mentioned.

Table 6. 4: Here Ethical Bottom Lines

HERE ETHICAL BOTTOM LINES

- PR.1 — What is the HER establishment’s PRODUCT QUALITY? For example:
 - ◆ Teaching and training quality as assessed by competent authorities, through student and faculty auto-evaluation, and in the eyes of outside stakeholders?
 - ◆ Academic research quality as assessed by competent authorities and through graduate student and faculty auto-evaluation (and, perhaps, in the eyes of outside stakeholders)?
 - ◆ Contributions/impacts of the HER community to society (including via expertise, educational outreach...)?
 - ◆ Strategy for maintaining and enhancing academic quality?
- PR.2 Is the HER establishment ECONOMICALLY VIABLE? For example:
 - ◆ Are the immediate costs of teaching and research programmes affordable with the available resources?
 - ◆ Are the current/envisaged resource management strategies cost-effective?
 - ◆ Are there major financial risks or costs being shifted into the future?
 - ◆ Reasonable prospects of mobilising resources for the forecast operating and investment costs in the longer term?
- PR.3 Have the OPERATIONAL RESPONSIBILITIES of partners/stakeholders been appropriately defined and assigned? For example:
 - ◆ Quality assurance in research and teaching (cf., the UK QAA and REF procedures)?
 - ◆ The funding base (including public, private and any other partnership) and financial management?
 - ◆ Health and security for students and HERE staff, and also for workers and the public on or close to the site?
 - ◆ Norms of equity (such as “*Equality and Diversity*”) in student access and staff recruitment and retention?
 - ◆ Well defined consultation, deliberation and decision procedures at internal, local and national levels?
- PR.4 Have responsibilities ‘towards other parties’ in the LONG TERM been adequately addressed? For example:
 - ◆ Application of the principle that ‘the polluter pays’?
 - ◆ A ‘sustainability’ principle of inter-generational responsibility (don’t pass on problems to others that you cannot cope with yourself);
 - ◆ A thorough characterisation of risks/uncertainties/future contingencies (with reference to: the dangerous substances, the engineering works, the living environment, and future societal evolutions);
 - ◆ An application of some version of the principle of precaution in all facets of HER activity (dangerous substances, engineering works, biodiversity and the living environment...);
 - ◆ Is there likely long term stability of the necessary knowledge base (e.g., transmission of records, specialised know-how, local knowledge) for competent stewardship?
- PR.5 Has available TECHNICAL KNOWHOW & SYSTEMS SCIENCE been mobilised? For example:
 - ◆ Best practice (technical reliability, simplicity...) in building, operations and wider territorial infrastructures?
 - ◆ Rigorous profiling (in scientific, health and sociological terms) of the direct and indirect environmental “footprint” of HERE activities and of associated risks?
 - ◆ Monitoring procedures attentive to social inequalities, respect of diversity, risks and future contingencies?
- PR.6 Does the HER establishment enhance the prestige of the HOST COMMUNITIES and other territorial stakeholder groups? For example:
 - ◆ Viable partnership between local and national stakeholders (e.g., agreed distribution of responsibilities; legal mandate for HER development; agreement on bases for financing of different cost components, etc.)
 - ◆ Site specificities clearly in evidence?
 - ◆ Local knowledge, knowhow, and workforce competencies clearly in evidence?
 - ◆ Well defined framework for ongoing involvement of stakeholders in HERE strategy oversight and review?
 - ◆ Access of the members of local communities to educational and training opportunities?
 - ◆ Societal relays for acceptability, enthusiasm, visibility and prestige?
- (1) PR.7 Does the HER establishment embody or enhance the SOLIDARITY PRECEPTS FOR SUSTAINABILITY? For example:
 - ◆ Circular Economy & Environmental performance ?
 - ◆ Institutional framework for co-management of environmental and social ‘common’ wealth/infrastructures?
 - ◆ Financial loops or cycles that, as monetary counterparts of an inclusive, green/circular economy, assure solidarity of markets-based transactions with maintenance of territories’ environmental and social infrastructures?
 - ◆ Operational and inclusive partnerships for implementing & governing the value loops?
 - ◆ Communication/Sharing of experience across different institutional scales (e.g., the HER establishment itself, territorial development, national policy, international obligations and comparisons)?

This is the multi-criteria framework that we will exploit in next section, as part of our proposed blueprint for a social networking approach to the quality appraisal of higher education and research establishments (HERE-QA) from a normative sustainability point of view.

6.1.5. Indicators and Dialogue in CSR Performance Appraisal

CSR performance challenges must, in general, be formulated with close reference to sector of activity, geography, social context, culture and evaluation purpose. For sector-wide CSR reporting and rating procedures, any empirical process of site-to-site comparison has to be worked up into a methodical procedure of *comparison of CSR evaluation profiles between sites*. So there is a tension between the “generic” and the “specific” in design of evaluation procedures.

This tension is, in the approach to evaluation advocated here, structured and managed by permitting a “free” choice of indicators by stakeholders, as signals to inform their judgement of HERE performance relative to each of the **standard or “generic” performance categories**.

This methodological choice responds to several different criteria. In previously, typology has shown that there are many different responses to address this tension. But attempts to be sensitive to “local specificities” while retaining the ambition of wide (e.g., national or international) comparability can easily end up very cumbersome.²¹⁷ Our key design criteria therefore, are not so much what is methodologically coherent (which we can consider necessary but not sufficient), but what is ergonomically feasible and socially powerful...

Following the sustainability precepts of respect for diversity and solidarity, by socially powerful we mean frameworks of evaluation that visibly give status to a wide diversity of stakeholders. It is thus inevitable to seek a procedure that will make divergences visible, but also that will facilitate “dialogues” and deliberation respectful of this diversity.

Practices of stakeholder dialogue can be seen as a pragmatic response in business strategy and management practices, to diversity as ***both an opportunity and an obligation***. A stakeholder dialogue process can, in principle, achieve much more than merely an “input” of data. It creates an opportunity for exchange and debate between stakeholders who will learn about what matters to the others and why (see Inset Box). An open deliberative process can, if the challenges and purposes of solidarity are taken up by the business and other key stakeholders, be powerful for partnership building — for building trust as well as enhancing information quality.

Potential Benefits of a Participatory Indicator based CSR Evaluation Framework

A framework is provided for making explicit the “balanced” coverage of the full spectrum of performance issues, with consideration to the diversity of stakeholder concerns across these issues. As needs are identified, priority can be given to addressing notable data “gaps” or points of controversy through the ongoing dialogue processes.

The sustainability CSR evaluation framework and stakeholder dialogue procedures, are a permanent visible feature — more fundamental and more robust than the individual information components or results at any moment in time. The overall framework is the key to orienting the collaborative CSR rating activity, even if the engagement of individual participants is only sporadic and even if individual judgements are of uncertain and debatable quality.

Stakeholders are considered and treated as (physical or moral) persons aware of their own objectives and concerns and having autonomous standing relative to the firm or corporate or state entity in question. The performance issues and the individual indicators that may be suggested through discursive process will be of varying scope and of widely varying quality regarding data availability, controllability and possibility for governance. But, they are affirmed in the collaborative deliberative framework as of equal standing, in the sense that they

²¹⁷ We will see examples in here relative to HER sector activity, of the difficulties that can arise in attempts to be sensitive to local specificities while retaining the ambition of wide comparability. Our preferred design options are not a magical solution but, are grounded in reflexion and experimentation around this over many years.

In this vision of collaborative process, it is neither necessary nor desirable to seek complete sector-wide agreement on specific indicators to be deployed. Nor, analogously, is it necessary to seek consensus across different categories of stakeholder on specific indicators to be deployed. *On the contrary*, by empowering stakeholders with their local and often parochial contributions, placed in a parsimonious but also intuitive way within the broader performance categories, a bridge may be built from local to global (and back again).

The local significance of individuals' proposed indicators is clearly in view to *all* participants; and Individual participants can appreciate the role of the wider rating/indicator system as an ongoing structured process for societal learning and debate across the full dimensions of sustainability.

We will now explain the application of these methodological precepts for a social networking approach to representation and evaluation of Sustainable Campus Strategies.

6.2. Sustainable Campus Strategies

6.2.1. How to do it? — Evaluating a “Sustainable Campus Strategy”

In this Section, building on the conceptual framing of the preceding section, we set out a set of reference points that will lead up to our operational proposals for multi-stakeholder multi-criteria evaluation of Higher Education and Research establishments relative to “sustainability” criteria. We compose this operational framework in terms of the didactic notion of a **SCS – Sustainable Campus Strategy**, as follows :

- A **SUSTAINABLE CAMPUS STRATEGY (SCS)** — existing or hypothetical — is made up of **ACTIONS**. Each of these **Actions**, and therefore the **Strategy** as a whole, can be situated in one or more **DOMAINS of Action**. The **Actions**, and therefore the **Strategy** as a whole, may also be described/characterised in terms of their attributes, referred to as **INDICATORS** which can be of various forms and types.
- A **SCS**, or its component **Actions**, is to be judged — *ex post* (for an existing or past situation) or *ex ante* (for any scenario) — for its **Qualities** relative to an agreed spectrum of **SUSTAINABILITY PERFORMANCE CONSIDERATIONS**.
- This evaluation is undertaken by people, as **Actors** linked in social networks, situated across the spectrum of **Higher Education & Research (HER) stakeholders**. These include, in broad terms: **HER “INTERNAL stakeholders”** (including students, academics and administrative staff); **HER Business PARTNERS, EXTERNAL (Social Contract) stakeholders**; and **GOVERNANCE Actors/Agencies**.

This characterisation across these three dimensions — Description of a Strategy, Quality-Performance considerations, and Multi-actor Judgement — leaves open the question, how exactly to carry out the evaluation (and to share/communicate the results). It also leaves open the question of what basis for comparison between HERE. We come back to this question of comparison and comparability, after we have exposed our suggestions on **How to do it**.

In order to anchor our design suggestions in the existing state-of-the-art, we now review very briefly a selection of programmes and tools for Quality Assessment in and of Higher Education & Research establishments (HERE-QA). Within the length constraints of a single paper we do not scrutinise all programmes around the world.²¹⁸ Our selection is motivated by, on the one hand, the notoriety of certain programmes (for example ‘STARS’) and, on the other hand, methodological pertinence for our needs (for

²¹⁸ See however, the overview and extensive references found in the PhD thesis by Bouckaert (2016).

example EVADES and the SCLC/SUCCESS project).

We have already highlighted the ways that participation can (i) contribute to CSR data; (ii) contribute to robust performance assessments (e.g., for selection and application of pertinent indicators); and (iii) help to build a sense of collective purpose and responsibility. In our review of existing tools we thus give particular attention to three methodological points:

- a) The structure of HERE-QA, in terms of performance concepts and criteria, and in terms of domains of action (and the associated indicators);
- b) The ways in which HERE stakeholders are engaged as Actors in and by the QA process: in its structure; in furnishing data, and in sharing data and judgements (at various levels of deliberation);
- c) How Internet and social networking technologies (IT for short) is, or might be exploited to support and facilitate the HERE QA and the sharing of outcomes.

As already mentioned previously, our key design criteria include methodological coherence (which we can consider necessary but not sufficient) and also, more particularly, procedures that are easy to understand, ergonomically feasible for the actors involved, and socially powerful. These considerations will show up in our adherence to the principle of “representative diversity” for the definition of Domains of action, of Stakeholder classes, and of the mechanisms for appraising SCS Performance across each of the domains.

6.2.2. From Academic Excellence to Sustainable Campus Strategy

HERE are, evidently, about the delivery of higher education and research products and services, but they are also about visions and aspirations of wider society. Any reading of the history of universities and of the controversies about higher education funding in contemporary societies shows that there can be widely divergent visions of the roles of HERE in and for the wider society.

Our focus here is being on contemporary sustainability and related solidarity considerations, little space will be devoted here to reviewing HERE evaluation procedures centred uniquely on academic teaching and research outputs. Nonetheless, views about how HERE does or should contribute to wider society are tied up with the values and visions expressed about those societies and, these values and visions impact in turn on the conceptions of HERE products and services. We will see this interdependence in various ways, as we work through examples of HERE evaluation relative to sustainability.

With the huge increases during the past 50 years in the numbers of students in higher education and in the budgets (public and private) committed to higher education, there is a concomitant rise in visibility and sophistication of procedures for the evaluation of HERE quality. These may be procedures of institutional “self-assessment”, or they may be conducted by “independent” and “external” agencies. There is a continuum between the two extremes, in the sense that self-assessment procedures may apply conventions specific to the institution itself (e.g., internal enquiries or reviews); or they may apply and feed into frameworks of HER evaluation that are established and maintained by external agencies.²¹⁹

Perhaps the most (in)famous HERE evaluation system at the present time is the so-called “**Shanghai Rankings**” compiled since 2003 under the heading ARWU — Academic Ranking of World Universities (see: <http://www.shanghairanking.com/>).

Moving on from these “high level” ranking systems that, necessarily, take into account only a very limited spectrum of HERE products and performance indicators indicators (for example, the number of academic

²¹⁹ In fact, the field has become so encumbered that, unsurprisingly, there emerges a perceived need for the « accreditation » of accreditation procedures and agencies! For example, the Council for Higher Education Accreditation (CHEA), a U.S.-based advocate and institutional voice for self-regulation of academic quality through accreditation, maintains an international directory of accrediting bodies.

See : http://www.cheainternational.org/intdb/international_directory.asp

papers published in ‘recognised’ scientific journals, the number of Nobel Prize winners...), there is a continuum to (i) detailed procedures for self-assessment and (ii) external auditing focussed on entire institutions or specific disciplinary domains. Some, but by no means all of these self-assessment and auditing procedures, address sustainability concerns in an explicit and systematic fashion.

For illustrative purposes, we first take two examples aimed at Business Schools of externally administered accreditation programmes for evaluation that focus on HERE “core” activities but that open out to wider sustainability considerations. Then, we give two examples of frameworks for HERE evaluation specifically in terms of sustainability considerations.

By “core business”, we refer to the first row of our Table, viz., “... *the outputs intentionally produced with a view to supply and sale (the sphere of exchange value) and, by corollary, to the quality of relations with the actors directly engaged by the creation and use of these products/services.*” Our examples are:

The **EQUIS Standards and Criteria** operated by the EFMD Quality Improvement,²²⁰
the **AACSB International** programme for Business School accreditation²²¹

Each of these programmes proposes detailed guidelines for the production, by the institutions engaged in the programme, of documentation that will permit, on the basis of quantitative indicators, interviews and qualitative appraisal, to form a judgement about academic quality and professional pertinence of the Management/Business schools that are candidates for accreditation.

These are procedures that, indeed, can run over several years, and that necessitate substantial institutional effort. Justified as tools that encourage and facilitate strategies of “continuous improvement”, there is the evident paradox that, in the name of rigour, objectivity, fairness and transparency (etc.), their implementation requires specialised skills (the guidance documents alone are typically between 50 and 100 pages in length) and dedicated budgets (the human resources being measured, by anecdotal evidence, at several person-years plus the support of many internal services of the institution, for a successful accreditation).

While the details of these evaluation frameworks differ, the “core” activities of HER institutions performance are scrutinised one way or another in terms of the 3 “bottom lines” set out at the top of our Table 5: (1) What is the HER establishment’s PRODUCT QUALITY?; (2) Is the HER establishment ECONOMICALLY VIABLE?; and (3) Have the OPERATIONAL RESPONSIBILITIES of partners/stakeholders been appropriately defined and assigned?

But, this is not enough. The vision of the HERE sector as a cornerstone in societal sustainability, requires evaluation also relative to more far reaching considerations. Just as, since the 1990s, formulations of Corporate Social Responsibility have set out increasingly sophisticated visions of the “triple bottom line and of “extra-financial” reporting obligations, so Higher Education & Research institutions must extend their quality considerations. We see this in different ways for the two cases just taken:

In the case of the AACSB International programme for Business School accreditation, the theme of sustainability is recognized discursively as an all-embracing reference for business quality. In a featured

²²⁰ See : <https://www.efmd.org/accreditation-main/equis>. Specificities include the accent on a « strong interface with the business world » and a « high degree of internationalisation ».

²²¹ See : <http://www.aacsb.edu/accreditation>. The acronym AACSB stands for : **Advancing Quality Management Education Worldwide**.

article on the AACSB Blog,²²² detailed reference is made to the United Nations Sustainable Development Goals, in the following terms:

Why Should Business Schools Care?

Although government plays a key role in advancing the goals, it is business that will be instrumental in the success of the individual targets through the way they operate, develop new business models, invest in communities, innovate, and collaborate. For companies, successful implementation of the SDGs will strengthen the enabling environment for doing business, minimizing increasing risks while also providing a myriad of new opportunities.

As such, it is business schools that will play an even more crucial, perhaps currently undervalued, role in the successful implementation of the SDGs. Business schools should be seen as a key enabler for all the goals to transpire. The daily decisions made around the world that influence the goals directly or indirectly are made by business school alumni or teams they work with or are based on academic research. As business takes these issues more seriously, business schools need to as well, to stay ahead of the game or risk being left even further behind. Business schools should be aligning with global priorities; they can no longer afford to sit on the side and watch.

In the case of the **EQUIS Standards and Criteria**, the guidelines go a step further and now include a separate section for reporting on themes of ethics, responsibility and sustainability. This is Chapter (EFMD 2016, pp.67-69) in the Standards & Criteria 2016 documents,²²³ which declares:

The School should have a clear understanding of its role as a “globally responsible citizen” and its contribution to ethics and sustainability. This understanding should be reflected in the School’s mission, strategy and activities. There should be evidence that the School’s contribution is reflected in its regular activities, covering education, research, interactions with businesses and managers, community outreach and its own operations.

Detailed paragraphs then explain the meaning given to the interdependent terms of ethics, responsibility and sustainability, and the importance for evaluating Business School quality:

... [R]esponsible and ethical behaviour should be an integral part of the School’s values and strategy and should be reflected in its regular activities. In particular, it should act as a catalyst for the development of business communities, as a forum for debate, and as a source of dissemination of new ideas and solutions. The School should be actively engaged in promoting business ideas and solutions to sustainability challenges. This implies that faculty, staff and students are encouraged and supported to participate in these activities as an integral part of their professional engagement.

... / ... The concern for responsibility and sustainability will be evidenced not only in the School’s approach to management education, but also in its research, its public outreach and its own behaviour. Evidence of this commitment to responsible and sustainable business practice is requested in other chapters, but should be summarised in this section of the report.

In effect, the principle set out by Specific chapter of the EQUIS Quality Improvement System (2016) is for

²²² See : <http://www.aacsb.edu/blog/2015/october/management-education-and-the-sustainable-development-goals-get-engaged>. The reference is to the 17 Sustainable Development Goals (SDGs) and 169 related targets that were adopted by the 193 states of the United nations on the 25 September 2015.

²²³ See <https://www.efmd.org/accreditation-main/equis/equis-guides> which gives access to PDF versions of several « Core Documents » including the EQUIS Standards & Criteria 2016.

appraisal of each facet of a HERE's objectives and attainments relative to sustainability and responsibility. For example, in annex documents the requirement is to provide:

- Brief description of policies and institutional projects in these areas
- Brief description of student-led projects in these areas
- Approaches to the assessment of ethics, responsibility and sustainability
- Examples of community outreach and public service activities

There is no specific tool or “template” supplied that would facilitate this aspect of EQUIS reporting. In the absence of any other guidelines, such reporting is likely to be uneven and onerous as an internal process, and of uneven readability beyond the institution.

We now turn to examples of evaluation programmes — the AASHE “STARS” programme and the French “EVADES” system — that have been conceived and implemented with the specific purpose of providing a protocol for HER establishments' self-assessment relative to sustainability criteria.

6.2.3. Sustainable Campuses? — The “STARS” and “EVADES” Frameworks

The AASHE STARS programme (**Sustainability Tracking, Assessment & Rating System™** STARS²²⁴) is described on its website as “... a transparent, self-reporting framework for colleges and universities to measure their sustainability performance.” STARS is intended to engage and recognize the full spectrum of colleges and universities—from community colleges to research universities, and from institutions just starting their sustainability programs to long-time campus sustainability leaders. The assessment framework encompasses long-term sustainability goals for already high-achieving institutions, as well as entry points of recognition for institutions that are taking first steps toward sustainability. STARS is designed²²⁵ to:

Provide a framework for understanding sustainability in all sectors of higher education.

Enable meaningful comparisons over time and across institutions using a common set of measurements developed with broad participation from the international campus sustainability community.

Create incentives for continual improvement toward sustainability.

Facilitate information sharing about higher education sustainability practices and performance.

Build a stronger, more diverse campus sustainability community.

In the STARS procedure, HERE as participants pursue “credits” within the framework provided on-line for self-assessment of performance. Through comprehensive reporting they obtain points so as to reach, progressively, the *Bronze, Silver, Gold* or *Platinum* rating.

The credits included in STARS span the breadth of higher education activities, and include sustainability related performance indicators and criteria organized into four broad categories: Academics, Engagement, Operations, Planning & Administration.²²⁶ Each category has several sub-categories, as listed below; and

²²⁴ AASHE is the (American) Association for the Advancement of Sustainability in Higher Education. Website : www.aashe.org. The STARS programme is presented, with access to members for the various technical documents and assessment procedures, on the secured website : <https://stars.aashe.org/>. This includes an interactive map locating all participating higher education establishments around the world.

²²⁵ <https://sustainablecampus.fsu.edu/our-programs/stars>

²²⁶ Full details are found in the [STARS Technical Manual](#) (Version 2.0, January 2014), available in PDF on-line. See : http://www.aashe.org/files/documents/STARS/2.0/stars_2.0_technical_manual_-_administrative_update_two.pdf.

then each sub-category is broken down into individual items for which Credits may be obtained.²²⁷

Table 6. 5: Structure of the AASHE “STARS” Framework

STRUCTURE OF THE AASHE “STARS” FRAMEWORK		
Acronym	Domain	Sub-domain of Activity
AC	<u>ACADEMICS</u>	Curriculum; Research
EN	<u>ENGAGEMENT</u>	Campus engagement; Public Engagement
OP	<u>OPERATIONS</u>	Air & Climate; Buildings; Dining services; Energy; Grounds; Purchasing; Transportation; Waste; Water
PA	<u>PLANNING & ADMINISTRATION</u>	Coordination, Planning and Governance; Diversity and Affordability; Health, Wellbeing & Work; Investment
IN	<u>INNOVATION</u>	<i>(no specified sub-domains)</i>

The STARS system is the still-evolving outcome of many years of collective effort. It seeks to find and apply a working compromise to the very evident challenges of complexity, variety, comparability and so on.

For example, in the formulation of self-assessment categories, the design strives “... to ensure that each credit is objective, measurable, and actionable”. Then, in order to accommodate the diversity of higher education institutions, some STARS credits do not include detailed specifications but are instead flexible or open. In other cases, credits include an applicability criterion, so that the credits only apply to certain types of institutions (and thus, institutions are not penalized when they do not earn credits in domains they could not possibly aspire to).

What starts simple, becomes cumbersome. But also, the intention of “comparability” across institutions is undermined, to the extent that the “diversity” of operating style and conditions is given standing. This is tension already noted in earlier sections of this paper. And in fact, we see in the flexibility of the “STARS” protocols the beginnings of a methodological compromise that, indeed, means abandonment of the ideal of complete comparability across all categories.

This “compromise” can be given a positive slant in the following terms. First, we see that, in practice, the teams compiling their institution’s auto-evaluation are invited and required to document ACTIONS in the different categories. Therefore, we could push the compromise to the extreme by suggesting that the categories of reporting cannot be varied, but there can be complete freedom in the choice of the Actions signalled as “proofs” of institutional commitment and attainment.

With this suggestion (that we will take further in Specific Section), we come back to the question of “comparison” in what terms, for whom and why? The “STARS” system as it currently stands, while ambitious, does not open the door to parallel evaluations by different stakeholders of a given HERE institution. Nor does it permit direct relational statements between self-evaluating establishments (except at the abstract level of overall scores). These are points that will be taken up in later subsections.

Finally, a significant innovation of the STARS website is that the engagement of HER establishments and the data of their self-evaluated performance, are made visible on-line. In this regard, importantly, STARS provides a system of **positive recognition**. Each level of recognition (*Bronze, Silver...*) represents significant sustainability achievement and leadership. Participating in STARS, which entails gathering extensive data

²²⁷ There is also, since the 2014 Version 2.0, a fifth credit category entitled Innovation (IN) with at present contains only a single generic item for scoring.

and sharing it publicly, represents in itself a commitment to sustainability. The system design does not permit aggressive or hostile criticism, but seeks rather to encourage and reward its members' participation at the same time as providing transparency in the institutions' self-assessment declarations. These are relational features of scoring that have particular importance in any future social networking approach HER sustainability assessment

We turn now to the **EVADES** system that has been developed in France, by FONDaTERRA²²⁸ and a consortium of HER partners, during the years 2009-2012 (that is, more or less in parallel with the AASHE STAR system).

The acronym, in French, stands for ***Outil d'auto-Evaluation du Développement Durable dans l'Enseignement Supérieur***²²⁹, which translates as: *Tool for the self-assessment of Sustainable Development in Higher Education*.

The creation of the **EVADES** tool followed on from the French law reform in 2009, known as the Environmental "Grenelle I law", which required all higher education establishments to set up a sustainable development strategy addressing economic performance, social responsibility and environmental targets, formalised by the name of a "Campus Green Plan". This was translated into an operational **Campus Green Plan** scheme in June 2010, via a self-assessment framework developed by the partnership foundation FONDaTERRA on behalf of the two major higher education umbrella bodies: the Conférence des Grandes Ecoles and, the Conférence des Présidents d'Universités. **EVADES** is thus a tool for piloting and monitoring implementation of a Campus Green Plan for each HER establishment. It is described as... *A sustainable development and social responsibility educational tool, a tool for communicating and sharing good practices, a strategic guideline (continuous improvement objectives at 1, 3 and 5 years, prioritising of the actions to be deployed) that is aligned with the objectives of the Green Plan scheme and ISO 26 000, a self-assessment tool (strong points, weak points, completed actions), a spreadsheet that tracks the approach for operational managements and DD advisors, and, a database that provides a basis for certification (Green Campus labelling).*

The currently operational version, in its main lines dating from 2012, is organised around 5 key focus areas: **strategy and governance; training; research; social policy and regional presence; environment**. These five areas are to be assessed on a logic of 5 "continuous improvement" levels, with the central level (Level 3 in the tabular set-out below) being seen as a "benchmark" level representing legislative compliance or similar. Achievements at levels 4 and 5 constitute excellence and leadership.

²²⁸ FONDaTERRA, the European Foundation for Sustainable Territories (*Fondation Européenne pour des Territoires Durables*), was a partnership structure set up in 2004 as an association and transformed in 2009 into a "Partnership Foundation" comprising 4 founding members (EDF, Vinci, GDF-Suez, UVSQ) and thirty contributing members from the business community.

²²⁹ The official website is www.evaddes.com, maintained since 2015 by Tetragora, an association registered under French law (see: <http://www.tetragora.eu/>). Most of the documentation is in French and little is currently in the public domain on line. A detailed presentation of the « référentiel » (evaluation framework and reporting procedures) was available in English, as an EXCEL file, on Internet during 2012-2014. This is one of the sources exploited here.

Table 6. 6: The Matrix Structure of the EVADES Sustainable Campus Evaluation Tool

The Matrix Structure of the EVADES Sustainable Campus Evaluation Tool					
Performance Level EVADES Area of Performance	Level 1 AWARENESS	Level 2 INITIATION	Level 3 CONFORMITY TO GREEN PLAN TARGETS	Level 4 Pro-ACTIVE	Level 5 LEADERSHIP
Strategy & Governance					
Training/Teaching					
Research					
Society and territory					
Environmental management					

Each of the 5 Focus Areas contains a series of "strategic" variables (between 3 and 5 per Area), which are then divided down into "operational" variables. In the 2012 version of EVADES; there are 63 variables, 19 of which are "strategic", as compared with the 129 solely "operational" items of the 2010 framework. The example is given below of *Focus Area 4, Environmental Management, strategic variable 4.1 'Global'*.

EVADES — Focus Area 4 — Environmental Management
4.1 DEVELOP A POLICY COVERING THE REDUCTION OF GREENHOUSE GAS EMISSIONS AND THE SUSTAINABLE USE AND LIMITATION OF RESOURCE CONSUMPTION
<i>Global</i>
4.1.1 Limit emissions and practices that emit greenhouse gases
4.1.2 Implement and integrate environmental, social and use-related energy performance criteria into building specifications
4.1.3 Set up a management system covering employee and student mobility together with an incentives-based policy that promotes the use of soft transport modes
4.1.4 Set up a responsible purchasing policy

As explained by the **EVADES** designers, a strategic variable formalises a major challenge for higher education institutions, and is expected to remain stable over time. By contrast, operational variables are defined by an action against a changing background (targets for National or European Strategies, etc.); they may evolve or disappear in future versions of the framework.

In this regard, the EVADES system, like the "STARS" system already discussed, seeks to provide a "standard reference framework", but then, for practical reasons, introduces flexibility to accommodate diversity of operating conditions. In the EVADES 2012 procedures, not all "operational" variables have to be applied in reporting for a HER institution or its constituent UGOs. This situation is analogous to that already recognised in "STARS". The teams compiling their institution's EVADES auto-evaluation are required to identify and document ACTIONS relating to the different strategic categories; but there is difficulty with maintaining the principle of "standard" categories of actions at the operational level.

This leads us to identify the methodological option of pushing the EVADES strategic/operational distinction to an extreme: Whereas the “**strategic**” categories of reporting cannot be varied, there can be *complete freedom* in the choice of the actions signalled at the “**operational**” level as proofs of institutional commitment and attainment. We will come back to this convention and its advantages shortly.

The tension of standard/flexible procedures shows up in EVADES in other ways too. Self-assessment with EVADES is carried out for a “Campus”, meaning a Geographic and/or Organisational Unit (in French: *unite géographique ou organisationnelle*, UGO) designed to accommodate the wide range of higher education institutions in terms of geographic location (site) and organisation. An institution’s (or UGO’s) progress is tracked, as continuous improvement, by movement to the right across each row of the above EVADES performance table. Institutions with several UGO are, however, confronted with the problem of different assessment levels for a given variable as per the UGOs. In practice, this means creating as many reporting sheets as there are UGOs, in order to frame the Green Plan approach at the level of each Campus/UGO. An institution then has two options when calculating its final rating:

- a) It may decide to treat all UGOs the same; so its overall rating will be obtained simply by averaging the individual assessments of its UGO (weighting = 1);
- b) It may decide to determine the specific weighting for each of its UGOs in the overall rating; the latter therefore represents a weighted average of the individual assessment of its UGOs.

The institution is then free to choose its weighting system. If it chooses to weight UGOs unequally, it is requested to explain the basis for the weights in the documentation sent to the reporting authority (that is, the joint *Conférences* of the Universities and the *Grandes Ecoles*).

The EVADES system at its current level of development (2012-2015) does not facilitate public access to results and comparisons of the self-evaluations. So we do not comment on its features directly in participatory or social networking terms. However, EVADES does present several features of potential interest for a social networking approach to Sustainable Campus Strategy appraisal and comparison.

- A first interesting feature, already highlighted, is the convention of **operational** variables being defined in terms of Actions (or a type of action). This is important because, declaring and judging the quality of an Action is, for most members of a HER community, much more feasible than searching out system data for quantitative indicator estimation.²³⁰
- A second interesting feature in EVADES, is the requirement for the HER institution to mark its advances for each Area — row by row and level by level in the Table.²³¹ This is a feature that could readily lend itself to a social networking process — such as participants’ “endorsing” (as a level of performance) a HER institution’s performance for a particular Area; or participants’ endorsing (as a level of performance) a specific Action as being interesting or pertinent for a performance domain (Area) within an existing or envisaged Campus Sustainability Strategy.

²³⁰ In fact, the 2010-2012 design of EVADES also proposes a process of reporting performance in terms of indicators — one or several for each action. This facet of the system is very data heavy, and many HER establishments would have difficulty with obtaining reliable estimates beyond a small percentage of the suggested indicators. This is a constraint that shows up in many (if not all) evaluation systems that depend on quantitative data to calibrate “indicators”. In the priority that we give to qualitatively described Actions we are seeking a way to sidestep and get beyond this constraint (see out methodological synthesis in Section §5 below).

²³¹ This is different from STARS, which most visibly awards a rating (*Bronze, Silver*, etc.) at aggregate level for the entire spectrum of domains and sub-domains. Of course, these two scoring conventions respond to different needs and could in principle be operated simultaneously.

6.2.4. The EURBANLAB 'B4U' tool & the limits to Benchmarking

We have seen that, although there are some significant differences in institutional ambition, the two systems STARS and EVADES are comparable (i) for their ambition of permitting HEREs to self-report progress year by year and (ii) for their ambition of providing an “objective” basis for rating and ranking. Further, they pursue this ambition of **comparable** auto-valuation in the same way. Although the demarcation of performance areas and sub-categories is somewhat different between EVADES and STARS, they have nonetheless a similar hierarchical structure. HERE sustainability performance is considered in terms of a small number of broad categories (that we can call “top-goals”), each of which is broken down into several “strategic” or intermediate goals, whose content is described in “operational” terms by one or more actions. These actions, and therefore the multi-faceted sustainability strategy as a whole, may finally be characterised by indicators. However, in practice the systems become unwieldy.

- ◆ First, as we have seen, it is difficult — if not impossible — to specify (for each intermediate goal) a full spectrum of actions or categories of action that might be initiated by a HERE. The more one attempts to provide comprehensive coverage of “diversity”, the larger and less intelligible to actors the list will become.

*We have suggested that the only way to get beyond this difficulty, without imposing a straitjacket that will be contested spontaneously by internal and/or external stakeholders, is to establish the methodological rule that, whereas the “strategic” categories of reporting cannot be varied, there is **complete freedom given to the actors in the choice of the actions signalled at the “operational” level as proofs of institutional commitment to and attainment of sustainability outcomes.***

- ◆ Second, this tension between (a) respect of diversity and (b) comparability based on a set of categories common to all HERE, is compounded if we move from the qualitative specification of Actions to the level of quantitative Indicators.

In order to bring out the importance of these methodology points, we now consider two innovation-research projects financed during 2011-2014 by the Climate KIC (Knowledge Innovation Community). These projects have pertinence in several respects. First, they propose frameworks that can be applied for characterising HEREs as actors in territorial eco-innovation and, by extension, in partnerships for sustainability. More particularly, each of these projects — EURBANLAB and SCLC — has sought to provide Internet-based tools and methods for applications in a collaborative learning process, addressing climate change, sustainability and resiliency of urban systems.

The EURBANLAB Project invested in the use of multi-criteria frameworks for analysis and evaluation that enable different stakeholders to compare qualitatively and quantitatively, how their respective territorial eco-innovation projects may perform. The **EURBANLAB** hypothesis was that for “stakeholders” in society — including decision makers in public administration and company management roles as well as scientists, entrepreneurs and the public at large — learning about climate innovation challenges can effectively be achieved by participation in procedures (real or simulated) of selection and deployment of indicator systems for a multi-criteria evaluation activity.

Evaluation in the **EURBANLAB** context can be focussed on a single technology or investment action, or it can be comparative across different options, sites or technologies. For a dynamic learning community, the accent is placed on comparative evaluation and thus, learning from others’ experiences.

The chosen approach was the application of multi-criteria assessment, through development of a web-based tool called ‘B4U’ (Benchmarking for You) providing a framework of indicator-based appraisal relative to sustainability criteria. Climate innovation solutions are considered qualitatively against high-level

sustainability criteria. These “top-goals” are the **5P’s, People, Planet, Profit, Propagation Potential, Process (Governance)**. For each of the top-goals, a set of specific performance concepts are articulated as “intermediate” multiple bottom lines: the “sub-goals”. We present in the figure below (Table 6.7), a 2014 specification of the Top-goals and their respective Sub-goals.

Figure 6. 1: “Top-Goals” 5P’s, People, Planet, Profit, Propagation Potential, Process (Governance)

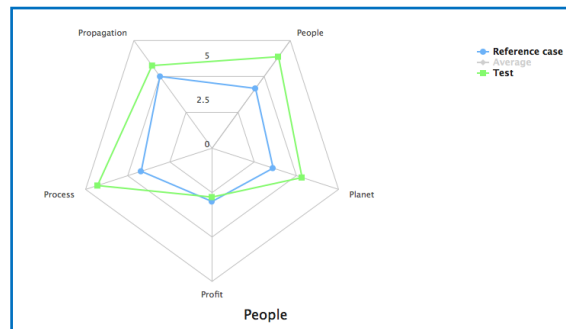
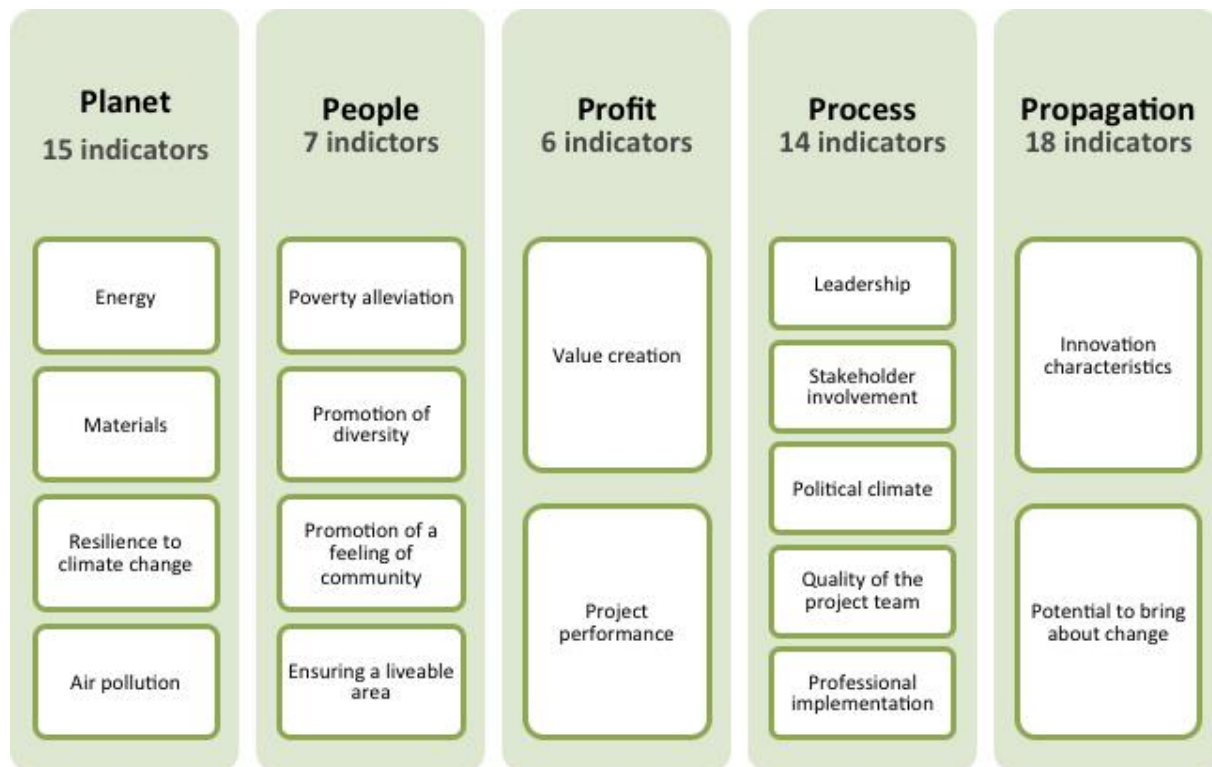


Table 6. 7: The EURBANLAB ‘B4U’ Top-goal & Sub-goal Structure²³²



Finally, an anchoring in empirical measurement is provided through a set of (one or more) indicators relating to each sub-goal “bottom line”. Each indicator is calibrated with reference values, so that a score between 0 and 10 is obtained relative to the WORST and the BEST and cases registered as reference values. A process of aggregation then obtains the average score at the sub-goal level, then at the top-level. The top-

²³² Source : <http://urbanlab.eu/assessments/>. As mentioned, several variants exist for the sub-goal retained for each of the 5Ps. This diagram dating from 2014, presents the top-goal/sub-goal framework and terminology applied for « B4U Self-Assessment » on-line corresponds to comes from the post-project website

goal scores (for each of the 5P's) are then shown in a five-spiked kite or radar diagram.

These conventions were chosen by the EURBANLAB team so as to permit the positioning of each innovation project's performance within the population of innovation cases as it grows. Thus the 'B4U' (Benchmarking for You) tool seeks explicitly to provide for comparisons — first, the benchmarking, by situating the project relative to the “best in class” (scored 10) for each of the 5P's; and, by extension, the juxtapositioning of two or more “radar” diagrams showing their relative performance for each of the 5P's.

The B4U tool has been implemented on-line in experimental fashion, with several different variations. A review of experience brings to the fore the “trade-offs” imposed by adoption of the conventions permitting benchmarking and comparisons and also highlights the potential of web-based CMS technologies for participative evaluation.

B4U on ePLANETe: The first version of B4U was implemented within the KerBabel 'ePLANETe' collaborative platform. After preliminary work to characterize urban system eco-innovations relative to the full spectrum of economic sectors and environmental services, the operational prototype was oriented towards eco-innovations responding to climate challenges in the building/renovation sector. This version of B4U, although available for on-line use, is not currently proposed for public autonomous exploitation. Rather, it is embedded within the larger ePLANETe gallery structure (<http://eplanete.blue>) and has served as a platform for experimentation across different sectors and across methodological alternatives (e.g., the “generic benchmarking tool” K4U, and the status of 'Actions' in the SCLC Project, see below).

- **The On-line EURBANLAB “Quick Scan Tool”.** At the end of the collaborative phase of the EURBANLAB Project, a stand-alone B4U tool was made available on-line for “Self-Assessment” of urban innovation projects. This variation is intended “...to provide a quick insight into the sustainability impact of urban innovations as well as their applicability in the local context”, and, to this end, the questionnaire format for collection of data is “...designed to allow for a quick evaluation of the project's impact”. The question can, in principle, be completed in less than an hour on-line.²³³ However, there is a sharp unevenness in the type of data requirement for the calibration of sub-goal performance in the People, Process and Propagation categories (which request qualitative impressions from the user), and the requirement for calibration of sub-goal performance in the Planet and Profit categories (which request specific quantitative systems data such as energy use, materials recycling coefficients, GHG gas emissions..., that can be known only after a rigorous technical appraisal).
- **From B4U to K4U:** The version of B4U implemented within the KerBabel 'ePLANETe' collaborative platform was oriented towards eco-innovations in urban systems and, more particularly, the building/renovation sector. Relative to this, work was carried out by the KerBabel team during 2014-2015, to identify adaptations that would make the evaluation procedure applicable to other sectors of innovation and territorial development. This work led to the compilation of a “generic benchmarking tool”, called K4U ((meaning: a **KerBabel Benchmarking Tool** for your particular needs)).²³⁴

²³³ This Quick Scan Tol is presented on : <http://urbanlab.eu/assessments/self-assessment/>. It is accessed (after user registration) at : <http://urbanlab.eu/tool/>. Our remarks are based on use of the self-assessment tool as currently (June 2016) available on this site.

²³⁴ The generic tool name is K4U As signalled on the website <https://proxy.eplanete.net/galleries/dst/allk4u> (which currently is not open to the public), “... Doing a K4U means building an assessment for a particular case study. A specific algorithm converts and aggregates each indicator value to draw a final spider diagram ...”.

- **The application of this K4U** methodology now extends to several sectors. One example is the adaptation of the initial B4U framework to provide a tool permitting the accompaniment of “sustainable construction” projects (Bittencourt, et al, 2014). Since this sector is quite close to the original B4U specification, only marginal modifications were needed at the level of sub-goals. However, the B4U principle of a fixed spectrum of indicators for each sub-goal proved to be very much in tension with the search for proximity to the operational performance preoccupations of individual worksites, and has once again highlighted the pertinence of a “free choice” by users of at least some indicators within the benchmarking framework. A second example is the application to urban transport systems and, more particularly, innovation proposals for “sustainable mobility” at local and territorial scales (Antonov 2014). The resulting tool, called **M4U – “Mobility for You”** — retains the 5P’s at the top-goal level, but introduces significant modifications at both sub-goal and indicator levels. In other words, the two tools B4U and M4U, while identical in their methodological conventions, are quite distinct at the substantive levels of description.

In methodological terms, the EURBANLAB ‘B4U’ and subsequent KerBabel ‘K4U’ developments can usefully be put in comparison with the online deliberation support tool kerDST described in Section §2 of this paper.

1. The KerDST tool provides systematically a “multi-stakeholder” evaluation framework, whereas ‘B4U’ in its on-line 2012-2014 versions did not implement a multi-stakeholder framework.
2. The approach initially adopted with ‘B4U’ was to have a fixed list of indicators for each sub-goal, whose estimation then depends on mobilisation of expert knowledge. This contrasts sharply with kerDST, which permits a stakeholder community, working on line or in proximity, to choose freely and declare their selection of indicator concepts as a function of perceived pertinence in a specific context.

In short, the restrictions of the ‘B4U’ procedure are what permit a ‘benchmarking’ process that situates an eco-innovation project unambiguously relative to others, through the “best/worst in class” scoring procedure. But, relative to kerDST, the inflexibility of the tool shows up in several ways: (i) at the level of sub-goals specification, which bears on the variety of innovation situations that can be addressed; (ii) at the level of stakeholder perspectives (there is no design provision for a diversity of judgements that different stakeholders may bring to the same innovation opportunity); and (iii) at the level of indicator selection (pre-established in ‘B4U’, whereas KerDST allows participants as stakeholders to choose freely their selection of indicator concepts).

The relative inflexibility of ‘B4U’ also shows up in the way that the indicators can be scored. In ‘B4U’ the scoring is intended to be ‘objective’, relative to the “BEST” and “WORST” performances registered in the reference population of cases. Whereas KerDST permits, by design, a “subjective” dimension of scoring, through the attribution of a colour judgement to each indicator concept retained in a “basket of indicators” by a given stakeholder for a performance concept (viz., a sub-goal).

6.2.5. From Indicators to Actions — ‘SCLC’ and Social Networking

Experiences with the major institutional programmes such as AACSB and EQUIS, and with sustainability-oriented programmes such as STARS and EVADES, and also EURBANLAB’s ‘B4U’, have revealed that the self-reporting processes are quite onerous.²³⁵

²³⁵ This statement is based on direct experience and contact with users of the cited systems. It is also one of the points made in a more general way by Mathias BOUCKAERT (2016) in his doctoral studies at REEDS (Université Paris Saclay) exploring the pros and cons of different approaches to the evaluation of universities’ performance relative to sustainability.

- The requirement for “verifiable” reporting on specific indicators and ‘objective’ data systems or reference values, is extremely restrictive relative to the likely diversity of stakeholders and their preoccupations.
- It can also become unwieldy in terms of data requirements.
- Such formats of self-evaluation and reporting by an institution rely on a small number of skilled persons, probably busy with multi-tasking; while others may interpret information requests as impossible or as an additional burden. Institutional capacity has a significant financial cost, and can be lost through departure of key people or burnout.
- Unresolved questions thus remain, of how to maintain adhesion to and identification of participating HER institutions and individuals with sustainability values.

If less onerous reporting structures and conventions are adopted — the setting of the sub-goals or categories of action, while leaving freedom for the signaling of specific actions; the setting of sub-goals while leaving freedom in the choice of indicator concepts (and, further, while permitting subjective judgements of quality rather than quantitative measurements) — the principle of strong comparability is compromised. The question that we now pose is, can the benefits of relaxing such restrictions, be shown to outweigh the weakening of comparability?

This takes us back to the question at the outset of this paper, of the uses and purposes of evaluation. By whom? For Whom? Why? At What Scale?

If a purpose of performance evaluation is to provide a focus on and a stimulus for solidarity and partnership, the **acceptance of diversity** (with, by corollary, the weakening of comparability) can be justified both scientifically and politically.

In fact, this diversity is present across several axes simultaneously. There is diversity of actors/stakeholders; there are multiple performance considerations; and the “object” to be evaluated (in our case, a higher education and research institution) can be described across multiple domains and at different scales.

The double question of evaluation actors and **evaluation scale**, was articulated, although not fully implemented, in exploratory action-research work carried out by an international collaborative R&D consortium, the **SCLC Pathfinder Project** funded during 2013-2014 by the Climate KIC and led by eco-innovation specialist teams at TU Delft and Utrecht University in the Netherlands. The project acronym stands for **Synergetic University Campuses boosting ClimatE innovationS in Society** (see the website <http://www.sustainablecampus.eu/>). The **SCLC** as a pilot project sought to catalyse « ... a transition in the role of universities and their campuses allowing for accelerated deployment of innovations throughout campuses and making them a key player in sustainable system innovation. » The intention, only partially achieved, was to develop an Internet-based “**campus transition toolkit**” that would provide Campus management teams with a strategy and with tools for sustainability strategy development and monitoring of progress. Moving beyond the institutional self-reporting logic of STARS and EVADES, the ambition was to implement social networking frameworks that would allow **individuals** acting as members of a *Sustainable Campus Social Network*, to share and comment on **innovation actions** suggested as appropriate for inclusion as building blocks in Campus Sustainability strategies. Preliminary work was undertaken at that time, to define ways that different functionalities of the **ePLANETE collaborative learning and deliberation support platform** system could be exploited to support a user community for the discovery and appraisal of possible Actions, and entire Strategies for a Sustainable Campus, including suggestions about the “transferability” of Actions from one campus/site to others.

6.2.6. Participatory Evaluation as Structured Social Networking

We now try to bring together these different considerations, in order to propose a blueprint for the

implementation of a **participatory Sustainable Campus evaluation process** exploiting social networking procedures. Our intention here is to go beyond institutional self-reporting and to offer a framework that provides meaningful incentives and opportunities, hence motivation, for evaluation activity across an “extended peer community” in and around academic research and higher education.

We will approach this in terms of **evaluation technology**, that is, the structure of the tools being deployed to carry out and communicate HER performance evaluation.

Recall the ‘B4U’ tool at the heart of the EURBANLAB project, which provides for the evaluation of the performance (ex post or ex ante) of innovative techniques, in territorial context, relative to the 5P’s spectrum of climate and sustainability criteria. The ‘B4U’ tool itself is quite restrictive. But the project had other dimensions, including the experimentation of innovative Internet technologies for building “virtual” communities around sustainability. This preoccupation was carried forward by the experimentation of the KerBabel collaborative learning platform called “**ePLANETe**” (see inset box).

The **ePLANETe** system developed by KerBabel™ (based during 2010-2015 at the Centre international REEDS), is simultaneously (1) a modular “Knowledge Gateway” with a spectrum of collaborative learning support functions; (2) an innovative approach to the “integrative” and participatory modelling of eco-socio-economic systems; and (3) a “deliberation support tool” (DST) facilitating the appraisal of sites, scenarios or other situations relative to multiple criteria.

Modules are composed with CMS (content management system) programming tools, to provide galleries of many ‘objects’ of particular types. In technical terms it is a relational data base. From a user point of view, examples of object types are:

PROFILES OF PEOPLE as members of a user community, *PROFILES OF PARTNERS*,

presentations of *IDEAS FOR GREEN ECONOMY INNOVATION*, and of specific *ACTIONS* that are components of, or proposed as desirable components of a wider *SUSTAINABILITY STRATEGY*;

reports of *performance assessments* of a Project or Action relative to CSR/sustainability criteria;

meta-information *PROFILES OF INDICATORS* that may be mobilized as (i) descriptive elements for characterizing a scenario or development strategy, and (ii) normative elements for the evaluation of an action or strategy relative to specified performance criteria

Considered as a whole therefore, **ePLANETe** is an on-line “Collaborative Platform” oriented towards social learning and deliberation support addressing sustainability challenges. Among other uses, it is a “workshop” for experimenting with different arrangements of objects and their cross-links, in support of different participatory evaluation and knowledge sharing tasks.

The EURBANLAB ‘B4U’ evaluation tool is embedded in the ePLANETe composite structure of on-line catalogues or “galleries” of objects. The specific variables or observation concepts that are mobilised to inform the scoring of each Sub-goal in ‘B4U’, are referenced in a Catalogue of *Indicators* (here called the KIC Indicator Kiosk). Further galleries in **ePLANETe** present respectively, *Case study terrains*, *Eco-innovation Actions/Ideas*, and *Analysis Tools*.

Through the KIC Indicator Kiosk, a resource of “candidate indicators” is made available, that can potentially be mobilised for an indicator-based performance judgement. Eco-innovations typically engage a wide variety of “actors”, including partners actively involved in the investment, construction, commercialisation and use processes and also the “external stakeholders” for whom the distribution of benefits and risks will be a key determinant of acceptability. This makes it natural, indeed essential, to open out the ‘B4U’ framework so as to permit multiple judgements in a complementary way. This enrichment can be provided through exploiting the **kerDST Variation ‘D’** design concepts outlined previously, by which we consider eco-innovation opportunities as collective “social choice” problems requiring appraisal in a **multi-stakeholder** as well as multi-criteria framework.

Adopting this convention, we consider that each participating member of the innovation community should be invited to contribute their appraisal of an *Eco-innovation Idea* or a *Terrain* of implementation, with

reference to each of the 5P performance considerations. This was the intuition of the **SCLC Project**, mentioned just above. For the domain of higher education & research institutions' sustainability performance, we consider people — individually or collectively — as de facto members of a **SCSN (Sustainable Campus Social Network)**, and we consider a **SUSTAINABLE CAMPUS STRATEGY (SCS)** — existing or hypothetical — as made up of **ACTIONS**.

This yields that

- These **Actions**, and therefore the **Sustainable Campus Strategy** as a whole, are characterised in terms of their attributes, referred to as **INDICATORS**, which can be of various forms and types.
- Each of these **Actions**, and therefore the **Strategy** as a whole, can be situated in one or more **DOMAINS of Action**.
- A **SCS**, or a component **Action**, is to be judged — *ex post* (for an existing or past situation) or *ex ante* (for any scenario) — for its **Qualities** relative to an agreed spectrum of **SUSTAINABILITY PERFORMANCE CONSIDERATIONS**.

This evaluation is undertaken by people, as **Actors** linked in social networks (the **SCSN, Sustainable Campus Social Networks**) situated across the spectrum of **Higher Education & Research (HER) stakeholders**.

For an operational procedure, the question then is, what precisely might be the contributions that different classes of participants in such a SCSN (*Sustainable Campus Social Network*) **can easily make** (in terms of time and knowledge) and, **will be motivated to make** (in terms of added value for themselves through visibility or other factors), to a higher education? Building on the preceding evaluation methodology considerations,

- It may logically be proposed that participants in a **HERE** evaluation exercise could mobilise **Indicators**. But this leaves still open three essential questions:
 - Precisely what sorts of indicators might be mobilised with regard to each of the different **DOMAINS** and Sub-Domains of **HERE** ?
 - Are these indicators to be mobilised for quality/performance judgements at the level of individual **ACTIONS**, or at the level of a **SCS (Sustainable Campus Strategy)** as a whole, or at both these levels?
- (3a) By whom (that is, which categories of stakeholders) are these indicators are to be mobilized, at each level and for each Domain/Sub-domain?
- It may also logically be proposed to mobilise individual **ACTIONS** as carriers of a quality judgement relative to the higher-order **SCS (Sustainable Campus Strategy)**. In other words, we can envisage **nested judgements**, moving upwards from individual Indicators, to Actions, to Campus-level Strategies. And so the analogous question will need to be posed:
- (3b) By whom (that is, which categories of stakeholders) might '**ACTIONS**' be mobilized, for each Domain/Sub-domain, in order to build a composition evaluation of an overall **SCS (Sustainable Campus Strategy)** ?
- What conventions are to be applied to convey performance/quality judgements at each level of evaluation, and in building 'composite' indicators from lower to higher levels? In a sense this is a multi-dimensional "aggregation" problem, which requires for each of the following axes:
- (4a) Moving from **Indicators** to Performance Sub-Goal to Top-Goals (the **7 ETHICAL BOTTOM LINES**);
- (4b) Moving from **ACTIONS** (with their various attributes), to the individual **DOMAINS (AND SUB-DOMAINS)** of action(s), to an overall vision of a HER institution's **SUSTAINABILITY STRATEGY**;
- (4c) Moving from **Individual** participants to **STAKEHOLDER CLASSES**, and to an overall judgement about a

HER INSTITUTION'S SUSTAINABILITY PERFORMANCE.

Without real surprise, we arrive back at the three dimensions of the KerBabel “deliberation Matrix” structure (Actors, Performance Issues, Objects to be evaluated), but with some added complexity — notably with the description of the evaluation “objects” as either an existing Strategy or a Hypothetical Strategy composed of many different Actions each associated by declaration of the contributing participant with one or more specific Domains (or sub-domains).

Within this robust structure, we can equally apply conventions of evaluation that are intuitive for the contributors and for the observers. We suggest a simple adaptation of the KerBabel Deliberation Matrix's colour conventions, with each Action being scored for its quality, with reference to a given Performance Issue, along the 5-point scale as follows:

Level 1	Level 2	Level 3	Level 4	Level 5
AWARENESS	INITIATION	CONFORMITY	Pro-ACTIVE	LEADERSHIP

With these conventions, a full “social networking” approach can be exploited as the basis for an ongoing process of multi-stakeholder multi-criteria evaluation of an actual or hypothetical Higher Education and research strategy.

6.3. Social Networking for Deliberation in support of Sustainable Campuses

In conclusion, on the basis of programmes and tools for Quality Assessment (henceforth QA) in and of HER establishments, we have proposed an architecture for development of ***IT tools for participatory and deliberative QA in Research & Higher Education***. In these proposals, we have focussed particularly on the question of the place of stakeholder dialogues in HER performance assessment. We seek to highlight ways that participation can not only contribute to CSR data and to robust performance assessments (e.g., for selection and application of pertinent indicators), but also to build a sense of collective purpose and responsibility. Across the spectrum of programmes reviewed, we have thus given special attention to three methodological points:

- (i) The structure of QA, in terms of performance concepts and criteria, indicators & actions;
- (ii) The ways in which the HER stakeholders are engaged in and by the QA process: in its structure; in furnishing data, and in sharing data and judgements (at various levels and facets of information and deliberation).
- (iii) How IT is exploited to support and facilitate the QA and the sharing of outcomes.

As will be shown in the conference presentation, the various specific “recipes” proposed by different institutions, can be obtained by imposing “filters” to select the corresponding Domains and Performance fields, and then by applying specific supplementary conventions for scoring. These latter, the specific evaluation procedures, can in fact be considered as the declaration of specific types of objects within an IT universe, and the production of data corresponding to such an object can itself be considered as an ‘Action’ within the participatory evaluation space.

This means that, among other things, participants in the evaluation community can, if they wish, provide an endorsement of the institutionally recognised evaluation objects, signalling their view of their pertinence and their contribution to Sustainable Campus quality for specified Domains and Performance themes.

In conclusion, these proposals for an ***IT social networking approach*** to HER performance appraisal,

monitoring and communication are considered as, on the one hand an experiment in “open innovation” and, on the other hand an experiment as the possibilities of “IT for green”. As with all innovation concepts, they carry specific biases and are not without risks. Our proposals for promoting sustainability in and through HER engage actively with several recognised threats to the normative ideals of a smart green economy: on the one hand the ‘Data Deluge’ (whose net effect is to bury notions of individual and collective responsibility); and, on the other hand the Prisoners’ Dilemma (whose effect is to dissipate hope through absence of accountability and solidarity). By pushing forward our experiments, we will learn more about institutional, technological and cognitive dimensions of success (and failure) in the construction and maintenance of desired solidarities.

CHAPTER 7: EVALUATION OF EPLANETE.BLUE PLATFORM IN HIGHER EDUCATION AND RESEARCH ESTABLISHMENT

The main goal of ePLANETe blue platform is to provide citizens and organizations a collaborative space where they can identify education and innovative solving solutions to achieve the new sustainability challenges for knowledge economy and society. EPLANETe blue provides a Knowledge-based online education Platform offering a set of tools and services to support the whole Social Innovation Project life cycle from problem identification and awareness and deliberation about collective decision-making, design and implementation. Two experiences are presented as a way to exploit ePLANETe.Blue platform as an integrated innovative pedagogic process. Each of the two activities will be supported by a specific service in this innovative platform. The first activity is the related to the exploitation of outputs of a research project, EJOLT, mobilising the concept of “roadmap” as a way to create the opportunity of a progressive disclosure in a pedagogic perspective. The second activity is on collaborative learning (and pedagogic) process by the mobilisation of different tools in the research project AGREGA.

7.1. Presentation of the EJOLT Project

The increase in global demand for the knowledge society and industrial economies intensifies the extraction and production of conflict-and resistance-generating wastes related to social and environmental impacts. These conflicts are characterised by controversies and strong uncertainties around the facts. This development has been accompanied by scandals related to corruption, denunciation and multiplication of cases of social and environmental injustices, which are hurting the governance of countries and engendering a breakdown of trust between the elites and the local population.

Scientific knowledge becomes an integral part of discussions. Companies and Governments tend to favour scientific knowledge to justify their decisions, thereby rejecting the arguments put forward by those affected by environmental degradation. In this way, the polluters spill the burden of proof, leaving the communities impacted by the need to prove and demonstrate the harm. This is where the need for research based on community involvement arises.

The European project EJOLT (environmental justice organizations, liabilities and trade) brings together a consortium of international research actors, non-profit associations and non-governmental organizations to collaborate and promote mutual learning among stakeholders in the context of participatory research and action on sustainable development issues, in particular on aspects of ecological distribution. Conflicts of unequal distribution of environmental rights, pollution levels and access to natural resources and environmental services are concerned (Martinez-Alier and O'Connor, 1996, Martinez-Alier et al., 2010). This goes through a participatory process of knowledge transfer in both directions. The EJOLT project promotes, on the one hand, participatory action research projects and, on the other hand, the transfer of methods with which environmental justice organisations (ECAs), communities and citizen movements can observe and describe the State of their environment, and document its degradation. It is also a question of allowing learning through the exchange of experiences of each other, but also, with academic research, in order to develop strategies to reduce environmental liabilities, i.e. the pressures carried out on the environment by economic activities or ecological debts, evoking the socio-environmental responsibilities and obligations arising therefrom (Muradian and Martinez-Alier, 2001; Martinez-Alier, 2002). This project also helps to translate the results of this mutual learning process into the political arenas.

The EJOLT project encompasses four pillars that bring together the main themes of the conflicts of environmental justice: conflicts around nuclear energy, oil and gas extraction as well as climatic injustices; biomass and land disputes; conflicts around mining; and those concerning the dismantling of ships and electronic waste. Five transversal axes are also being worked out: the construction of a mapping of socio-

environmental conflicts, the assessment of environmental health through an understanding of the relationships between environmental variables and health human rights, risk assessment, assessment of human activity pressures on the environment, law and institutions and, lastly, notions of consumption, unequal ecological exchange and ecological debt.

7.1.1. **Developing RoadMap as a way to discover evaluation process outputs**

REEDS International Research Centre (Research in Ecological economics, Eco-innovation and tool Development for Sustainability) was a partner in a major European project to empower environmental justice organisations and improve collaborative research on environmental conflicts. This project has been funded by the European Commission FP7 Science in Society programme over four years at a total cost of nearly four million euros and involves 23 members representing 20 countries throughout Europe, the African continent, Asia and South America.

REEDS has considerable expertise in economic and environmental valuation and sustainability indicators, eco-innovation strategies and corporate social responsibility, deliberation support in the public and private sectors as well as monitoring and information systems for socio-economic and environmental values. What this means is that REEDS provided training materials, workshops, and advice relating to case studies of environmental injustice in an academically robust yet very practical way to other members of the project, in particular the Environmental Justice Organisations (EJOs).

EJOs are civil society organisations locally or globally involved in conflicts over resource extraction or waste disposal. Such conflicts are increasing in number as the world economy uses more materials and energy. A primary objective of this project is to empower EJOs and the communities they support that receive an unfair share of environmental burdens to defend or reclaim their rights.

This project focuses on the areas of Nuclear energy, Oil & gas extraction/Climate Justice, Environmental health & risk assessment, Liabilities and valuation and Training in best practices and policy recommendations. To combat environmental damage by human activity it is necessary to be able to monitor and measure it as well as determine the actual costs in order to discover how to mitigate it and take legal actions for appropriate compensation to affected communities. This module will illustrate real examples from EJOs and will link into modules on Ecological Economics and Evaluation.

Throughout the process EJOs have been introduced to a number of tools developed by REEDS that they used them for assessment and learning, such as KerDST (deliberation matrix) and the Forest of Brocéliande (for pedagogic resources).

By retaining the different stages of INTEGRAAL, the approach emphasized not only the capacity building of stakeholders, but also the desirability of participatory research based on the capacity of civil society to conduct analysis and create assessments “from scratch”. The ePLANETe portal, through the various links between the galleries, allowed all, to access and share experiences of discovery and deliberation around environmental conflicts, both from the cognitive and meta-cognitive point of view, in particular by the understanding of the issues, methods and interpretation of situation assessments. **7.1.** shows the cross-links that are established between the INTEGRAAL integrated assessment method and the various galleries and tools of the ePLANETe knowledge portal. The RoadMaps is an integrated analysis that define different cognitive pathways related to environmental injustice problems. Each step translates into a specific task for the EJO, a specific type of advice that may be asked of REEDS and into one or several units of information produced by the EJO to document this process.

Table 7. 1 : How case studies information works towards creating documentation and teaching materials

WP11 -EJOs Training, Report Outline		Outline for case studies (EJOLT template)	Integraal framework (REEDS methodology)	learning & Documenting process in Brocéliande (REEDS tool)
Stage 1. Narrative description of the case study [see Report Outline doc in EJOLT Dropbox]	Step 1	From the “Background”, the “Description of project” and the “The conflict” sections in the Narrative (page 6)	Description of social choice problem and context	- Presentation of the case study, context and social choice problem. - Who is bringing this case to study or evaluation? Fruits: docs from EJO.
Stakeholders (Actors) involved and their roles	Step 2	From “Description of project”: “Actors promoting the project” adding other stakeholders. → “Impacts of the project” can give you insights on the performance issues.	Structure the social problem: a. Stakeholders (actors), b. Options to be assessed, c. Performance issues (value criteria)	How the social choice problem was structured in the exercise.
Stage 2 in the Outline doc as well as leading into Stage 3	Step 3	Part 2 “Relevant data for the analysis of the conflict and its impacts” of the Outline for core case studies. →	a. Gather and start to organise information. b. Structure information. Create an indicator kiosk.	Summary of how the catalogue of indicators was built. Fruits: the list of indicators if available, a link to the deliberation on KerDST.
	Step 4	Related to “Analysis of the case”, which can give some insights, or be an exercise done according to the rules of the exercise type	a. Choose assessment type. b. Conduct evaluation or deliberation exercise.	The choice of a particular assessment type/method. Summary of the evaluation/delibe ration exercise
	Step 5	Think about elements you	Communication	A presentation of

		want to communicate, and each stage of the Outline description of your case.	results and recommendations via appropriate channels	the types of communication conducted, text elements.
	Step 6	Would you frame your case study differently, had you started with this assessment exercise?	Reflection on process 1 to 5 and on original issue.	A summary of the reflections done.

Each steps also translates into the use of specific gallery in ePLANETE.blue, in order to frame Knowledge and its use.

The INTEGRAAL steps	Description	Cross-links with ePLANETE Galleries
Step 1-discover and co-construct the problem	The objective of this step is to define the problem of social choice.	<p><u>The profiles of the "hotspots"</u>: hotspot profiles are based on a part of the descriptive information of the case studies presented in the Atlas of environmental conflicts (www.ejatlas.com) and the news links about in the EJOLT blog (http://www.ejolt.org/section/blog/).</p> <p><u>BROCELIANDE</u> (broceliande.kerbabel.net): to access and discover online educational resources on evaluation approaches in the field of sustainable development</p>
Step 2-structuring the problem in terms of social choice problem	To construct the problem as a problem of social choice, it is a question of defining the categories of actors, of the performance stakes (i.e. socially defined criteria) and of the situations to be compared, through an iterative process of analysis of the literature and appropriation of the problem studied, in particular from the consultation of the relevant actors. These components are the basis for the structuring of multi-stakeholders and multicriteria evaluation, and correspond to the 3 axes of the deliberation matrix used in step 4.	<p><u>Gallery "shipyard/Espace INTEGRAAL "</u>: discover other experiences of mobilising the INTEGRAAL method on similar or other problems</p> <p><u>BROCELIANDE</u>: to access and discover online educational resources on issues of social choice and evaluation</p>
Step 3-represent the problem of social choice	<p>Any multi-stakeholders and multicriteria evaluation is based on the participants' appreciation of the pertinence of the knowledge.</p> <p>While the majority of actors are already aware of the situation, knowledge is often unshared, heterogeneous and poorly disseminated. Using this KerBabel Representation Rack, participants will find information gaps or uncertainties related to absence of analysis. This identification will allow them to be presented to the participants and sometimes to fill them</p>	<p><u>The KerBabel Indicator Kiosk</u>: Identification of indicator related to environmental justice problems.</p> <p><u>Gallery "theories, methods and tools "</u>: detailed presentation of theories, methods and analysis tools</p> <p><u>Gallery "KerBabel Representation Rack"</u> that aims to identify pertinent indicators using 4 axes (Knowledge carriers; Tools/Method/Theory; Issues and Scenarios)</p>

	by the contribution of new knowledge. This is a dynamic approach to dialogue between knowledge carriers, whether scientific, expert or not.	
Step 4-evaluate and deliberate	Developing a sustainability assessment approach can be carried out in a mono framework (monetary evaluation, physical unit evaluation) or multicritère. It can be carried out by experts or by stakeholders. As part of the INTEGRAAL, each situation must be assessed against each of the performance issues identified in step 2. In addition, each stakeholder category or actor within a stakeholder group produces its own assessment of the performance of each situation. This allows everyone to express, with their language, in a common framework, their assessment, through their judgement, of the situation.	<p><u>Gallery evaluation</u>: possibility to access different experiences of evaluation approaches mobilising a variety of tools and methods</p> <p><u>KerBabel™ matrix of deliberation (KerDST)</u>: is a multi-actor and multicriters tool for deliberation that can be used in situations of social choice and evaluation.</p>
Step 5-communicating	<p>The analysis of the results will be very variable from one study case to another, since this analysis will depend on the results obtained and the communication process defined.</p> <p>The INTEGRAAL approach is iterative, i.e. you can go back to any stage when evaluating multi-actors and multicriters, if necessary. Step 5 goes beyond that because it is cross-sectional by construction. A communication process must be in place throughout the evaluation – in both written and oral form – and must be determined from the outset (even if changes may occur as needed). The communication must, on the one hand, be one of the objectives defined in step 1 and, on the other hand, take into account all the objectives. It ensures the reality of the problem insofar as without the involvement of the actors, the evaluation will have no reality. It is through communication that actors can take ownership of knowledge and thus enter into a collective process in which negotiations are to be put in place.</p>	<p><u>NEWSREELS</u>: use of the online news presentation system to present the main results of the study conducted and to access current information about related activities.</p> <p><u>BROCELIANDE</u>: to construct a detailed presentation of the evaluation approach chosen to address this issue. It is a question of valuing this experience in the form of a RoadMap.</p> <p><u>The gardens of BABEL</u>: this storage and referencing space (reports, video, URL link, PDF) is mobilized in each of the steps to make complementary elements accessible. It is also possible to use it to discover documents relating to, for example, the EJOLT project, depending on the rights associated with the user community to which you belong.</p>
Step 6-question	Step 6 of the INTEGRAAL approach is to question the whole evaluation process. This leads in a sense to go back to step 1 in a reflexive way.	<u>PANORAMIX</u> : possibility to access the presentations of the various approaches to valorization of collaborative activities (scientific articles, websites, events, etc.)

Framing EJOLT Project Roadmap using INTEGRAAL stages and ePLANETe.blue Galleries

7.1.2. The EJOLT Project Roadshow: Application to Madagascar case studies

The **Environmental Justice Organisations, Liabilities and Trade (EJOLT)** project, in which this work has been led, addressed these socio-environmental conflicts and helped the Environmental Justice Organisations (EJOs) to map them in the Environmental Justice Atlas (EJAtlas). To date, REEDS Researchers have sixteen conflicts from Madagascar reported on the EJAtlas (Raharinirina et al., 2018). They have been included in the database in collaboration with civil society organisations (not exclusively EJOs), investigative journalists and scholars from Madagascar. Both are socio-environmental conflicts which imply that they highlight the distributive and structural impacts of economic activities on the health and environment of specific populations. The effects may be economic, health impacts, economic, socio-cultural or environmental (Martinez-Alier et al, 2010). Currently, socio-environmental conflicts are visible or latent.

The EJOLT Project RoadShow is a way to mobilise Broceliande Forest Gallery. It aims at framing a progressive disclosure of output of EJOLT research project in the virtual library of online teaching resources. As presented in Chapter 4, Broceliande Forest Gallery is composed by Pathways, Areas and Grains.

Figure 7. 1: Presentation of the EJOLT RoadShow in the Forest of Broceliande Gallery

The screenshot shows the EJOLT website interface. At the top, there is a navigation bar with the text "You are in ePLANETe > Broceliande Forest Gallery > Space PEDAGOGIC RESOURCES". Below this is a header section with a circular logo on the left and the text "Module: EJOLT - Ilmenite Exploitation in Madagascar" and "The Forest of Brocéliande" on the right. A "Table of Contents" link is visible. Below the header is a contact information bar for "Brocéliande team" and a language selector. The main content area is divided into three columns: "Pathways available" (with links for Introduction, EJOLT RoadShow: Mobilising Justice Principles, and EJOLT RoadShow: Mobilising Stakeholders to build the problem), "Environmental Integrated Analysis of Ilmenite exploitation in Madagascar" (with detailed text about the QJM project), and "Crosslinks by Gallery" (with a list of links like BROCELIANDE, T Area, T Grain, Mining, etc.).

7.1.3. The EJATLAS and the concept of Hotspots in the ePLANETe.blue (Step 1)

As part of this research project, environmental justice organisations have been asked to mobilize and test, for their case studies, the tools, methods and approaches proposed by the EJOLT project. The exchanges between the OJE and the project scientists at workshops have helped to strengthen the capacity to build the environmental justice issues of each of them. Dissemination and training materials have been developed and are available on the EJOLT website (www.ejolt.org). They are available to all stakeholders, including journalists, environmental activists, parliamentarians, businesses and Government representatives.

One of EJOLT's flagship achievements is the construction of a global mapping of environmental justice conflicts (ejatlas.org). The aim is to establish a database of profiles of socio-environmental conflicts in order to understand the determinants of mobilizations of local communities against economic activities whose environmental impacts are important (temper et al., 2015). More than 2700 cases are presented. EJATLAS is an independent website of what is called "Hotspots" in ePLANETe.Blue platform.

The EJAtlas provides a knowledge tool. Knowledge carriers can be scientists, EJO, International NGO's, inhabitants, industries, authorities at local, regional, national or international levels... It aims to help denounce cases of environmental injustice, to encourage dialogue and exchange of experiences, ideas, data and strategies for action, to link with resources in the form of reports on concrete cases, legal disputes, and other relevant issues, to sensitize the media, public opinion and decision-makers for the implementation of public policies more favourable to environmental justice, to develop and strengthen strategies international articulation on environmental justice issues, and to contribute to new processes of knowledge creation (temper et al., 2015).

The scientific approach adopted is built from a perspective of political ecology, at various scales (national, regional, local and sectoral). These conflicts usually result from inequality in the distribution of income and power. The construction of the EJAtlas database aims to develop a system in which environmental conflicts can be described, analyzed, compared and interpreted, where quantitative data of activity at the source of dissatisfaction can be gathered, where the modes of mobilization (such as the frequency of participation of indigenous groups in such conflicts, the rates of success in stopping the extraction projects or the introduction of new regulations) can be discerned and lessons can be learned (temper et al., 2015).

7.1.4. **The Representation Rack applied to injustice problems (Step 3)**

The analyses underlying the assessment and compensation process are often based on the possibility of monetization of the environment and the rationality of the market. Socio-environmental conflicts show the importance of taking local information into account in order to identify the feasibility and acceptability of such an approach. O'Connor (2006) specifies the four categories of irreducible information for the construction of the representation of an environmental problem: economic information and environmental information characterizing the system, local information, through community knowledge and values, and political or institutional information.

The challenge of the ePLANETe Portal is therefore to offer a platform allowing an integrative and interdisciplinary approach (Gallopín et al., 2001) for the expression and recognition of the different "languages of valuation" (Martinez-Alier et al., 2015), such as social metabolism, ecological debt, cost-benefit analysis... or the languages of local communities relating to the way of life, to cultural and sacred values, to the environment. Different tools are needed to carry out such an approach.

In his book, "The environmentalism of the poor. A study of ecological conflicts and valuation", Joan Martinez-Alier (2002) shows that struggles and mobilizations are less often aimed at preserving nature than claiming the necessary environmental quality of communities' living places Human. Various expressions of the environmental inequalities felt by individuals can be used to represent the same reality. The forms of domination of certain individuals on other individuals are strengthened by the use of evaluation systems as a basis for the decision. However, these environmental assessment systems are irreducibly plural. However, these environmental assessment systems cannot be reduced to formal approaches, carried out by experts, scientists... They are irreducibly plural.

For example, in the case of the extraction of ilmenite by Rio Tinto/QMM at Taolagnaro, a system of compensation for environmental damage, relocation of populations and environmental benefits (conservation programs of the biodiversity) has been put in place. Land grabbing was strongly criticized by the beneficiaries and actors of civil society, Malagasy and international scientists and Malagasy politicians. Numerous demonstrations took place between 2009 and 2014 to request a recalculation of the amount of compensation and for a greater number of jobs offered to the local population. The sale price of the m² was estimated between 100 and 6.000 ariary Malagasy (approximately US \$0.04 to US \$2.41).

In order to structure the analysis of this challenge, for example, one must succeed in identifying and

understanding the diversity of modes of representation of the problem. This is the objective of the computer tool imagined and created in 2014 within the ePLANETe portal, the KerBabel Representation Rack. Specifically, it proposes a process, combining objective and subjective dimensions, to identify and collect the knowledge associated with a socio-environmental conflict, on the one hand, and, on the other hand, to provide the opportunity to Knowledge Carriers to assess the pertinence of knowledge in relation to the way in which the representation of the conflict is constructed.

The first step is to identify the knowledge carriers (environmental justice organisations, the extractive industry, local authorities, international associations, scientists, experts...) and the conceptual approaches related to the production of knowledge (whether derived from academic work, expert reports, or in the form of vernacular knowledge) to understand the foundations of representations of injustices Environmental.

In a second step, it is necessary to re-populate the knowledge in the analysis of environmental injustice. In order to be able to describe the expressions of environmental injustices, REEDS Researchers chose to retain the inequality dimensions as common criteria for describing and comparing the different socio-environmental conflicts studied (Douguet et al., 2016). This approach does not deny the plurality of expressions of inequality in culturally diverse contexts. REEDS Researchers propose to mobilise inequality dimensions identified using existing typologies: Sen (2009) and Nussbaum (2011) on capabilities, Maslow (1964/2004) and Max-Neef (1991) on basic needs, Honneth (2000) on recognition, Arnstein (1969) on participation, Martinez-Alier & O'Connor (1996) on the economic and ecological distribution distribution, O'Connor (2006) on sustainability (see box 1).

Box 1: presentation of axis 4 of the representation grid: the comparison criteria in terms of the dimensions of inequality:

- Recognition: linked to self-esteem (Rawls, 1971), to practical reasoning, to the ability to consider other human and non-human beings and who are capable of imagining the situation of another (Nussbaum, 2004; Honneth, 2000).
- Participation: the means to be part of a policy process and decision makers (Arnstein, 1969)
- Economic distribution: deals with the distribution of benefits, opportunities, risks and costs for individuals or sectors of society concerned, or through generations through time, etc.) (O'Connor, 2002)
- Ecological distribution struggles over pollution levels or sacrifices to extract resources (Martinez-Alier et al., 2010)
- Creation ("wealth of being"): the ability of an individual to express himself without constraint, freely (Maslow, 1964/2004, Max NEBS, 1991, Nussbaum, 2011)
- Subsistence ("poverty of being "): means to support oneself at a level minimum but it is also the protection, the ability to pay attention to others, of adaptation and autonomy (Max-Neef, 1991, Nussbaum, 2011).

Thus constituted, the KerBabel Representation Rack combines a diversity of knowledge, which can be constituted in the form of indicators, qualitative or quantitative, proto-indicators, concepts, ideas, how to describe the injustice Environmental. For the case of Madagascar, the first conflicts identified for the use of the representation grid are (1) the operation of ilmenite at Ranobe and (2) at Fort-Dauphin (Rio Tinto/QMM), (3) the nickel and cobalt operation in Ambatovy, (4) the fisheries with the European Union, (5) REDD + (reduction of emissions from deforestation and forest degradation) proposed in the framework of the holistic forest conservation programme in southern Madagascar.

In addition to its structuring, the representation grid allows each knowledge holder to propose knowledge which he considers relevant according to the four axes chosen, namely: knowledge-carriers, conceptual approaches, criteria (inequality dimension) and the situations to be compared (socio-environmental conflicts). Knowledge carriers provide an index of pertinence for each of the indicators selected, for each crossing of the values on the four axes (van der Sluijs, Douguet et al., 2008; Douguet, O'Connor et al., 2009;

Funtowicz and Ravetz, 1994). It will have to choose between "0 " which means "no pertinence " (default), "1 " - "low pertinence "; "4 " - "strong pertinence ".

The KerBabel Representation Rack allows to structure the diversity of the existing modes of representation concerning the conflicts studied, according to different actors. This creates an interface between the production of knowledge by various actors and the way in which this knowledge can be mobilized to represent the socio-environmental conflict. As the KerBabel Representation Rack is a computer tool, the processing of information is simplified to understand who the knowledge carriers are, what knowledge is necessary to understand the question, for example, of distribution or by crossing all requests referring to two or more axes of classification of the information

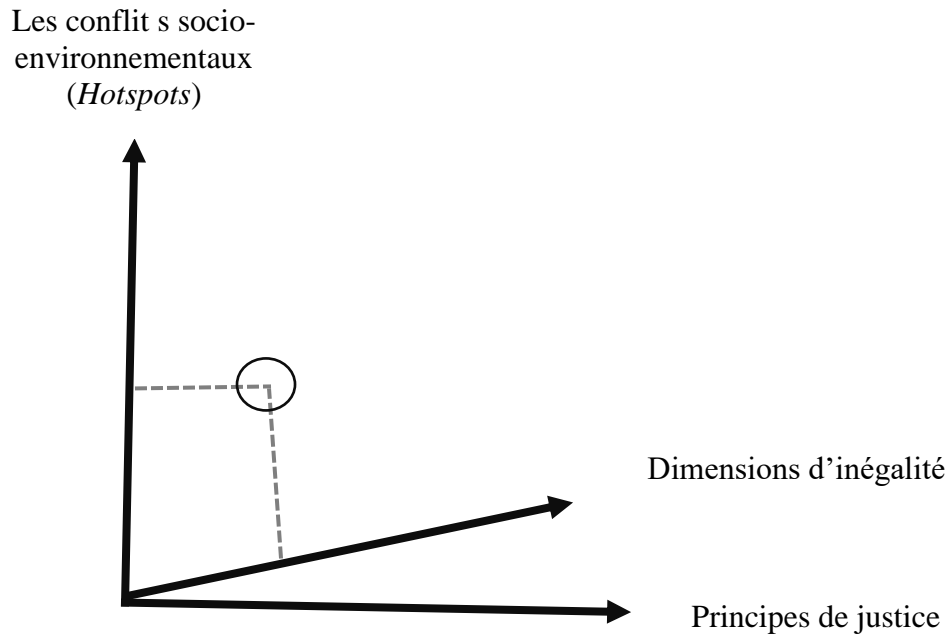
7.1.5. Using the Deliberation Matrix to injustice problems (Step 4)

While the KerBabel Representation Rack makes explicit the diversity of the modes of representation of inequality, the fact remains that actors perceive injustice differently. If the dimensions of inequality allow the different actors to describe the situation experienced, recourse to an analysis in terms of principles of Justice proposes a normative approach. It makes explicit the principles of Justice to which the actors refer in order to judge the injustice of the situation experienced.

The approach taken in this analysis is to compare the different socio-environmental conflicts from the point of view of the principles of Justice and by retaining the dimensions of inequality. To enable this comparison, we selected the deliberation matrix, an online multi-actor and multicriters evaluation tool from ePLANETE (O'Connor et al., 2007; Raharinirina V., O'Connor M., 2010). Conceived on the idea of Rubik's cube (TM), the deliberation matrix is a method and a computer tool that allows to structure the comparison of the forms of injustices associated with different socio-environmental conflicts. The first step is the definition of the different axes:

- What are the situations to compare? Here, it is the socio-environmental conflicts studied as identified in the representation grid.
- What are the comparison criteria? We have retained the dimensions of inequality as identified in the representation grid.
- A focus on the categories of stakeholders could be used to analyse their position in relation to conflict. This axis is possible, but has not been privileged as part of this research.
- What are the principles of Justice? Referring to the literature in the field of philosophy (notably, Schlosberg, 2013; Walzer, 1983), we can identify the following principles (see box 2).
- The second step is the composition of a basket of indicators at the level of each cross between the values of the three axes selected (see Figure 1 for a presentation of the structure of the deliberation matrix, i.e., the presentation of the forms injustice for a conflict (hotspots in Figure 1 below). In other words, the aim is to analyse, for each of the different socio-environmental conflicts studied, the forms of environmental injustice. The latter correspond to the crossing of the six inequality dimensions and the eight principles of Justice, i.e. 48 possible crosses by conflict. Their characterization is accomplished through the selection of possible indicators for each of the crosses expressing the expression of injustices as experienced by the knowledge carriers

Figure 7. 2: Structure de la Matrice de délibération



Through this example on the mobilisation of the roadshow using ePLANETe.blue platform, it was a question of presenting an interdisciplinary approach, in a broad sense, mobilising various forms of knowledge and methods as well as user-friendly tools for a diversity of actors, in order to accompany them in dialogue processes around environmental justice issues. The power of the roadshow and the ease of access to the Internet are new ways to explore to involve the actors of society, in particular, in research activities, to imagine, to build and to implement collective actions. The explosion of the use of social networks questions us about the necessary structuring of the knowledge brought by the Internet users, to represent the problems and to consider ways of restitution of judgments carried out. The current development of ePLANETe is in this direction, to create new interfaces

Box 2: Principles of Justice (Douguet et al., 2016):

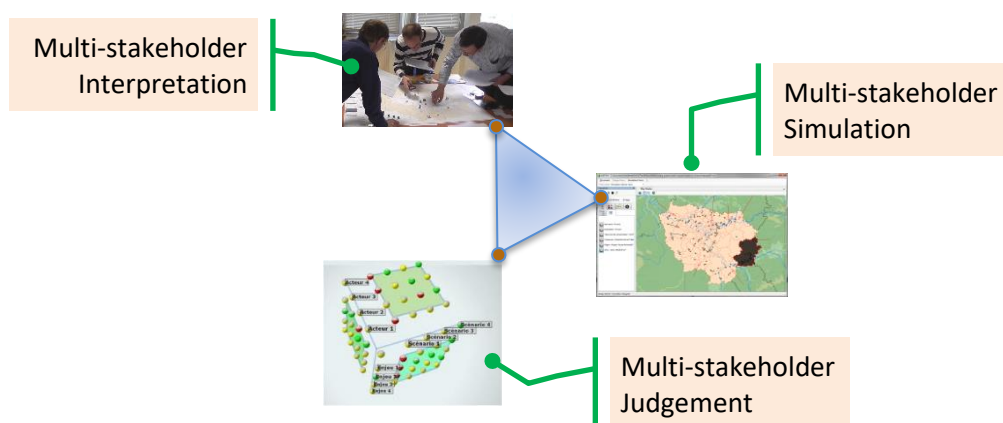
- Recognition (Social-Social Interface) is related to self-esteem (Rawls, 1971), to practical reasoning as a way of being able to engage in critical reflection and to form judgments and, to affiliation which refers to the recognition given to those who shape society, who show concern for the other humans and non-humans and, who are able to imagine the situation of another (Nussbaum, 2004; Honneth, 2000).
- Participation (Social-Institutional Interface) is about means to be part of a policy and decision processes. More precisely, participation, is defined as the redistribution of power that enables people who are excluded from the political and economic processes, to be deliberately included in (Arnstein, 1969). It involves peoples in a social process, in which they have to use their sense of curiosity, of intuition, of critical capacity, they can access to new inform, develop arguments, reflexivity, the respect of others and the capacity of understanding others points of view and have a sense of belonging (for example, to a stakeholder category).
- Distribution refers to the amount of relevant thing that accrues to each individual or group of individuals. Distributive justice may refer to widely different interpretations (see Lamont and Favor, 2012, for an overview), such as strict egalitarianism (e.g. Cohen, 2008), the 'difference principle' (Rawls, 1971), equality of opportunity and luck egalitarianism (e.g. Dworkin, 2000), welfare based principles (e.g. Arneson, 1989), desert-based principles (e.g. Locke, 1690 [2005]), feminist principles (e.g. Garvey, 2011) and libertarian principles (e.g. Nozick, 1974) of distributive justice. It deals also with time (intragenerational, intergenerational) and with space. Following the Martinez-Alier & O'Connor (1996), we distinguish economic distribution and ecological distribution.
 - Economic distribution (Social-Economic Interface) which deals with the distributions of benefits, opportunities, risks and costs for the individuals or sectors of society concerned, or across generations through time, etc.). In other words, it is related to the choice of distribution of wealth and (re)distribution of sacrifice (O'Connor, 2002; Samuels et al., 1997)
 - Ecological distribution (Social-Environmental Interface) refer to struggles over the burdens of pollution or over the sacrifices made to extract resources, and they arise from inequalities of income and power (Martinez-Alier et al., 2010).
- It was proposed to distinguish two principles, Subsistence and Creation, related to the capabilities and functioning approach (Sen, Nussbaum, Rauschmayer & al...) and of basic needs (Max-Neef). It refers to the conditions or states of enablement that make it possible to achieve things.
 - Subsistence is usually defined as means for supporting oneself at a minimum level. More precisely, this refers to the provision of the basic materials needed to live "to the end of a human life of normal length" such as food, freshwater, the ingredients of medicines that prevent diseases, the forms of energy necessary for regulating one's body temperature (Nussbaum, 2011). It includes ecological dimension such as livestock and agricultural product on which humans depend, soils, cycle nutrients (oxygen, water, nitrogen,), economic dimension such as possesses enough goods to be used by a particular nation to maintain its existence and provides little to no surplus for other investments, and social and institutional dimensions, about mental and physical health, dignity, power mode, types of activity, manner of dress, lifestyle, environmental living (Max Neef, 1991, Nussbaum, 2011). Subsistence is also about protection, to pay attention to others, ability to adapt and autonomy.
 - Creation is generally considered as the ability of an individual or group to imagine or construct and implement a new concept, a new object or to find an original solution to a problem. According to social and institutional dimensions, creation is about self accomplishment (Maslow, 1964/2004), the use of senses, imagination, curiosity, spontaneity, tranquillity, thinking and reasoning (Max Neef, 1991, Nussbaum, 2011) and, freedom of expression, with respect to both political and artistic speech and freedom of religious exercise. It is related to means to build their own future, to leisure and to free time, to spatial and environmental dimensions such as landscapes, intimate spaces.

7.2. Collaborative learning process: The AGREGA Project

Financed by the French National Research Agency (ANR) as part of its theme "Towards a Circular Economy – Associated Methodology and Services", the AGREGA project wants to provide a cornerstone in supplying scientific means of dialogue, by developing three tools that are functionally independent but complementary: a set of scenario interpretations (role plays), a model for simulating scenarios and a tool for evaluating scenarios.²³⁶ The simulation tool evaluates "Aggregate and Construction Waste" systems objectively (by estimating variables) whereas the judgement tool evaluates these systems subjectively (giving a social meaning), and the role plays fall in between.

With the construction of Grand Paris Express (SGP, 2018), the construction of 70,000 housing units per year, the organization of the Olympic Games in 2024, the Europacity project, etc., supply of aggregate in the Ile-de-France region (Paris and the surrounding area) will be a major issue in the coming years (Panorama IdF, 2017). So, facing this expected growth in demand, the profession has announced a production tension, as different constraints become more intense (PIPAME, 2016): de facto constraints (urbanization and the like), environmental constraints (recommendations from the French authorities, in this case the regional department for energy and the environment, DRIEE, to reduce alluvial production) and societal constraints (resistance by residents to new facilities because the activity is a source of inconvenience). Waste recycling still remains an option because, among others, the process benefits from better resident acceptability (possibility of facilities in urban areas, backfilling quarries), and it is supported by a European Directive (OJEUW, 2008) that sets a minimum material reclamation objective for 2020 at 70% by weight of waste from construction and demolition activity. However, the use of recycling remains limited (ratio capped in concrete production, cost of materials handling still estimated to be high, etc.). What is more, because of competition, the sector perceives resistance from companies establishing inert waste storage facilities. So after the Ile-de-France region recommended suspending the extension/creation of new inert waste storage facilities in Seine-et-Marne for 3 years, to boost recycling (PREDEC, 2015), this measure was cancelled (Le Parisien, 2016).

Figure 7. 3: : The three AGREGA tools developed to analyse scenarios



The entire situation justifies the need for all those involved in Ile-de-France to talk and together build future scenarios for aggregate supply and waste reclamation, a dialogue whose results would contribute to the implementation of future regional schemes for quarries and regional plans for management of

²³⁶ The AGREGA project was financed by the French National Research Agency (ANR), under reference ANR-13-ECOT-0008, and was conducted as part of its Ecotechnologies & EcoServices programme, sub-theme Towards a Circular Economy – Methodology and Associated Services

construction waste. To implement this, the idea, inspired by (Chamaret et al., 2009), consists in leveraging scientific methods that publically recognize the plurality of the values and, in the same way, to publically indicate the issue of the research (or lack of research) for all the diverse stakeholders coexisting. These scientific methods would allow stakeholders in Ile-de-France to mould more, sometimes diverse opinions, on the different scenarios that they build together. Consequently, this multi-stakeholder discussion should not be about eliminating the contradictions but instead to admit them and discover original ways to articulate them and allow action.

7.2.1. The circularity of the aggregate sector

Following Douguet et al. (in press), the circular economy denotes an economic model whose objective is to produce goods and services sustainably, limiting consumption and waste of resources (raw materials, water, energy) and waste production. This breaks the linear economy model (extract, produce, consume, discard) to move to a "circular" economy model.

The concept of circular economy officially entered into law in France in the law on Energy Transition for Green Growth of 17 August 2015 (JORF, 2015). This law recognized the transition to a circular economy as a national objective and as one of the pillars of sustainable development. The transition towards a circular economy requires progress in several domains:

- Sustainable supply: take into account the environmental and social impacts of the resources used, particularly those associated with their extraction and exploitation;
- Eco-design: taking into account environmental impacts on the entire life cycle of a product and integrate them from the design stage;
- Industrial and territorial ecology: synergize and mutualize between several economic stakeholders the flow of materials, energy, water, infrastructures, goods or even services to optimize the use of resources in a region;
- The economy of functionality: prefer use to possession, sell a service rather than a good.
- Responsible consumption: take into account the environmental and social impacts of all steps in the product life cycle in the choice of purchasing, whether the buyer is public or private;
- Lengthening the duration of use of products by means of repair, second-hand sale or purchasing, or donations, as part of reemployment and reuse;
- Improvement of prevention, management and recycling of waste, including reinjecting and reusing materials from waste in the economic cycle.

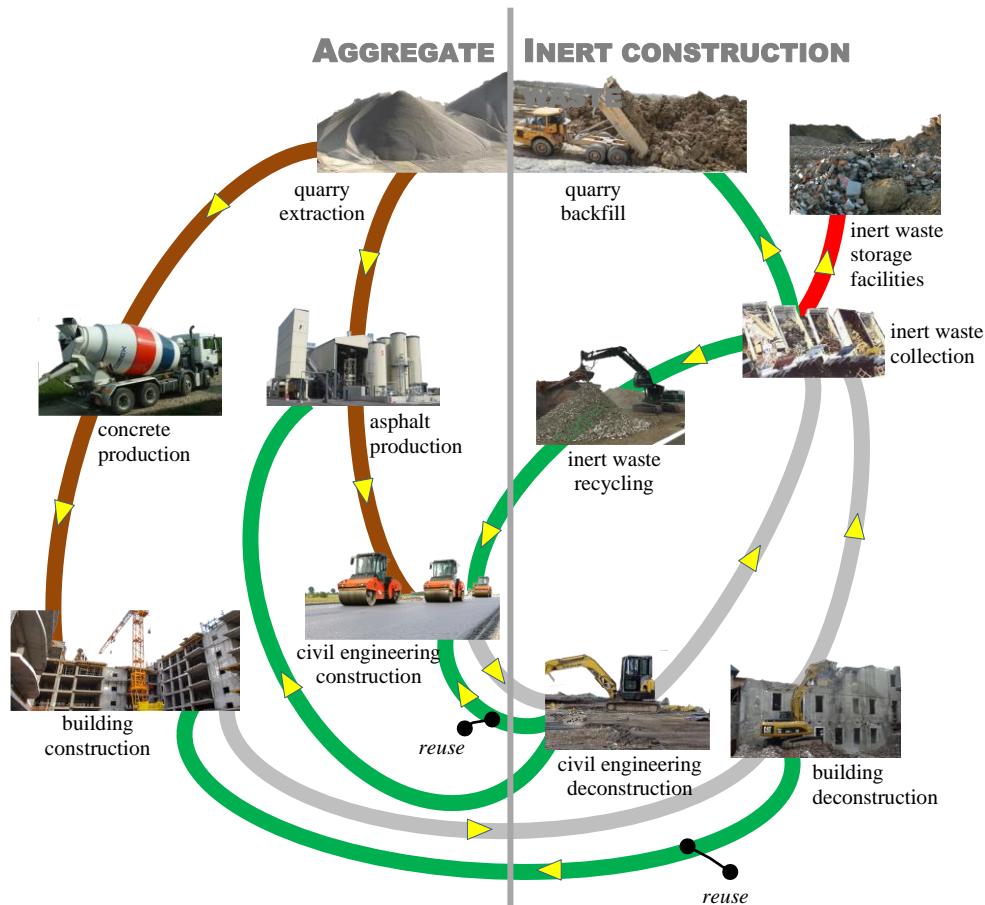
The law of circular economy also contains structuring objectives concerning waste prevention and management:

- Waste prevention: to reduce by 10% the quantities of household and similar waste, and to stabilize the quantities of waste from economic activities produced in 2020 relative to 2010;
- Recycling: to reach in 2025 65% of recycling for non-hazardous non-inert waste;
- To reduce landfill by half in 2025 relative to 2010.

The circular economy has been a substantial area of work for the European Commission for a long time (OJEUW, 2008). Like in France, the circular economy is perceived at the European level as a means of improving the environment, while strengthening and sustaining the industry, particularly by securing the supply of raw materials through greater use of materials from waste recycling. The move to a circular economy is at the core of the initiative on the effective use of resources established from the Europe 2020 strategy for intelligent, sustainable and inclusive growth.

Figure 7.4. tells us how to express forms of circularity in the aggregate sector, in terms of materials. This figure is inspired by (PanoramaldF, 2017) but there the "waste" section focuses on inert construction waste.

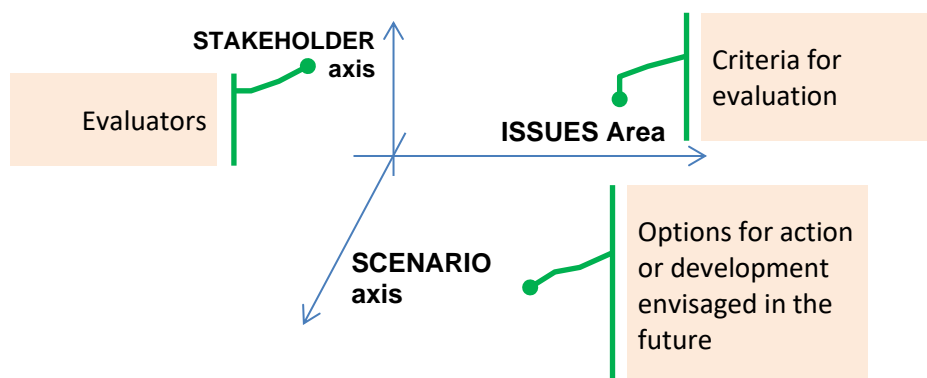
Figure 7. 4: A view of circularity in the aggregate sector, focused on the secondary circuit (on the right), on inert construction waste



7.2.2. Evaluating forms of circularity in aggregate sectors: The use of the Deliberation Matrix

To allow comparison of different aggregate supply and waste reclamation scenarios, Douguet et al. (in press) selected the "Deliberation Matrix" tool, an online tool for multi-stakeholder and multi-criterion evaluation from ePLANETe. Designed on the idea of the Rubik's Cube(TM), the Deliberation Matrix constitutes a method and an electronic tool that allows the comparison of forms of associated injustices to be structured with different socio-environmental conflicts. It implements 3 axes of multi-criterion and multi-stakeholder evaluation: (1) an axis of categories of stakeholders, those who will make an assessment, (2) an axis of performance issues and (3) an axis of supply and reclamation scenarios.

Figure 7. 5: Summary of axes involved in the subjective evaluation



This matrix is filled in two steps. The first step is the definition of elements located in the various axes, with the following questions:

- Stakeholders axis: who are the stakeholders?
- Issues axis: what are the criteria for comparison?
- Scenarios axis: which are the situations to be compared?

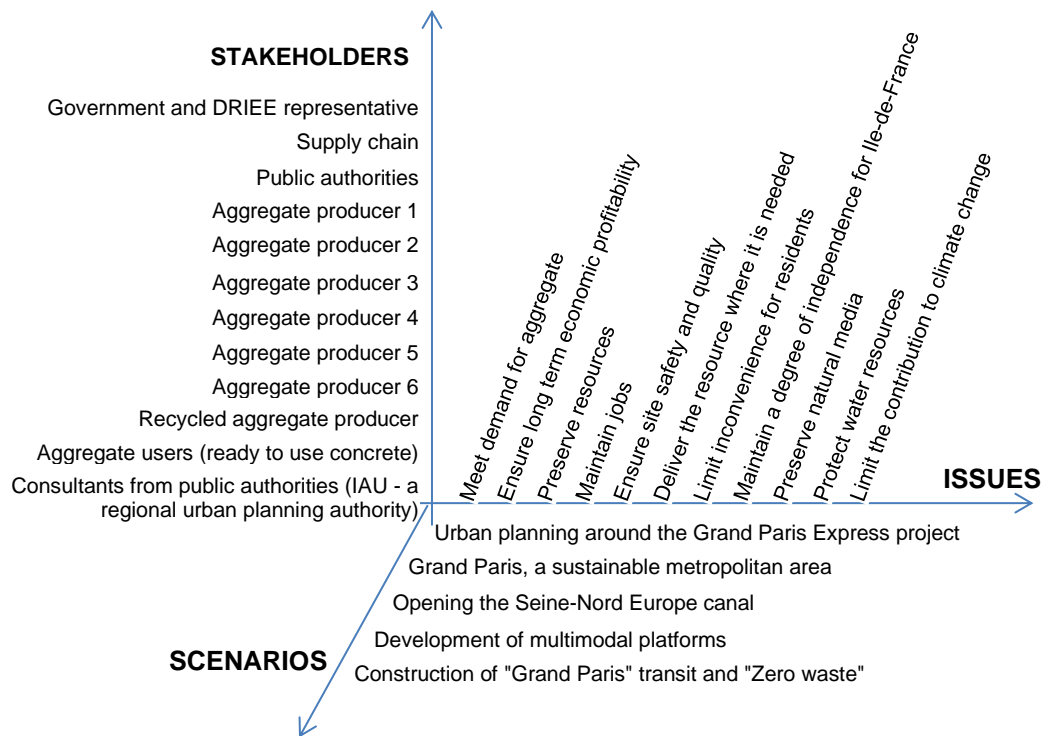
The second step of completion is the conclusion itself. The stakeholders' conclusion corresponds to the intersection of the three axes. For each of the different scenarios studied, the conclusion is made by creating a "matrix segment" presented at the intersections, risks and opportunities, as expressed by a category of stakeholders, by resituating relative to the performance issues. The matrix is therefore composed of different segments representing the conclusions issued by the different categories of stakeholders. To be more precise:

Stakeholders identified

10 categories of stakeholders were identified to represent the diverse primary and secondary (recycling) group in the aggregate sector:

- Aggregate producers (professional associations, integrated groups, small and medium sized businesses)
- National bodies and their representatives (MEDDE, DREAL, DRIEE, the Prefectures)
- Ile-de-France region
- Local public stakeholders (General counsels, Société du Grand Paris, SCOT, PNR, etc.)
- Consultants from public authorities (IAU, ADEME, Agence de l'Eau, etc.)
- Users (Union representatives from the Fédération Nationale des Travaux Publics, Syndicat Français des Industries Cimentières, Syndicat National des Entreprises de Démolition)
- Stakeholders from the supply chain (e.g. HAROPAPORT, SNCF, VNF, RFF)
- Scientists
- Community associations (e.g. environmental associations)
- User representatives (fishermen)

The last two stakeholder categories did the initial interview (to set up the 3 axes) but did not participate in the concluding session. In the category of aggregate producer, 6 different stakeholders were interviewed.



Summary of elements on the stakeholders/issues/scenarios axes. So in all, the Stakeholder axis has 12 stakeholders

Performance issues identified

Douguet et al. (in press) identified 11 performance issues. These issues represent the conditions in which the "Aggregate supply and waste reclamation in Ile-de-France" can be viewed as part of a circular economy (Chamaret, 2015). These performance issues show challenges for the economy, not only through accounting for materials circularity, but also how the activity affects biosphere cycles (water, carbon, biodiversity).

- Meet demand for aggregate

Ile-de-France consumes about 30 million tonnes of aggregate per year. Its needs are essentially for concrete for building and future transport infrastructure (as road building projects are in a good state). The Grand Paris project causes a substantial unknown for future needs. Aggregate producers only have a few levers on demand. They can only meet demand. One of the difficulties in managing aggregate supply is related to the lack of information on needs, which makes the work of planning difficult for all stakeholders.

- Ensure long term economic profitability

The production of aggregate requires substantial onsite investments, so long term management (it may take more than 10 years to open a site). This element causes relative inertia in companies, who cannot change strategy quickly.

- Preserve resources

Aggregate is an exhaustible resource, though reserves are still substantial in France. Nevertheless, increased scarcity of alluvial resources, a high quality material, mean that it is now reserved for more noble uses like concrete manufacturing, whereas previously it had been also used for roads. This observation obliges the profession to find alternatives to this material, and also new uses.

- Maintain jobs

Quarries provide jobs. The 1550 companies employ 14,660 people. Indirect jobs are estimated at 50,000 (UNPG, 2011). These are mainly onsite jobs, so they are important in the current economic context.

- Ensure site safety and quality

Quality and safety issues are substantial in construction. However, they do compete with the issue of resource preservation. Research and development work has been conducted in various fields (constructors, concrete and cement producers, quarrymen) to ensure the same quality of work with less material. This question is being asked particularly for materials from recycling, whose use today is very regulated. This issue could also be looked into for understanding the development of new techniques related to recycling.

- Deliver the resource where it is needed

For aggregate, the question of transport and logistics is major: for heavy but cheap resources, transport costs make up a substantial portion of final cost. Aggregate transporters double their price for every 30 km. So there is a massification issue for the resource for better economic profitability.

- Limit inconvenience and disturbances for residents

Aggregate extraction does not profit residents, yet they have to suffer the disturbance it causes: noise, dust, traffic, changing landscape, etc. Ever increasing opposition to quarries opening is an expression of NIMBY (not in my back yard) syndrome that we find for much industrial activity. Elected officials, often unaware of materials questions, often follow the opinion of their constituents and oppose projects (in particular by supporting urban planning regulation).

- Maintain the current level of independence for Ile-de-France

Ile-de-France extracts about 11 million tonnes of aggregate per year, to which we must add the production of alternative materials from concrete recycling, asphalt and clinkers from incineration of household waste (5.5 million tonnes). With its average annual consumption of 30 million tonnes, the region has an average need deficit of 45%. Therefore, we must import materials from nearby regions but also places further away like Belgium. The decisions to export or not to Ile-de-France are firm decisions, following political reorientations. Therefore, it is important that the region displays a desire to maintain a level of dependence of maximum 45%, even if the feasibility of this objective is questionable for some stakeholders.

- Preserve natural media

There are differences of opinion on the question of whether quarries are beneficial to natural media or not. However, the impacts of the activity on natural media exist. Increased societal interest for the preservation of the environment makes it harder and harder to access the resource with ever increasing exclusion zones.

- Protect water resources

Using aggregate may cause impacts on water resources: water consumption for washing and transformation, risk of proximity to water catchment areas, etc. Using alluvial resources poses a particular problem. Water management plans (Called SDAGE in French) enforce tighter and tighter constraints. It happens that the quarrymen do not obtain enough water to allow them to wash the resource.

- Limit the contribution to climate change and pollution

Like all industrial activity, quarries consume energy and emit greenhouse gases when they extract, transform and transport resources. Depending on the materials and modes of transport, the impact is of varying degrees. However, the difficulties in accessing the resource lead to sites becoming progressively further from production and therefore of greater and greater distances having to be covered. This point means that for some stakeholders, this question is one of the most important for activity.

Scenarios identified

Aggregate is a low value-added product. Its price depends mainly on transport and handling costs. Imagining supply scenarios from a circular economy perspective requires identification of key variables and how they change over space and time, depending on the various contexts.

As a result, 5 aggregate supply and waste reclamation scenarios (Horizon 2018-2030) have been defined, with broad participation, to envisage different situations in which the opportunities and risks of developing a circular economy around aggregate supply are mixed.

- Urban planning around the Grand Paris Express

This scenario proposes (a) retaining the major developments that are part of constructing Grand Paris for a more cohesive region, (b) anticipating environmental changes and (c) consolidating the attractiveness of this space. In this vast project, components relate to: (1) improved habitat, (2) rail infrastructure that needs to be modernized and developed. A network transport project, the Grand Paris Express, whose route has been specified and should achieve this.

- Grand Paris, a sustainable metropolitan area

This scenario repeats much of Scenario 1, but also integrates new aggregate needs relating to organizing the 2024 Summer Olympic Games in Paris, Europa City, redevelopment of the Plateau of Saclay.

- Opening the Seine-Nord Europe canal

This scenario carries out in two steps. The first step is the construction of the Seine Nord Europe canal, which will connect the river Oise to the Dunkerque-Escaut canal, from Compiègne to Aubencheul-au-Bac, near Cambrai. The large canal construction site (107 km) will lead to redevelopment for 7 years (from 2018 to 2024) requiring substantial transport of materials such as backfill and rubble, rip-rap and alluvium, of about 57 million cubic metres. In a second step, from 2024, river transport will become more important, passing from 28% today to 30% in 2030.

- Development of multimodal platforms in the transport of aggregate and waste

The development of massified, alternative and complementary modes of transporting merchandise other than roads is a national political priority in France. These alternative modes would actively contribute to the reduction of greenhouse gas emissions (This may coincide with the French regulation on the polluting emissions of motors [Engins Mobiles Non Routiers (EMNR)] coming into effect in 2019.). To tackle this situation, various choices have been made. One is to develop multimodal platforms in a 30 km network around Paris Petite Couronne (inner Paris), along supply axes (rail, river, road).

- Construction of "Grand Paris" and "Zero waste"

In this scenario, the objective is to achieve "Zero waste" to inert waste storage facilities to maximize recycling and reclamation. In the regional plan for prevention and waste management from construction sites (PREDEC, 2015), six major issues have been identified, looking out to 2020 and 2026: (1) generalize and systematize recycling; (2) strengthen offering and develop the demand for recycled aggregate; (3) develop reemployment, reuse and recycling of inert excavated earth; (4) supervise practices during floor elevation (5) favouring backfill by inert waste as part of redevelopment of quarries and (6) ensuring territorial reequilibration of storage capacities for inert waste.

7.2.3. Collaborative learning process

The various performance issues have allowed us to structure the challenges of a circular economy for supplying aggregate in the Ile-de-France region. However, we observe that the challenges are not even for all of the issues, scenarios and impacts. Certainly, recycling is involved in most of the issues to varying degrees depending on the issue and not always with the same effects: often positive (employment, etc.)

but also sometimes negative (e.g. disturbance, increased CO2 if increased incorporation in concrete production – because of the cement, etc.). Moreover, recycling is not the only contributor to the challenge: backfill is also concerned, in particular to meet the issues of long term economic profitability (because long term recycling profitability alone is not guaranteed) or even to absorb the effects of increased aggregate demand (for some of the scenarios evaluated). In all, this is not only about imagining forms of recycling or waste reclamation, but also of the insertion of production, transport, use, recycling and reclamation activities into the biosphere cycles. Developing circular economy strategies requires strengthening of the coordination between the stakeholders to mobilize governance forms including land use planning projects. However, we have not solved all of the issues at this time, because according to our work, there will always be scenarios that involve sending waste to inert waste storage facilities.

In spite of our efforts, the interviews did not allow us to determine an opinion on all of the links in the circular sector (See Figure 4). The construction stakeholders are missing, as are inert waste storage facility managers, railroad stakeholders and associations representing environmental matters and local residents. All interpretation of results from this work will take account of this situation.

Moreover, whereas the specificity of this approach to evaluation is the engagement of a diverse set of formal (from results of simulation or observation) or informal knowledge, the knowledge from this formal portion could not be taken into account in the judgement process, since the modelling portion is still under development. More generally, the knowledge from the two other tools planned as part of AGREGA, the simulation model and the set of roles (reminder Figure 1), have not really been taken into account. Consequently, we have not for example considered space and time during this deliberation process, i.e. the element bearing the knowledge on how geographic distribution of offers, demands and constraints of the sector changes over time (prospective), and along the sector's supply chain. This mechanism for spatial and dynamic representation of indicators would however merit being strengthened (Andriamasinoro, 2013) to enrich the debate.

The perspectives for connecting these three tools (towards integrated analysis) are detailed in the sections that follow.

Connecting the matrix with the modelling

It is not easy to develop this modelling, to objectively represent the "Aggregate and Construction Waste" system. Indeed, as we drew our conclusions, Douguet et al. (in press) observed at least two points that make the model harder to construct. First, there are controversies about two important figures. The first figure relates to how many housing units are built per year: stakeholders claims vary from 45,000 to 70,000 units per year. The second figure is the limit of aggregate production, in Ile-de-France and imported from other regions: what is the threshold where we will have to consider structural changes in the production of natural aggregates? Secondly, the modelling requires access to a set of data to represent the system. But this data is not all easily accessible (for example, the flow of materials to produce secondary aggregate). To move forward on these points, it would be interesting to use related scientific work such as (Augiseau & Barles, 2017), which also tackles the problem of "Aggregate and Construction Waste" in Ile-de-France. Once the modelling method has been developed, the next step will be to establish a bridge

- Between the objective knowledge from this scientific modelling work, which will provide estimations about key variables (economic, risk, environmental, etc.)
- Those necessary for the decision process in legislation or management strategies.

Establishing this path is not easy because it requires mobilization of two knowledge systems:

- Positive use of knowledge to represent the situation or simulate possible changes
- Normative use to give it social meaning, where knowledge serves as arguments to express the conclusion provided.

One possible mode of operation for this path would be management of emerging areas (David, 2010). Indeed, from these simulation models new objective knowledge will probably emerge on aggregate supply or waste management. However, and to repeat (David, 2010), although the simulation is indispensable, the most interesting emerging area will not them be the phenomena in the simulation but those of new ideas that this simulation would raise in stakeholders, and what will feed their reflections and analyses as they draw conclusions on the scenarios. This is even more true when as (Feitosa, Bao Le, & Vlek, 2011) reminds us correctly, any result from an exercise modelling complex systems does not represent precise provisions or deterministic responses and that the results of such an exercise ought mainly to serve to feed public debate (In our case, the conclusion of AGREGA scenarios).

Connecting the matrix with the set of roles

The other element of the AGREGA project that has to be connected with the matrix is the sets of roles. This is a different but complementary way that the Deliberation Matrix will be used to make a subjective evaluation of the scenarios in the "aggregate/construction waste" system in Ile-de-France. Currently, the set is developed either for pedagogical reasons (De Yrigoyen, 2017) or in for more operational purposes (Le Port, 2017) but in any case, this is independent work.

The bridge between matrix and sets of roles is being built. The first experimentation currently consists, in a pedagogical sense, of alternating each turn – where one turn corresponds to one scenario - with an evaluation process for the scenario that is being interpreted. Figure 7.6. shows a photo of a session of this type, taken in February 2018. The current results are limited to the identification of indicators (known or emerging from discussions) that can be implemented for the two tools simultaneously and to the improvement of the logistic block between the two tools.

Figure 7. 6: Photo of a session (February 2018) aiming to connect sets of roles (interpretation of scenarios) and completing the deliberation matrix (evaluation of the scenarios)



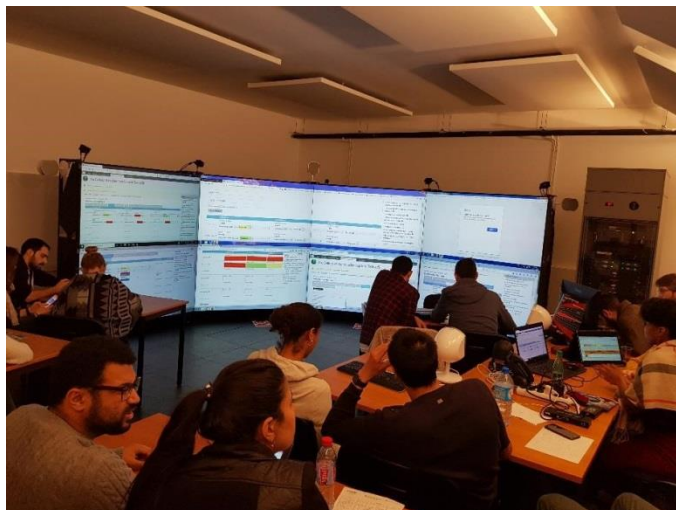
Connecting the matrix and the modelling with MIRE:

Different evaluation sessions to assess the supply of aggregates in Greater Paris were carried out in the MIRE room (Immersive Wall for Research and Education) of the DIGISCOPE (www.digiscope.fr) within the Observatory of Versailles Saint-Quentin-en-Yvelines. MIRE is a large stereoscopic image wall with a motion tracking system, characterized by a curved configuration favoring immersion.

DIGISCOPE is a network of platforms for the interactive visualization of large quantities of data and complex calculations. Installed within the Paris-Saclay University, the ten rooms of DIGISCOPE are interconnected by a telepresence network allowing remote collaboration. Targeted applications are scientific research, industrial design, decision support and training. Each of the MIRE screens is controlled independently from a desktop computer, a laptop, a tablet or a smartphone. All the knowledge gathered and results are gathered within the ePLANETe Blue.

In the context of the construction of the Representation Rack, the use of MIRE enabled the different groups of knowledge holders to attribute and judge the relevance of the Indicators of other categories of knowledge carriers. The use of the ePLANETe.blue portal makes it possible to engage students and teachers in collaborative learning. Indeed, collaboration is based on a common goal, each member realizing part of the overall task, drawing on the resources of the environment, in its own resources (AGREGA project) and in those of the group. Focus groups were formed autonomously, to deliberate around the relevance of the Indicators in relation to the four axes of the Representation Rack. These groups are formed between students playing the same role of Knowledge Carriers.

Figure 7. 7: The exploitation of ePLANETe.Blue in MIRE



The figure 7.7. presents the opportunities offered by the use of MIRE to observe, exchange and change the positions of the different actors in the framework of the construction of judgments in the evaluation using the Deliberation Matrix. MIRE presents the results of the evaluation, each of the other screens allows different categories of actors / stakeholders to provide judgments. Unlike the Representation Rack, where students play the role of knowledge Carriers, as part of the Deliberation Matrix, students take on the role of stakeholder. New groups of students were formed and new consultations were conducted.

Restitution of the results of the evaluation of aggregates supply strategies for the construction of Greater Paris can also be done using MIRE. It allows students and teachers to support the presentation or discussion around the results of the Deliberation Matrix by interacting directly with interactive screens. Several levels of restitution were mobilized at the level of the Representation Rack and the Deliberation Matrix:

At the level of the Representation Rack:

- Restitution using a slice of the Representation Rack to present either the positioning of a knowledge carriers for all objects to be compared for all issues for all conceptual approaches, or analysis, from the point of view of an issue, of the set of objects to be compared for all the actors for all the conceptual approaches, ie the analysis, from the point of view of an object to be compared, of the set of issues for all actors for all conceptual approaches or, for a conceptual approach, the analysis of all the objects to be compared, for all issues and for all stakeholders.
- Restitution using the information concerning the relevance of the indicators for the crossing of the 4 axes constituting the Representation Rack
- Restitution using information on the mobilization of indicators

At the level of the Deliberation Matrix:

- Restitution using a slice of Deliberation Matrix to present either the positioning of an actor for all the objects to compare for all the issues, or the analysis, from the point of view of an issue, of the set of objects to compare for all the actors or, or the analysis, from the point of view of an object to compare, of all the issues for all the actors.
- Restitution using the information contained in a basket of indicators
- Restitution using the information on mobilization of the indicators in the different baskets of judgment in the Deliberation Matrix

GENERAL CONCLUSION

We live in a world in crisis, in a knowledge society, and in an era in which time is liquid: nothing lasts; everything changes and is unstable (Granados. 2015). In a knowledge society, education is the capacity to be creative in an environment of particular uncertainty, the capacity to properly manage the cognitive dissonance that gives rise to our failure to comprehend reality (Innerarity, 2010) The arrival of the knowledge society disrupts the entire education ecology, educators and researchers are convinced of the need to prepare learners to be productive citizens in knowledge societies, and many initiatives have been launched worldwide. When new forms of knowledge and symbolisation qualitatively impregnate all basic aspects of a society, or when a society's structures and processes for reproducing itself are so penetrated by knowledge-dependent operations that information creation operations, symbolic analysis and expert systems are more important than other factors of production, and then we're talking about the knowledge society (ibid, 2010). There are two important challenges: eco-innovation and sustainability that are the key aspects for a better global wealth distribution and combining them looking at a compatible approach to educate, however, how human beings can satisfy their needs without compromising future generations implies in significant changes in human behaviour only achievable by a new educational paradigm (Mota and Oliveira, 2013). In this thesis we have called for the need of new education paradigm as practices of eco-innovation and sustainability where new forms of knowing and learning and how to be human activities in different and diversity as ways to deal with representations learning opportunities and the process of evaluation that have a primary role. Thus, we argue that the "triangle issues" (i) eco-innovation and sustainability; (ii) evaluation of the quality of higher education and research establishments (HERE), and (iii) the specific roles of information technology for green innovation case of '*ePLANETE*' which provides (a) a vehicle for innovation in the conception & delivery of HER sustainability-related programmes and (b) a vehicle for the evaluation of HERE quality in a multi-stakeholder multi-criteria perspective that have been emerged as a paradigm for revising and reorienting today's higher education challenges.

The viewpoints of new **challenges of higher education in the 21st century**, the higher education institutions are clearly in the midst of rapid change in response to environmental, social, economic, technological, and political transformations sweeping the globe (Sarker et al, 2010). In this paper we have mainly used the two supranational organisations *taxonomy due to their functionary features* i.e. Economic Co-operation and Development (OECD) and United Nations Educational, Scientific, and Cultural Organization (UNESCO). Both of the organisations are corresponding the national and international challenges of higher education institutions in advancing the prospection of trends and improvements, as well as in promoting networking and twinning programmes among institutions; encourage international cooperation between institutions in order to share knowledge across borders and facilitate collaboration, which, furthermore, represents an essential element for the construction of a planetary (Morin, 2009) and post-cosmopolitan citizenship (Dobson and Bell, 2006): the assumption of interdependence, "deterritorialisation", participation, co-responsibility, and solidarity among all inhabitants of the planet . The European Union (EC-JRC, 2010), for example, has stressed that higher education must change and adapt to economic and social needs, that institutional change is essential to educational innovation, and that information and communication technologies must form part of the teaching and learning process (Freidenfelds, Kalnins, & Gusca, 2018) . Therefore, universities are facing a number of challenges that have been identified and in this paper and we have picked up 9 important challenges from these as group wise (**Group1:** Education, **Group 2:** Innovation and **Group 3:** Sustainability) that has presented before. Addressing those challenges are critical not only for the future of institutions but also for the world at large. Einstein once said that no problem can be solved from the same level of consciousness that created it (Granados. 2015). Contemporary needs of education for facing the new challenges suggest that we must

learn to view the world and therefore education, in a new way. Higher education has in the past demonstrated its crucial role in introducing change and progress in society and is today considered a key agent in educating new generations to build the future, but this does not exempt it from becoming the object of an internal reformulation²³⁷. According to the World Declaration on Higher Education for the 21st Century (1998), higher education is facing a number of important challenges at the international, national and institutional levels (Freidenfelds, Kalnins, & Gusca, 2018). There are three important challenges that have focussed in this paper as a **Group1- Education Challenges**: Sustainable Development Goal 4: Towards inclusive and equitable quality education and long-life learning for all, Sustainability strategies of Higher Education, and Value Creation Strategic in higher education: Globalization.

In “**Group1- Challenges of education**” that we have presented before in my paper, lifelong learning is at the center of international debate, since it is part of the Agenda 2030 Sustainable Development Goal 4, which urges countries to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”²³⁸. Today, the ideal is creativity: the capacity to learn and a lifelong willingness to face new things and modify learned expectations accordingly; there can be no learning without re-learning, without the revision that must be undertaken when we realise the weakness of what we thought we knew (Granados. 2015). In a knowledge society, education is the capacity to be creative in an environment of particular uncertainty, the capacity to properly manage the cognitive dissonance that gives rise to our failure to comprehend reality (Innerarity, 2010). Therefore, in the world of liquid modernity, we must move away from sporadic education and towards lifelong learning (*Global University Network for Innovation*, 2015). Moreover, The OECD’s 2030 learning framework, ultimately, aims to serve as a life-long and life-wide learning framework for 2030 (Miho Taguma, 2016). Also, Progressing towards sustainable development remains a key global challenge (United Nations, 2016; Holden et al., 2016) and the Sustainability strategies of Higher Education are the key driver in this field. Additionally, the Value Creation Strategic at higher education as well as the Globalization is also a key challenge at higher education. It is inevitable that higher education institutions (HEIs), and higher education systems and policies, are being transformed to globalization by the value creation strategies i.e. Cross-border higher education (CBHE). In the era of globalization, the education, economic, social and cultural changes are combined to increase the competitive advantage of regions that create the best conditions for growth and development. On the other hand, it rests on the first world-wide systems of communications, information, knowledge and culture, tending towards a single world community as Marshall McLuhan (1964) predicted.²³⁹ It is the processes of communications and information, where the economic and cultural aspects are drawn together, that above all constitute what is new about globalization; and inclusion/exclusion in relation to ICT networks and knowledge have become key dividing line in shaping relations of power and inequality (Castells, 2000; Giddens, 2001).

For the “**Group 2- Challenges of innovation**” that we have presented before in my paper. The Innovation in knowledge or methods is the most common form of innovation, with education outperforming all sectors of the economy on this measure (OECD, 2014). Within education, higher education is much more innovative than the primary and secondary levels – and is one of the most innovative sectors of the economy in terms of innovation in knowledge or methods (ibid,2014). Undoubtedly, the capability to innovate and to bring innovation successfully to the sectoral market of institutions will be a crucial

²³⁷ The Challenges of Higher Education in the 21st Century. (2015, May 19). from Guni Network website:

<http://www.guninetwork.org/articles/challenges-higher-education-21st-century>

²³⁸ Lifelong learning | United Nations Educational, Scientific and Cultural Organization. Retrieved from

<http://www.unesco.org/new/en/santiago/education/lifelong-learning/>

²³⁹ Guy Neave’s description of globalisation as “quickening exchange” is suggestive of both its economic and cultural aspects (Neave, 2002, p. 332)

determinant of the global competitiveness of nations over the coming decade (OECD, 2007). There is growing awareness among policymakers that innovative activity of the institutions is the main driver of social and economic progress and well-being as well as a potential factor in meeting global challenges in spheres such as the education transformation to the supporting equitable access to the knowledge Portal for Campus related arrangement and the teaching and Learning inventory for the teaching program; Building capacities and Empowerment by the Campus community, alumni and partnership; and and the Technology facilitation mechanism for building effective partnerships for education

Besides, in “Group 3- Challenges of sustainability”, the highlighted points are the promoting education for sustainable development; Sustainable Development at higher education; Sustainable campus: Green Campus. Those indicates to our imperfect world which is advancing relentlessly towards uncertain future scenarios, and we must try to redirect it towards sustainability, that is, towards a new way of doing things in order to improve our environment while at the same time achieving justice, social equality and economic stability (Granados. 2015). The sustainability in HE remains a rather recent and emerging research area (bursztyn and Drummond 2014; Christie et al. 2013; Müller-Lindeque 2014; Wright 2010), with much research typically focussed on developing descriptive case studies and examples of: good practice of universities in environmental management and greening of university estates and operations; embedding sustainability in specific courses such as environmental sciences, business and engineering; developments in teaching and learning approaches that support sustainability content and outcomes; and analysis of university policy within rather than across cases (Corcoran, Walker, and Wals 2004; Cotton et al. 2009; Fien 2002).

Since the 1970s, higher education institutes (HEi) have tried to improve environmental commitment and sustainable development in their system, including institutional systems, education, research, campus management (Lozano *et al*, 2013). In this context, several policy papers (declarations, charters and initiatives) for higher education for sustainable development have been developed (ibid,2013) so that HEi provide a framework for better implementation of sustainable development in their systems (Freidenfelds, Kalnins, & Gusca, 2018). Some mentionable policy papers are Tailloires Declaration (Presidents Conference, France), Halifax Declaration (Conference on University Action for Sustainable Development), Global Higher Education for Sustainability Partnership and more (ibid, 2013). Many studies have been published on this topic, which deal with Sustainability strategies of Higher Education. Cantalapiedra et al. in a case study analyzed institutional framework and campus operations²⁴⁰, Jain in a case study analyzed education²⁴¹, Alshuwaikhat and Abubakar in a framework proposal analyzed campus operations, education, research and outreach²⁴². The Association of University Leaders for a Sustainable Future (ULSF), which includes over 350 universities, issued the following statement about the centrality of sustainability in higher education: “We believe that the success of higher education in the 21st century will be judged by our ability to put forward a bold agenda that makes sustainability and the environment a cornerstone of academic practice” (Report and Declaration of the Presidents Conference, 1990). Over the past two decades, over 1,000 university leaders, presidents, and vice chancellors have committed their institutions to change toward sustainability through pledges such as the Talloires Declaration (1990), Swansea Declaration (1993), Copernicus Charter (1994), Lindberg Declaration (2001), and American College and University Presidents Climate Commitment

²⁴⁰ Cantalapiedra IR, Bosch M, Lo F. Involvement of final architecture diploma projects in the analysis of the UPC buildings energy performance as a way of teaching practical sustainability. *J. Clean. Prod.* 2006;14:958–62.

²⁴¹ Jain S, Aggarwal P, Sharma N, Sharma P. Fostering sustainability through education, research and practice : a case study of TERI University. *J. Clean. Prod.* 2013;61:20–4.

²⁴² Alshuwaikhat HM, Abubakar I. An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. *J. Clean. Prod.* 2008;16:1777–85.

(2007) (Tilbury & Whortman, 2008). The HESI initiative²⁴³, focus on Sustainable Development GOAL 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, globalization, and - in support of CBHE, that is completely flow the new knowledge economy. By signing the Commitment for Sustainable practices in higher education institutions, on the occasion of the United Nations Conference on Sustainable Development Rio+20, many partner institutes along with the University of Versailles Saint Quentin-en-Yvelines are wish to strengthen its leadership on this field. They are wish also to share knowledge and experience feedbacks relating to territories innovation strategies and their implementation modalities. They believes in its ability to federate public and private actors of its territories to develop innovative projects in sustainable development and to build together an open-minded university to meet the challenges of the 21th century, that will fulfill the requirements of knowledge society/economy. The **UNESCO** (2004) identifies two unique opportunities for HEIs to engage in sustainable development. First, "Universities form a link between knowledge generation and transfer of knowledge to society for their entry into the labour market. Such preparation includes education of teachers, who play the most important role in providing education at both primary and secondary levels. Second, they actively contribute to the societal development through outreach and service to society." Cortese (2003) seconds this notion, stating "Higher education institutions bear a profound, moral responsibility to increase the awareness, knowledge, skills, and values needed to create a just and sustainable future. Higher education often plays a critical but often overlooked role in making this vision a reality. It prepares most of the professionals who develop, lead, manage, teach, work in, and influence society's institutions." Thus, HEIs have a critical and tangible role in developing the principles, qualities and awareness not only needed to perpetuate the sustainable development philosophy, but to improve upon its delivery through stakeholder participation. From this view point, a key question becomes apparent "What is the role and implications of stakeholder participation in the context of universities' organisational change towards sustainable development"? In this sense, we have to establish a Sustainable development model that integrates environmental, social and economic considerations connecting to the participations of stakeholder by their Multi criteria evaluation process of deliberative support tools.

The various interpretations of the concept of new challenges of Higher education institutions (Sarker, Davis, & Tiropanis, 2010.), sustainable development (Bonnett, 2002, 1999; Stables and Scott, 1999; Haque, 2000; Holt and Barkemeyer, 2012; Fischer et al., 2017), innovation (Mota and Oliveira, 2013), and the questions it raises about knowledge society(Granados. 2015), economic growth (Baker, 1997; Bosselmann, 2001), facing way to the new challenges of education, sustainability and innovation at higher education for creating knowledge Economy and make its implementation difficult. Despite the difficulties in progressing towards education, sustainable development and innovation, policymakers at national and international levels have widely adopted the terms and condition to the best practices of higher education. So, how could the difficulties in implementing the new challenges of education, sustainability and innovation at higher education for creating knowledge Economy be overcome and who are the actors that could help overcome these difficulties? Higher education institutions are one of the actors that may help to overcome these difficulties by developing a common knowledge platform and new evaluation processes of change that will be the development milestone for best practices of HE challenges In Terms Education, Sustainability and Innovation education. Our innovative institutional knowledge platform (*ePLANETe*) model could lead to different transformational change in institutions by the evaluation process that will

²⁴³ The Higher Education Sustainability Initiative (HESI) was created the run-up to the [United Nations Conference on Sustainable Development \(Rio+20\)](#). The partners of the initiative are UN-DESA, UNESCO, UNEP, UN Global Compact's Principles for Responsible Management Education (PRME) initiative, UNU and UN-Habitat. With a membership of almost 300 universities from around the world, HESI accounts for more than one-third of all the voluntary commitments that came out of Rio +20.

provide (a) vehicle for innovation in the conception & delivery of HER sustainability-related programmes and (b) a vehicle for the evaluation of HERE quality in a multi-stakeholder multi-criteria perspective that have been emerged as a paradigm for revising and reorienting today's higher education challenges. The potential of *ePLANETe* system across the Higher Education sector to address these challenges has been presented in the previously in my paper. This thesis aimed to develop an approach to assist the decision-making in the quality evaluation process toward the higher education and research establishments (HERE) in terms of new education, sustainability and innovation challenges. The INTEGRAAL methodology was adopted in this work to help us with the problem of issue identification, but also in the utilization of standardized indicators to evaluate our case study, the '*UPSaclay teaching programs and campus level sustainability*'. The *ePLANETe* platform was used to support us in the higher education and research establishments (HERE) in terms of education, sustainability and innovation challenges as a new and innovative model for best practices; The Multi criteria analysis has been observed as a suitable set of approaches to accomplish sustainability evaluations as a result of its flexibility and the possibility of simplifying the dialogue between stakeholders(i.e. faculty, staff and student) , analysts and scientists; The deliberation section with the actors showed a few contrast of opinions expressed by the expert system and the actors' assessment, confirming that the actors' participation in the evaluation was crucial to provide some acceptability to the case study assessment. However, the low representatively of stakeholders at this moment provided us with similar results between both evaluation systems. To answer this central scientific research question "In what ways , the Knowledge Portal (*ePLANETe* blue) works as an corporate intermediary to define new challenges of education, innovation, and sustainability to support the identification and the implementation of best practices at higher education and research establishments (HERE) for creating knowledge Society and Economy? Is it really solving knowledge gateway for facing the upcoming challenges of education, innovation and sustainability of higher education intuitions? that could be lead and give further guidance about the quality evaluation and performance improvement of the higher education and research establishments (HERE). Also, this research allows us to answer several questions that we asked at the beginning of the thesis as essential to the understanding of new challenges of higher education institutions as the specific roles of information technology for green innovation case of '*ePLANETe*' which provides (a) a vehicle for innovation in the conception & delivery of HER sustainability-related programmes and (b) a vehicle for the evaluation of HERE quality in a multi-stakeholder multi-criteria perspective that have been emerged as a paradigm for revising and reorienting today's higher education challenges.

How technology, methodology, and data infrastructures could provide responses to address those challenges in a world where students are changing, their learning styles are changing, and the technologies to accommodate their needs are changing?

The ePLANETe' is an online platform of the intellectual product created by ex-REEDS for the community, people, partners, faculty, research staff, and students for the activities of Collaborative Projects, Thesis, Creation of Pedagogic Ressources, Knowledge Mediation Tools, Networks, Teaching programmes, Pedagogic Resources, quality evaluation space, Space PANORAMIX, The Space Of Deliberation Support tools of online knowledge platform and accessible to end-users both within and outside of the institution that support their scholarly activities by the operational way of several doorway of *ePLANETe'*

There are many different technologies that support the storage and distribution of digital contents including:

- Collection-based digital repositories alfresco managed by association of *ePLANETe* Blue

- presentation of teaching program, Pedagogic Ressources, management systems and associated file stores
- Collections of research data and reports managed by association ePLANETe Blue
- Documentation portfolio systems
- Institutional file storage systems
- Online quality evaluation management workflow systems via INTEGRAAL methodology ,
- Content management systems for deferent user.

Entering through the Doorways, the objects found in, or through, the various galleries of ePLANETe, may individually be of simple and well-known types, for example electronic files such as photos or PDF documents. Or they may be more complex. Often, they are Profiles of various sorts, composed using state-of-the-art *Content Management Systems* (e.g., the CMS 'Drupal'). Most are the creations, or the cross-linked emergent outcomes, of learning, discovery, analysis and documentation work of User communities. The overall result is an evolving lattice of cross-linked objects — an always-incomplete “modelling” of human activity, to which the users contribute and within which they navigate.

The use of information technology for green innovation case of 'ePLANETe' knowledge platform across the institutions could be relevant to addressing important HE challenges. The content of this knowledge platform can be available for integration within different departments of the institution, and can also be made available to colleagues and students at other institutions, as well as to the general public higher education and research establishments (HERE) could start exposing such platform in linked data formats starting with information that is already available on their Web pages. (e.g. promoting education for sustainable development) to address the challenges. For example, promoting education for sustainable development could be supported by establishing how the teaching programs across HE institutions compare to each other and identify potential gaps that new degree programmes could address; Sustainable Development Goal 4: Towards inclusive and equitable quality education and long-life learning for all, Sustainability strategies of Higher Education, and Value Creation Strategic in higher education could be lead practical oriented education for upcoming days; Sustainable Development output of institutions could be more visible to Sustainable campus, Green Campus; the education transformation to the supporting equitable access to the knowledge Portal could deliberate the campus related arrangement and the teaching and Learning inventory for the quality of the teaching program; Building capacities and empowerment could be supported by more efficient monitoring of student activities; Technology facilitation mechanism for building effective partnerships for education could be more noticeable to community engagement and assessment of their progress and so on. Challenges could be addressed in groups, could we look at data infrastructures per group to address the challenges? It is clear that the ePLANETe' innovative concept is a very powerful idea that can serve as an engine of change for institutions of higher education. If properly developed, it advances a surprising number of goals, and addresses an impressive range of challenges where students are changing, their learning styles are changing, and the technologies to accommodate their needs are changing.

How triangle issues (i) innovation and sustainability; (ii) evaluation of the quality of higher education and research establishments (HERE), and (iii) the specific roles of information technology for green innovation case of 'ePLANETe' work together to response those challenges?

The arrival of the knowledge society disrupts the entire education ecology in to the **higher education and research establishments (HERE)**. Educators and researchers are convinced of the need to prepare learners to be productive citizens by the quality education, and many initiatives have been launched worldwide. As pointed out by Mota and Oliveira (2013), education, innovation and sustainability are strongly connected.

As per knowledge society/economy, the triangle issues are the vital points to achieve the new challenges in education, innovation and sustainability.

From the view point of Sustainability defines, how the humanity can meet its demands today without compromising the needs of future generations. It should be a guiding principle for world social and economic development and is closely depending on the way our student is educated by quality education to face such challenge. The best way to produce quality education with sustainable development is to incorporate innovation as a tool to become increasingly environment-friendly. Quality higher education is definitely strategic connecting path of higher education and research establishments (HERE) to achieve the new challenges in a globalized knowledge economy increasingly requiring innovation practices as well as - educated workers, able to perform complex tasks and adapt rapidly to new technologies and the new demands of the knowledge society/economy. The presence of quality higher education institutions and excellent scientific research laboratories generate the basic knowledge needed to build the new scenario where innovation and sustainability are central priorities and main targets (Mota and Oliveira, 2013). Extensive collaboration between academia and enterprises provides technological developments able to face the high levels of competition, which will be crucial for sustainable growth in the contemporary knowledge society. Innovation can emerge from knowledge, which can be closely related to the know-how, skills, working conditions and technological breakthroughs that are embedded in organizations (ibid, 2013). That's why, Innovation is becoming more and more central in our higher education and research establishments (HERE) and it is directly associated to the possibility of quality of higher education and research establishments (HERE) as conception, evaluation & delivery of sustainability-related programmes that have been emerged as a paradigm for revising and reorienting today's higher education challenges . In this new scenario, the educational institutions and research establishments have increasingly assumed a relevant role for the information technology, the correct use of new technologies and the dissemination through education, in all levels, of management methods based on the collaboration between schools, research teams, companies and society in general, innovative knowledge based platform where all information, data and contents are open for best exercising of new challenges education, innovation and sustainability. A contemporary education, covering innovation solutions for a sustainable existence on our planet, has the chance to contribute to correct the adopted paths so far, so that the balance of higher education and research establishments (HERE) could be achieved challenges of education, innovation and sustainability with innovative knowledge based portal establishment and social development.

Concerning our new **green innovation case “ePLANETe blue”** approaches, we have presented before as an appropriate strategy and an open fresh opportunity to prepare students, contributing platform to the formation of professionals able to face the challenges associated with a new scene where innovation and entrepreneurship are central priorities. Also, there are new challenges to be globally faced, among them how to educate for innovation taking into account the demands for sustainability. This particular concern is huge, since education, innovation and sustainability are complexes issues, demanding attention to the rapid dynamics with the way knowledge is produced and transferred nowadays. The “**ePLANETe blue**” is a good example on how this can be articulated for the case of education, innovation and sustainability for exercising. It is presented as “an innovative higher education and research establishments (HERE) framework for producing the next generation best practising way and tools of education, innovation and sustainability for knowledge society/economy. The main landscapes of “**ePLANETe blue**” are not only the contents and methods but also the intense international collaboration in an open system that accepts new followers who will train the education, innovation and sustainability challenges case studies of the future. The exchange with the deliberative experiences from different countries in different values, with the openness of information and the use of online platform combined with the high motivation hands on methods are the key for the success of this system. Moreover, this framework initiative not only for higher education Institutes and research establishments (HERE) but with focus on the innovation and

sustainability values could be the key for a new educational paradigm able to build a next generation of citizens capable of building a sustainable , knowledge economy , which will have a better wealth distribution all over the world. In this new framework, the motivation on innovation exercise based on self-learning, the high level of awareness about the earth institutional sustainability issues and the universal coverage with concentrated international cooperation can be the starting point for building a better knowledge economy through education.

How do higher education and research establishments (HERE) organize themselves to respond to the above challenges? Are there any barriers that prevent institutions to open their information to be accessible to deliberative respond these challenges by the multi-criteria assessment methods? , If yes then how can they solve these problems?

Addressing the challenges of education, innovation and sustainability is critical not only for the future of higher education institutions and research establishments (HERE) but also for that of the world at large. Knowledge portal consist of formally organized and managed collections of digital content generated by faculty, staff, and students at the higher education institution and research establishments (HERE) which can help us at this end. It plays an important role in 21st century's higher education challenges. It is now clearly and broadly being recognized as an essential infrastructure to respond the higher education challenges in the digital world. Sharing portal based institutional knowledge platform have some concerns that we need to fix for greater benefit of higher education. This is an area where we believe higher education institutions and research establishments (HERE) need to invest aggressively, but where they also need to implement thoughtfully and carefully, with broad consultation and collaboration across the campus community and with a full understanding that if they succeed they will permanently change and solve the landscape of 21st century's higher education. The potential of Institutional knowledge portal *ePLANETe* blue across the Higher Education sector to address these challenges has been discussed in my paper previously. There is a value to be gained by letting institutions have access to external knowledge platform and by sharing their data with them. Exposing data for sharing can provide significant value in addressing higher education challenges and in supporting teaching and learning activities.

The potentially response the higher education challenges enabled by linking and sharing institutional portal based knowledge platform need to be documented properly and open information to be accessible to deliberative respond by the multi-criteria assessment methods to enhance our understanding on the pedagogical potential of institutional knowledge portal . We need to diagnosis and take necessary steps to solve the above concerns relating to linking or sharing institutional knowledge platform to get the greatest benefit from this portal in the higher education institution. Sharing portal based knowledge platform is a big challenge in today's higher education institutions. The multi-criteria assessment tools are the vital point on it. In the deliberative multi-criteria assessment process, the participating communities believed that teaching and learning in higher education is a shared process for documentation and open access information with responsibilities on student, teacher and evaluator to contribute to their success. Within this shared process of inventory, higher education must engage the students, teachers and evaluators in questioning their preconceived ideas and their models of how the world works, so that they can reach a higher level of understanding and a desire decision by deliberative assessments. But students, teachers and evaluators are not always equipped with this challenge, nor are all of them driven by a desire to understand and apply knowledge, but all too often aspire merely to survive the course, or to learn only procedurally in order to get the highest possible marks before rapidly moving on to the next subject. The best evaluation of teaching and learning helps the students to question their preconceptions, and motivates them to best practices, by putting them in a situation in which their existing model does not work and in which they come to see themselves as evaluators of possible answers, as agents of responsibility for change. That means, students, teachers and evaluators need to be faced with problems which they think are important.

Also, they believed that most of higher education institutions and research establishments (HERE) are attempting to use the deliberative support tools of specific innovative knowledge portal for assessing the quality of education (teaching programs), and the campus level sustainability

But In my point of view, uncertainty assessment relating to complex issues on quality assurance of knowledge are the main barriers that prevent institutions to open their information to be accessible for deliberative respond these challenges by the multi-criteria assessment tools. The tools to assess uncertainty must take into account following three types of concerns (Douguet *et al*, 2007): The first concern is the identification and the analysis of the various forms of uncertainty that stakeholders and decision maker have to face; The second concern is linked to the quality of knowledge and its evaluation by the scientific community and/or an extended community of peers; The third concern is the pertinence and “fitness for purpose” of our knowledge, including knowledge about uncertainties, in a given decision, policy or governance context. We need to solve these barriers by diagnosis of uncertainty; characterisation and analysis, which is linked to the quality of knowledge and its evaluation by the scientific community and/or an enlarged community of peers; with the pertinence of knowledge, here illustrated by integrating uncertainty in a dialogue about mobilising indicators for multi criteria evaluation in a comparative scenario perspective. All exercising features are presence in our proposed “ePLANETe blue” system that I have been presented in my paper. The implementation of appropriate technological tools to facilitate uncertainty case is an issue. Certain tools and technologies can go a long way to make knowledge exchange far easier and more efficient. The kerDST evaluation process and outcome is thus built by several layers of judgements: the selection, from amongst the range of “candidate indicators” available, of a set of (not more than 5) indicators for each basket; the interpretation (significance) to be attributed to each indicator in a basket; the relative or absolute importance (weight) of each indicator in relation to the others in the basket, for arriving at a synthetic judgement for the cell as a whole; the overall comparison, via the Deliberation Matrix, between scenarios based on the multi-stakeholder multicriteria profile of each one. The underlying complex vision of collaborative learning is based on the hypothesis that individual reflection and/or exchanges of views between protagonists in a deliberation/negotiation process may lead to modifications at any or all or the steps of the choices and judgements leading up to an entry in a cell of the Matrix table. Those ‘representing’ stakeholders of one type may try to persuade stakeholders of another type to modify their criteria or relative weighting; and so on. The Deliberation Matrix framework for indicator-based evaluation thus highlights the information requirements for, on the one hand, representing the situation and its possible evolution (via, we presume, a set of options or scenarios) and, on the other hand, making judgements about the present and eventual future situation (via a battery of indicators). More particularly, the DM provides a framework for a structured discussion and evaluation of the significance, for the policy or governance issues being addressed, of the different forms of uncertainty that may be associated with the various classes of empirical information, modelling and simulation results being introduced into the deliberation.

The utilization of “ePLANETe blue” is increasingly becoming clear that the key to progress compatible with sustainability, particularly in times of 21st century’s challenges of higher education institutions and research establishments (HERE), is innovation associated with education. A new framework system based on these pillars should be the only solution for building a economy where the main values are related to a more sustainable world and a better wealth distribution. Future work and research for recommendation should be focused on implementing solutions of higher education challenges with the help of “ePLANETe blue”. This could be development and availability of tools that will assist to efficiently address those challenges. Taking this forward requires institutional governance, policies on exposing institutional quality evaluation that could address the HE challenges (i.e. education, sustainability and innovation), consider revealing knowledge platform or space to share across the institutions and what platform or space should not be

shared. Based on this classification future research could involve case studies and experimentation to test how effective this classification is to address the challenges? Moreover this could be development and availability of tools that will assist to efficiently address those challenges

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LIST OF ACRONYMS

AACSB: Association to Advance Collegiate Schools of Business

AASHE: Association for the Advancement of Sustainability in Higher Education

ADEME: Agence de l'Environnement et de la Maîtrise de l'Énergie (Agency for the Environment and Energy Management)

AFNOR: Association Française de Normalisation

AHELO: Assessment of Higher Education Learning Outcomes

AHP: Analytical Hierarchy Process

AISHE: Auditing Instrument for Sustainability in Higher Education

ANABF: Association Nationale des Architectes des Bâtiments de France (National Association of Architects of Buildings of France)

ANR: Agence Nationale de la Recherche (National Research Agency)

ARWU: Academic Ranking of World Universities

AR5: Fifth Assessment Report

BN: Bergerie Nationale

BRE: Building Research Establishment

BREEAM: Building Research Establishment Environmental Assessment Method

BSR: Business for Social Responsibility

B4U: Benchmark for You

CBA: Cost-Benefit Analysis

CCPY: Communauté de Communes Plaines et Forêts d'Yvelines (Community of Plains and Forests of Yvelines)

CDHO: Dutch Committee on Sustainability in Higher Education

CEREMA: Centre d'Études et d'Expertise sur les Risques, L'Environnement, la Mobilité et l'Aménagement (Center for Studies and Expertise on Risks, Environment, Mobility and Development)

CERTU: Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques (Center for Studies on Networks, Transport, Urban Planning and Public Buildings)

CEZ: Centre d'Enseignement Zootechnique (Zootechnical Education Center)

CGE: Conférence des Grandes Écoles (Conference of Grandes Écoles)

CIAM: Congrès international d'architecture moderne (International Congresses of Modern Architecture)

CIUP: Cité Internationale Universitaire (International University City)

COMUE : Communauté d'universités et Établissements (Community of Universities and Institutions)

COP: Conférence des Parties (Conference of the Parties)

CPU: Conférence des Présidents d'Université (Conference of the of the University Presidents)

CSPS : Coordonnateur en matière de Sécurité et de Protection de la Santé (Health and Safety Coordinator)

CSR : Corporate Social Responsibility

C3ED : Centre d'Économie et Éthique pour l'Environnement et le Développement (Center for Economics and Ethics for Environment and Development)

C4U: Construction for You

DATAR : Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale (Interministerial Delegation of Land Planning and Regional Attractiveness)

DM: Deliberation Matrix

DST: Deliberation Support Tools

EAUC: Environmental Association for Universities and Colleges

EC: European Commission

EEC: European Economic Community

EIA: Environmental Impact Assessment

EIT: Institute of Innovation and Technology

EPA: Environmental Protection Agency

EPN: Établissement Public National (National Public Institution)

ESR: établissements d'enseignement supérieur et de recherche

EQB: Environmental Quality of the Building

EQUIS: European Quality Improvement System

EU: European Union

EVVADES: Outil d'auto-Evaluation du Développement Durable dans l'Enseignement Supérieur

GB: Green Building

GBR: Green Buildings Rating

GCY: General Council of the Yvelines

GII: Global Innovation Index

GHG: Greenhouse Gas

GNP: Gross National Product

GSR: Global Social Responsibility

GR: Green Revolution

GRI: Global Reporting Initiative
HE: Higher Education
HERE: Higher Education and Research Establishments
HIA: Health Impact Assessment
HQE: Haute Qualité Environnementale (High Environmental Quality)
IAQ: Indoor Air Quality
IAU : Institut d'aménagement et d'urbanisme de la région Île-de-France (Institute of Planning and Development of the Île-de-France Region)
IEEP: International Environmental Education Program
IEQ: Indoor Environmental Quality
IISD: International Institute for Sustainable Development
IMF: International Monetary Fund
IPCC: Intergovernmental Panel on Climate Change
ISO: International Organization for Standardization
IUCN: International Union for Conservation of Nature
KDM: KerBabel™ Deliberation Matrix
KGBCC: Korea's Green Building Certification Criteria
KIC: Knowledge and Innovation Communities
KIK: Kerbabel™ Indicators Kiosks
KPI: Key Performance Indicators
KRR: Kerbabel Representation Rack
K4U: Kerbabel For You
LA21: Local Agenda 21
LCA: Life Cycle Analysis
LCI: Life Cycle Inventory
LCIA: Life Cycle Impact Assessment
LIFE: Learning in Future Environments
LOF: Loi d'Orientation Foncière
LRU: Liberties and Responsibilities of Universities
MAUT: Multi-Attribute Utility Theory
MESR: Ministère de l'Education Nationale, de l'Enseignement supérieur et de la Recherche (Ministry of Education, Higher Education and Research)
NGO: Non-governmental organization
MCDA: Multi-Criteria Analysis Decision Analysis
MDGs: Millennium Development Goals

MEDDE: Ministère de l'Ecologie, du Développement durable et de l'Énergie (Ministry of Ecology, Sustainable Development and Energy)

MEDDTL : Ministère l'Écologie, du Développement durable, des Transports et du Logement (Ministry of Ecology, Sustainable Development, Transport and Housing)

MESR: Ministère de l'Education Nationale, de l'Enseignement supérieur et de la Recherche (Ministry of National Education, Higher Education and Research)

MLH: Ministre du Logement et de l'Habitat Durable (Minister of Housing and Sustainable Building)

OECD: Organisation for Economic Co-operation and Development

OMS: Operational Management System

OPC: Ordonnancement, Pilotage et Coordination (Scheduling, Management and Coordination)

PADOG: Plan d'Organization Générale de la Région Parisienne (Parisian General Organization Plan)

PCET: Plan Climat-Énergie Territorial (Plan of Climate, Air, and Energy)

PISA: Programme for International Student Assessment

PNSE: Plans Nationaux Santé Environnement (National Environmental Health Plan)

POE: Post Occupancy Evaluation

PPP: Promote Public-Private Partnership

PRES: Pôle de Recherche et d'Enseignement Supérieur

PROMETHEE: Preference Ranking Organization Method for Enrichment of Evaluations

REEDS : Centre International de Recherches en Économie-écologie, Éco-innovation et ingénierie du Développement Soutenable (International Centre for Research in Ecological Economics, Eco-Innovation and Tool Development for Sustainability)

SA: Sustainability Assessment

SB: Sustainable Buildings

SCOT: Schéma de cohérence territoriale (Territorial Coherence Strategy)

SCP: Sustainable Cities Programme

SD: Sustainable Development

SDGs: Sustainable Development Goals

SDU: Schéma de Développement Universitaire (Strategy of the University Development)

SEA: Strategic Environmental Assessment

SQY: Saint-Quentin-en-Yvelines

SR: Social Responsibility

SRCAE : Schéma Régional du Climat, de l'Air et de l'Énergie (Regional Strategy Plan of Climate, Air, and

Energy)

SRCE: Schéma Régional de Cohérence Écologique (Regional Strategy Plan of Ecological Coherence)

SRU : Solidarité et Renouvellement Urbain Law (Solidarity and Urban Renovation Law)

STARS: Sustainability Tracking, Assessment and Rating

TBL: Triple Bottom Line

TICE: Technologies de l'Information et de la Communication pour l'Enseignement

THE: Times Higher Education

UCLG: United Cities and Local Governments

UGO: Unite Géographique et/ou Organisationnelle (Geographic and/or Organisational Unit)

UIT: University Institutes of Technology

ULSF: University Leaders for A Sustainable Future

UN: United Nations

UNCED: United Nations Conference on Environment and Development

UNCHS: United Nations Centre for Human Settlements

UNCSD: United Nations Conference on Sustainable Development

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNEP: United Nations Environment Programme

UNFCCC: United Nations Framework Convention on Climate Change

UN-HABITAT: United Nations Human Settlements Programme

USGBC: U.S. Green Building Council

USR: University Social Responsibility

UVSQ: Université de Versailles Saint-Quentin-en-Yvelines

U2000: Université 2000

U3M: Université du Troisième Millénaire (University of the Third Millennium)

VAT: Value-Added Tax

VOC: Volatile Organic Compounds

WBCSD: World Business Council for Sustainable Development

WCED: World Commission on Environment and Development

WCS: World Conservation Strategy

WEEE: Waste Electrical and Electronic Equipment

WSSD: World Summit on Sustainable Development

ZNIEFF: Zone Naturelle d'Intérêt Écologique, Faunistique et Floristique (Natural Zone of Ecological Interest, Fauna and Flora)

ANNEXES

ANNEX 2. 1: PRESENTATION OF MASTER SETE

MASTER SETE -- Sciences of the Environment, Territory and the Economy at the Université de Versailles Saint-Quentin-en-Yvelines -- A New Interdisciplinary Programme at the UVSQ

Source: Presentation for the 1st ASEAN-EU University Rectors' Conference
Higher Education and Sustainable Development
University of Malaya, Kuala Lumpur, Malaysia, 4–6 October 2004

Professor Martin O'Connor (DSEM & C3ED, UVSQ)

2.1. The SETE Masters Degree at the UVSQ

A New Interdisciplinary Programme at the UVSQ

- The purpose of the SETE Masters Programme is to prepare the new generations to meet the challenges of understanding, decision and action for sustainable development.
- Students are invited to address in an integrated way the relationships between the economy, climate, the physical environment and natural resource use

including questions of:

long time horizons, social justice and democratic political process...

... in the context of ...

deep uncertainty, irreversibilities and systems complexity.

2.1.1. Sustainability: An Interdisciplinary Challenge

Analyses addressing sustainable development are at the crossroads of physical and human sciences.

They treat, on the one hand, the 'environmental' dimension of the insertion of economic activity within biophysical processes and, on the other hand, the 'symbolic' dimensions of institutions, culture, ethics and politics.

This entails:

- The 'hard sciences' challenges of the measurement and representation (including analytical modelling) of complex systems; and
- The 'soft sciences' challenges of analysing societies' goals and values, including individual and collective resource use choices, governance, justice and the legitimacy of decisions.

2.1.2. Interdisciplinary Profile of The SETE Programme

Disciplinary foundations that guarantee the quality of training and entry points to professions, responding to the need for new combinations of skills, in research and in professional practice.

Initiation to inter-disciplinary research and teaching through a cross fertilisation of:

- ◆ environmental sciences (physics, chemistry, earth sciences, biological sciences),
 - ◆ mathematics and computing,
 - ◆ the sciences of social systems (economics, law, management, geography)
- and human interactions within ecosystems, the humanities (ethics, sociology, political studies, demography)

Examples of Sustainability Challenges	
Data and Modelling	Interfaces of Science & Society
<ul style="list-style-type: none"> How to assure the establishment and exploitation of environmental data systems, not only for researchers but also by public administration, business and civil society? 	<ul style="list-style-type: none"> How to assure that the scientific community responds to contemporary societal preoccupations in research?
<ul style="list-style-type: none"> How to link environmental and socio-economic data? 	<ul style="list-style-type: none"> How to assure reliable scientific information to different stakeholders (territorial authorities, companies, NGOs, consumers...) in a fair and transparent way?
<ul style="list-style-type: none"> What procedures and priorities for development of integrated environment-economy modelling tools whose results are useful and accessible to stakeholders (e.g., climate change and economic activity, with ramifications for agriculture, water resources, biodiversity, land use for energy, transport infrastructure)? 	<ul style="list-style-type: none"> How to communicate risks and uncertainties (e.g., possible effects of climate change on rainfall and temperature, and impacts for vegetation, species diversity, agriculture and recreation)?

2.1.3. Organisation of the SETE Programme

The Masters Degree in Sciences of the Environment, Territory and the Economy (SETE) is obtained on the basis of a two year period of study 120 European credit points (ECTS): 60 in the 1st year (M1) and 60 in the 2nd year (M2). **The student may progress towards a doctoral programme (PhD) or towards professional fields.** The SETE Programme is divided into three thematic fields (called 'Mentions' in French), each of which is sub-divided, at the 2nd Year (M2), into Specialities.

- During the 1st Year (M1) the student enrolls within one of the three fields (SEN, IDD, EGET), and chooses his/her programme of studies with a view to the Speciality (M2) being pursued.
 - A disciplinary 'major' (Physics, Chemistry, Economics, Geography, Management, Law);
 - Or an interdisciplinary profile ('major SETE').
- During the 2nd Year (M2), the student takes a programme within a Speciality:
 - Some of the Specialities are close to 'traditional' disciplinary degree programmes;
 - Others focus directly on building dialogue and competence between disciplines.

The Three thematic fields — SEN, EGET and IDD

- **“SCIENCES OF THE ENVIRONMENT” (SEN)**
- **“ECONOMICS AND GOVERNANCE OF THE ENVIRONMENT AND TERRITORIES” (EGET)**
... are degree programmes that have their roots in a core discipline, but where the disciplinary focus is complemented by cross-cutting topics (sciences and society, environment, risk and governance) that are common across all fields.
- **“SUSTAINABILITY SCIENCE, TOOLS AND TECHNIQUES” (IDD)**
... has a directly interdisciplinary character, mobilising an international panel of teaching expertise through partnerships to offer students an integrated approach to the analysis of sustainability challenges.

THE SPECIALITIES (M2) OF THE MASTERS PROGRAMME SETE
Programme Directors: Dr. Isabelle Nicolaï and Prof. Laurent Labeyrie

SEN: SCIENCES OF THE ENVIRONMENT (GÉRARD CAUDAL)	IDD: SUSTAINABILITY SCIENCE, TOOLS AND TECHNIQUES (MARTIN O'CONNOR)	EGET: ECONOMICS AND GOVERNANCE OF THE ENVIRONMENT AND TERRITORIES (DENIS REQUIER-DESIJARDINS)
AIR QUALITY AND NOISE CONTROL Coordinator: Guy Cernogora	SUSTAINABLE DEVELOPMENT STRATEGIES AND CORPORATE SOCIAL RESPONSIBILITY <i>(Business-university teaching partnership)</i> Coordinator: Isabelle Nicolaï	ECONOMICS AND GOVERNANCE OF RISKS Coordinator: Samir Allal
CLIMATE-ENVIRONMENT INTERACTIONS AND REMOTE SENSING Coordinator: Matthieu Roy-Barman	OPERATIONS RESEARCH PRINCIPLES AND TOOLS: ELECTRONIC NETWORKS, INFORMATION SYSTEMS AND COMMUNICATION Coordinator: Barthélémy Alcantara	TRANSPORT SYSTEMS AND SAFETY Coordinator: Robert Delorme
PLANETARY SCIENCES Coordinator: François Forme	ENVIRONMENTAL LAW, SAFETY AND QUALITY IN BUSINESS Coordinator: Jean-Pierre Desideri	TOURISM AND THE ENVIRONMENT Coordinator: Didier Ramousse
CLIMATE-ENVIRONMENT SOCIETY INTERACTIONS <i>(planned for 2006)</i> Coordinator: Laurent Labeyrie	SHARING ENVIRONMENTAL KNOWLEDGE: PARTNERSHIPS FOR SUSTAINABILITY <i>with 2 options: 'Territory/Environment' and 'Partnerships with Business'</i> Coordinator: Martin O'Connor	INTEGRATED SUSTAINABLE DEVELOPMENT with 2 options: 'Socially Sustainable Development' and 'Ecological Economics, Environment & SD Policies' Coordinator: Denis Requier-Desjardins

2.1.4. The Courses on Offer

COURSES IN THE 1ST YEAR OF THE MASTERS SETE PROGRAMME AT THE UVSQ

For more detail see the website <http://www.uvsq.fr>

SCIENCE-SYSTEMS-ENVIRONMENT	INFORMATION & COMMUNICATIONS TECHNOLOGIES AND THE ENVIRONMENT	OPERATIONS RESEARCH
Environmental Education	Mapping and Spatial Analysis — GIS and Remote Sensing	GPAO and e-Logistics
Applied Sciences of the Environment	Introduction to Methods of Geographical Representation	Computer Science (several modules)
Society and Sciences of the Environment	Information & Communication Technologies and Environmental Awareness	Operations Research and Transport
Systems and Complexity	Multimedia Deliberation Support Tools	Applied Operations Research
FACETS OF SUSTAINABLE DEVELOPMENT	ECONOMICS	EARTH SCIENCE
Natural Resources and Environmental Economics	Econometrics	Geochemistry
Development Economics	International Economics and Financial Markets	Methods of Environmental Sensing
Ecological Economics	Public Economics	Paleoclimatology
Economic, Social and Environmental Ethics	History of Economic Thought	Physics and Chemistry for the Environment
Introduction to Ecological Economics	Evaluation and Decision Support Methods	The Planet Earth
Sustainable Business (several modules)	The New Microeconomics	Planetology
SPATIAL AND REGIONAL ANALYSIS	(TOOLS)	PHYSICS AND CHEMISTRY
Environmental Law and Land Use Planning	Statistics and Probability	Numerical Approximation Techniques for Physics
Spatial Economics	Computer Sciences	Fluids and Thermodynamics
Mobility, Flows and Territories (several modules)	Mathematics	Lasers
Tourism and Territorial administration	Project Management	Analysis and Separation Methods
UNCERTAINTY, RISK AND INTEGRATED ASSESSMENT		Plasma Physics
Systems analysis & integrated modelling (climate-energy-economy-environment)	Integrated Water Resources Management	Statistical and Kinetic Physics
Analysis and Management of Natural Hazards	Introduction to the Observation, Analysis and Governance of Risks	Radioactivity and Nuclear Chemistry

THE CLIMATE SYSTEM

PLANETOLOGY

Environmental Measurement

Indicators, Information Systems and Communication

ECONOMICS OF SUSTAINABLE DEVELOPMENT

LAW, INNOVATION AND INSTITUTIONS (BUSINESS, THE STATE AND CITIZENS)

FIELDS OF SUSTAINABILITY STUDIES

OPERATIONS RESEARCH AND SYSTEMS ANALYSES

INTEGRATED ANALYSIS, VALUATION AND DELIBERATION

RISK OBSERVATION, ANALYSIS AND GOVERNANCE

TRANSPORT AND SAFETY

GEOGRAPHY, TOURISM AND THE ENVIRONMENT

Organisations and Management

SETE — Our Partners Worldwide

THE SETE PROGRAMME immerses students in an interdisciplinary knowledge environment, without neglecting competence at a disciplinary scale.

Our ability to offer such a programme at the UVSQ is directly linked to the fields of research excellence within the university, allied to our partners in public research institutions and business.

PARTNERSHIP ACTIVITIES take many different forms, from exchange of students for short-term projects and doctoral studies, to collaboration on modules of the SETE teaching programmes, to joint activities at the level of Specialities in the M2 programme.

LINKS WITH THE BUSINESS WORLD AND PUBLIC ADMINISTRATION are given a new emphasis through the establishment, in 2004, of the EUROPEAN FOUNDATION FOR SUSTAINABLE TERRITORIES (FETD) as a centre of excellence allying public sector teaching and research, business interests and territorial governance agencies.

At the international level...

The SETE Masters Programme gets much of its strength through networking, for example:

- European research and exchange programmes on climate change, environment and integrated assessment, such as the Carbo-Europe programme, the PROPER network (Proxies in Paleoclimatology: Education and Research), the EFEIA (European Forum for Integrated Environmental Analysis).
 - The COPERNICUS network (Co-operation Programme in Europe for Research on Nature and Industry through Coordinated University Studies).
-

- The EEESDP Network (Education in Ecological Economics and Sustainable Development Policy) linking more than 20 centres of excellence worldwide for research and teaching in ecological economics, environmental politics, governance and sustainability.
- The UNESCO programme of 'Ecotechnie' University Chairs.
- North-South cooperation activity supported by the *Institut de Recherche pour le Développement* (IRD, one of the patrons of the C3ED research laboratory) promoting exchanges and research partnerships in Africa, Latin America and the South Pacific.

The European Foundation for Sustainable Territories

The FETD (Fondation Européenne pour des Territoires Durables) is a centre of excellence for research and partnerships for sustainability in a territorial perspective, established through the alliance of higher education, specialised research institutes, private companies, business federations, publicly owned companies and territorial administrations.

Three priorities are established for its operations:

- Ramifications of climate change at a territorial scale, and associated challenges for regional development, infrastructure and technology choices;
- Participatory governance through state-business-civil society partnerships, notably for territorial development at a regional level;
- Environmental planning, resource management and organisational change.

THE FETD IS LINKED ACROSS FRANCE, EUROPE AND WORLDWIDE IN A NETWORK OF CENTRES OF EXCELLENCE ON SUSTAINABILITY, TERRITORIAL GOVERNANCE, RESEARCH AND TECHNOLOGY THEMES.

2.1.5. Research-based Teaching

The Masters SETE is strongly linked to internationally recognised research centres at the Université de Versailles Saint-Quentin-en-Yvelines.

(see <http://www.uvsq.fr/lab/index.html>)

These include the IPSL on climate, earth and environmental sciences, and the C3ED in economics and interdisciplinary studies on sustainable development.

Teaching contributions from business partners, consultants and civil society coming from France and abroad reinforce our in-house research expertise.

IPSL — Institut Pierre Simon Laplace

The IPSL (website <http://www.ipsl.jussieu.fr/>) is the leading French research centre in the field of environmental sciences, notably in the analysis of ocean-atmosphere-climate and interactions with terrestrial environments. With an extensive international network, it is a major centre for doctoral studies.

Three of the six centres making up the IPSL are based at the UVSQ:

- The CETP (CENTRE D'ÉTUDE DES ENVIRONNEMENTS TERRESTRE ET PLANÉTAIRES) on interactions between the atmosphere and ocean and continental surfaces; medium scale phenomena in the weather system; upper atmosphere and Solar System plasma studies.
- The LSCE (LABORATOIRE DES SCIENCES DU CLIMAT ET DE L'ENVIRONNEMENT) on climate science, biogeochemical cycles, geochronology and geoindicators.
- The SA (SERVICE AÉRONOMIE) on planetary atmospheres, atmospheric chemistry and applied meteorology.

C3ED — Centre d'Économie et d'Éthique pour l'Environnement et le Développement

One of the leading social sciences centres in Europe on sustainable development.

Since 1995, the C3ED has established a major interdisciplinary programme spanning ethics, economics, geography, ecosystems sciences and communications technologies, that seeks to address in an integrated way the 'four dimensions' of sustainability — economic, social, institutional and environmental.

Jointly financed by the UVSQ and the French IRD (Institut de Recherche pour le Développement), the C3ED has a special preoccupation with North-South relations and cooperation for research and teaching. (Website <http://www.c3ed.uvsq.fr>)

Other UVSQ Research Centres
linked to the SETE Masters Programme

- **PRISM** — Computer science research including parallel networks, multimedia and distributed information.
- **DANTE** — Research on business law and new technologies, centred on innovation practices including competition law, market dynamics, intellectual property, ICT and biotechnologies.
- **LDVP** — Research on public law with applications to urban policy and administration.
- **LAREQUOI** — Research in management concerned with business strategy and quality, innovation and communication, training and technologies.

2.1.6. Profile of the UVSQ : The Université de Versailles Saint-Quentin-en-Yvelines

The UVSQ is composed of four main faculties:

Sciences, Law & Political Science, Humanities & Social Sciences, and Medicine.

There are also two University Technology Institutes (IUT), one School of Engineering (ISTY), and a specialised atmospheric and earth sciences research centre (the OSU at the IPSL).

The UVSQ is spread over a network of sites on the west of the Paris metropolitan region:

- ◆ the new town of Saint-Quentin-en-Yvelines,
- ◆ the research and innovation districts of the Saclay plateau and the conurbation of Mantes,
- ◆ the rich heritage of Versailles, Rambouillet, the Chevreuse regional natural park, the Seine.

The UVSQ offers 'initial' and continuing education. Teaching programmes are backed by centres of research excellence including medicine and health, environmental sciences, sustainable development and territorial analyses.

For students, the UVSQ offers the attractions of...

- ◆ **A dynamic and multi-disciplinary educational programme;**
- ◆ **A wide choice of applied fields, many of which address directly the industrial, research and territorial development and governance challenges of the Yvelines region;**
- ◆ **Research-based teaching that builds on internationally recognised scientific excellence;**
- ◆ **An active policy of building international partnerships including European and North-South mobility programmes.**

Website: <http://www.uvsq.fr>

UVSQ President: Professor Sylvie Faucheux

ANNEX 2. 2: MODERATION OF TEACHING PROGRAM- TRANSITION MASTER SETE (UVSQ) TO PARIS SACLAY

Analyse économique et gouvernance des risques							
2013 Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)							
Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Aménagement, Énergie et Écologie Territoriale (AMENET)	MSETE33- Analyse économique et gouvernance des risques (AEGR)	1	Analyse économique et gestion des risques urbains	Denis LEVY	IGD		3
		2	Analyse économique et gestion du risque radiologique	NO	NO		NO
		3	Ateliers risques AEGR	Samir ALLAL	UVSQ		2
		4	Modélisation, gestion de projet et prise de décision	Samir ALLAL	UVSQ		4
		5	Gestion du risque industriel et droit de l'environnement	Jean Daniel FINCK	Sanofi		3
		6	Politiques Environnementales Comparées et DD	Samir ALLAL	UVSQ		3
		7	Economie du changement climatique et risques énergétiques	Samir ALLAL (UVSQ/REEDS)	UVSQ		4
		8	Economie du Risque et de l'Assurance	Olivier SUDRIE	UVSQ		4
		9	Qualite, Sécurité, Environnement	Philippe DONIE (CEA)	CEA		3
		10	Stage en Entreprise, Mémoire AEGR	Samir ALLAL	UVSQ		18
		11	Anglais M2 - AEGR	Taïna TUHKUNEN	UVSQ		3
		12	Analyse économique et Maîtrise du Risque	Jean-François VAUTIER	CEA		4
		13	Démarche systémique en analyse des risques			NO	

TRANSITION (UVSQ to UPSay)

The Université Paris-Saclay(UPSay)

Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement local(GETDELO)	Analyse économique et gouvernance des risques (AEGR)	1	Anglais Transversal	Roxana BAUDUIN	UVSQ	24	3
		2	Economie du changement climatique et risques énergétiques	Samir ALLAL	(UVSQ/REEDS)	54	4
		3	Analyse économique et maîtrise des risques : gestion des risques et prévention des accidents	Marc DARRAS (OME)	OME	45	4
		4	Economie du risque et de l'assurance	Olivier SUDRIE	UVSQ	72	4
		5	Economie du risque et de l'assurance	Catherine VESPERINI	IEMSR		
		6	Gestion du risque radiologique	Thierry SCHNEIDER	UVSQ	60	3
		7	Gestion du risque radiologique	NO TEACHER	CEPN		
		8	Gestion des risques urbains	Frédéric LOURADOUR	UVSQ	60	3
		9	Gestion des risques urbains	Hicham MAAREF	UEVE		
		10	Démarche Qualité, Sécurité, Environnement : application à des installations à risques	Karine ROZE (PassECO)	UVSQ	45	3
		11	Système d'information et retours d'expériences				
		12	Système d'information et retours d'expériences	B,AMRHEIN (THALES)	INSTN		
		13	Cycle de conférences AEGR				
		14	Apprentissage en entreprise, mémoire AEGR	Samir ALLAL (UVSQ/C3ED)	UVSQ	27	18
		15	Modélisation, gestion de projet et prise de décision	R, SOLER (EDF)/Change	UVSQ/EDF	54	4
		16	Gestion du risque industriel et droit de l'environnement	NO TEACHER/	(Sanofi)	60	3

			EX. Jean Daniel FINCK			
	17	Gestion du risque industriel et droit de l'environnement	Benoit PETIT	INSTN		
	18	Politiques environnementales comparées et développement durable	Samir ALLAL	UVSQ/REE DS	60	3
	19	Ateliers risques	Philippe DONIE (INSTN/CEA)	UVSQ	24	2

REMARKS:

Same	
Modified	
Unique	

Gouvernance de la transition, écologie et sociétés

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)							
Teaching Field	Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
		10					
		11					
		12					
		13					

The Université Paris-Saclay(UPSay)							
Teaching Field	Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement local(GETEDEL0)	Gouvernance de la transition, écologie et sociétés	1	Savoirs, incertitudes et perspectives en matière d'écologie	Nathalie Frascaria	APT	22.5	2
		2	Droit constitutionnel, Institutions politiques et instruments d'action publique	A définir	APT	15	1.5
		3	Droit de l'environnement et du vivant	Louis de Redon	APT	30	1.5
		4	Droit de l'environnement et du vivant	Laurent Fonbaustier	UPSUD		
		5	Partis et champs politiques face à l'écologie	Guillaume Sainteny	Ecole Polytechnique	30	1.5
		6	Fiscalité de l'environnement	Guillaume Sainteny	Ecole Polytechnique	30	1.5
		7	Gouvernances du local : réformes territoriales et métropolisation	Cécile Blatrix	APT	10	1.5
		8	Gouvernance européenne et dynamiques d'intégration régionale	Delphine Placidi-Frot	APT	30	1.5
		9	Politiques et administrations européennes de l'environnement				
		10	Espace mondial et gouvernance globale: acteurs, enjeux, systèmes				
		11	Management de la transition et conduite du changement	Ambroise de Montbel	APT	30	1.5
		12	Conflits, causes et controverses	Ariane Debrondeau	APT	15	1.5
		13	Méthodes et Pratiques Participatives (1) Typologie	Cécile Blatrix	AgroParisTech	15	1.5
		14	Evaluation et développement durable : regards croisés écologie/sciences sociales	Cécile Blatrix, Nathalie Frascaria	AgroParisTech	30	1.5
		15	Méthodes Participatives (2) Retours sur	Cécile Blatrix	AgroParisTech	10	1.5

	Expériences				
16	Négociations internationales et dynamiques de coopération	Delphine Placidi-Frot	UPSud	30	1.5
17	Analyse, gouvernance et gestion intégrée : Biodiversité	Change: Jean-Marc DOUGUET	UVSQ	7.5	1.5
18	Analyse, gouvernance et gestion intégrée : Biodiversité	Cécile Blatrix(Coordinator)	APT		
19	Analyse, gouvernance et gestion intégrée : Biodiversité	Jane Lecomte	UPSUD		
20	Méthodes de recherche-intervention	Ambroise de Montbel	APT, UPSud	15	1.5
21	Méthodes de recherche-intervention	A définir			
22	Méthodologie de la recherche	Cécile Blatrix	APT, UPSud	15	1.5
23	Méthodologie de la recherche	Jane Lecomte			

Dynamiques des pays émergents et en développement (DYNPED)

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)

Teaching Field	Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS

The Université Paris-Saclay(UPSay)

Teaching Field	Program	S.l	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement local(GETEDEL0)	Dynamiques des pays émergents et en développement (DYNPED)	1	Méthodologie et pratique du développement	Nathalie Frascaria	Paris 1/7	30	5
		2	Territoires du développement et mondialisation	A définir	Paris 1/7	30	5
		3	Dynamiques des relations villes-campagnes	Louis de Redon	Paris 1/7	30	3
		4	Contraintes, potentialités des milieux et développement	Laurent Fonbaustier	Paris1/7	30	3
		5	Différenciation des systèmes agraires	Guillaume Sainteny	APT	30	3
		6	Gestion des espaces ruraux, développement et environnement	Guillaume Sainteny	Paris1/7	30	3
		7	Dynamiques de l'urbanisation et des sociétés urbaines	Cécile Blatrix	Paris1/7	30	3
		8	Pouvoirs et logiques territoriales	Delphine Placidi-Frot	Paris1/7	30	3
		9	SIG appliqués aux pays en développement		Paris1/7	30	3
		10	Statistique et cartographie		Paris1/7	30	3
		11	Documentaire scientifique	Ambroise de Montbel	Paris1/7	30	3
		12	un enseignement de langue	Ariane Debrondeau	(à prendre à l'INALCO, à Paris 7-LANSAD ou à	30	3

				Paris 1-SELVA)		
13	Recompositions territoriales en Asie orientale	Cécile Blatrix	Paris1/7	30		3
14	Territoires et sociétés dans la mondialisation en Asie du Sud et du Sud-Est	Cécile Blatrix, Nathalie Frascaria	Paris1/7	30		3
15	Mutations sociales et territoires en Amérique latine	Cécile Blatrix	Paris1/7	30		3
16	Mutations sociales et recompositions des territoires en Afrique subsaharienne	Delphine Placidi-Frot	Paris1/7	30		3
17	dans les enseignements théoriques et méthodologiques non retenus	Jean-Marc DOUGUET				3
18	dans les enseignements d'autres formations de niveau master avec lesquels un accord de partenariat existe	Cécile Blatrix(Coordi nator)				3
19	Mémoire de recherche	Jane Lecomte				

2013

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)

Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Ingénierie du Développement Durable (IDD)	Environmental Knowledge Mediation, Partnerships for Sustainable Development (MEDIATION)	1	Multimedia Tools (1): Design and evaluation of learning pathways	Jean-Marc Douguet	UVSQ	30+24	6
		2	Multimedia Tools (2): Processes of consultation and Deliberation	Jean-Marc Douguet	UVSQ	30	6
		3	Méthodes et Pratiques Participatives (2) : Retours sur Expériences	Jean-Paul VANDERLINDEN		21	3
		4	Concepts et Indicateurs du Développement Durable	Martin O'CONNOR, Joachim SPANGENBERG	UVSQ	21	3
		5	Indicateurs du DD (2) : La Foire aux Indicateurs	Martin O'CONNOR, Jean-Marc DOUGUET	UVSQ	12+18	3
		6	Micro-Economie, Choix Social & Evaluation Environnementale			20	3
		7	Théorie de la Valeur Approfondie et comptabilité verte	Martin O'Connor	UVSQ	15+15	3
		8	KQA : Mesure et Incertitude	Jeroen P. VAN DER SLUIJS, Martin O'CONNOR	UVSQ	30	6
		9	Territoires / Politiques d'agriculture durable	Jean-Marc Douguet	UVSQ	20	3
		10	Consommation Durable				3
		11	Integrated Analysis & Economy-Environment Modelling	Matéo Cordier	UVSQ	21	3
		12	Economie du carbone	F. Louradour	UVSQ	21	3
		13	Reporting développement durable et parties prenantes	Farid BADDACHE	UVSQ	21	3
		14	Investissement Socialement	G. Schneider Maunoury	UVSQ	20	3

TRANSITION(UV SQ)

		Responsable, Notation				
15	Méthodes et pratiques participatives (1) Typologie	J.P. Vanderlinden	UVSQ	21		3
16	Sustainable Agriculture	Jean-Marc Douguet	UVSQ	21		3
17	Analyse Prospective et Veille	Christelle HUE	UVSQ			3
18	Agenda 21 et aménagement (Territoires Durables)	Arnaud Comolet, Martin O'Connor	UVSQ	24		3
19	Analyse, gouvernance et gestion intégrée : biodiversité	Martin O'CONNOR	UVSQ	20		3
20	Energie-Climat-Environnement	Samir ALLAL	UVSQ	15		3
21	Analyse, gouvernance et gestion intégrée : les zones côtières	Juan BAZTAN et Jean-Paul VANDERLINDEN	UVSQ	20		3
22	Systèmes d'Information Géographique (SIG): initiation	Sébastien GADAL	UVSQ	21		3

2016

The Université Paris-Saclay(UPSay)

Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement Local(GETEDEL0)	Médiation des connaissances environnementales, Partenariats pour le développement durable	1	Médiations Multimédia (1) Les parcours Cognitifs	Jean-Marc DOUGUET	UVSQ	30	3
		2	Médiations Multimédia (2) Processus de Concertation & Délibération	Jean-Marc DOUGUET	UVSQ	30	3
		3	Méthodes et Pratiques Participatives (1) Typologie	Cécile Blatrix	APT	30	3
		4	Concepts et Indicateurs du Développement Durable	Martin O'Connor	UVSQ	30	3
		5	Projet ou Stage				18
		6	Méthodes Participatives (2) Retours sur Expériences	Cécile Blatrix	APT	30	3
		7	Indicateurs du DD (2) : Le kiosque aux indicateurs	Martin O'Connor	UVSQ	30	3
		8	Développement durable et intelligence territoriale	Isabelle Nicolai	UVSQ	52.5	3
		9	Territoires/Politiques de l'Agriculture Durable	Jean-Marc DOUGUET	Rambouillet	30	3
		10	Analyse, gouvernance et gestion intégrée : Biodiversité	Cécile Blatrix	APT, UVSQ, UPSUD	30	3
		11	Analyse, gouvernance et gestion intégrée : Biodiversité	Jane Lecomte			
		12	Analyse, gouvernance et gestion intégrée : Biodiversité	Jean-Marc DOUGUET			
		13	Evaluation intégrée environnementale	Jean-Marc DOUGUET	UVSQ	30	3
		14	Agenda 21 et aménagement	Marie-Françoise	UVSQ	30	3

		(Territoires durables)	Guyonnaud			
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2013							Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)						
Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS						
Ingénierie du Développement Durable (IDD)	Eco-Innovation dans les systèmes agricoles et alimentaires (AGRO-INNOV)	1											
		2											
		3											
		4											
		5											
		6											
		7											
		8											
		9											
		10											
		11											
		12											
		13											

2016

Université Paris-Saclay (UPSay)

Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement local(GETDELO)	Innovations, Territoires et proximités(TER-INNOV)	1	Innovations économiques et sociales dans les territoires	Martin O'Connor & Jean-Marc Douguet	UVSQ	20	3
		2	Innovations économiques et sociales dans les territoires	André Torre & JB Traversac	INRA		
		3	Attractivité et compétitivité des territoires	Voir IEDD	UVSQ	25	3
		4	KQA: Measurement and uncertainties	Martin O'Connor	UVSQ	20	3
		5	Evaluation économiques des systèmes agricoles et agroalimentaires	Jean-Marc Douguet & Jean-Baptiste	INRA	20	3
		6	Le foncier et les pratiques de gestion des sols innovantes	Romain Melot	INRA	20	3
		7	Mémoire/Stage	Jean-Marc Douguet & JB Traversac			18
			Politiques de smart développement et espaces ruraux	Frédéric Wallet	INRA	20	3
		9	Innovations locales: Logistique des circuits courts et nouvelles formes de relations agriculteurs - consommateurs	JB Traversac & Leila Kebir	INRA	20	1.5
		10	Gouvernances du local : réformes territoriales et métropolisation	Cécile Blatrix	APT	20	3
		11	Territoires/Politiques agricoles	Jean-Marc Douguet	Rambouillet	20	3
		12	Politiques de smart développement et espaces ruraux		INRA	20	3
		13	Valorisation des produits alimentaires, promotion de l'origine et labels innovants	Frédéric Wallet & Emmanuel Raynaud	INRA	20	3
		14	Analyse, gouvernance et gestion	change/ Jean-Marc DOUGUET	UVSQ	20	3

		intégrée : Biodiversité				
	15	Analyse, gouvernance et gestion intégrée : Biodiversité	Cécile Blatrix	APT		
	16	Analyse, gouvernance et gestion intégrée : Biodiversité	Jane Lecomte	upsud		
	17	Evaluation intégrée environnementale	Jean-Marc DOUGUET	UVSQ	20	3
	18	Agenda 21 et aménagement (Territoires durables)	change/ Marie-Françoise Guyonnaud	UVSQ	20	3
	19	DD et intelligence des territoires	Voir IEDD	UVSQ		
	20	DD et intelligence des territoires	Voir IEDD	APT	35	3
	21	DD et intelligence des territoires	Voir IEDD	EIEE		
	22	Gestion de projet: Entreprenariat, Finances, analyse économique...)	F. de Ligondés	UVSQ	46	9

M2- Ecological Economics and Integrated Environmental Assessment (Expected in 2016)

Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Ingénierie du Développement Durable (IDD)	MSETE20-Ecological Economics and Integrated Environmental Assessment	1	KQA : Mesure et Incertitude	Jeroen P. VAN DER SLUIJS, Martin O'CONNOR	UVSQ		6
		2	Economie du carbone	F. Louradour	UVSQ		3
		3	Reporting développement durable et parties prenantes	Farid BADDACHE	UVSQ		3
		4	Investissement Socialement Responsable, Notation	G. Schneider Maunoury	UVSQ		3
		5	Agenda 21 et aménagement (Territoires Durables)	Arnaud Comolet, Martin O'Connor	UVSQ		3
		6	Projet ou stage, mémoire		UVSQ		18
		7	Analyse, gouvernance et gestion intégrée : les zones côtières	Juan BAZTAN et Jean-Paul VANDERLINDEN	UVSQ		
		8	Méthodes et Pratiques Participatives (2) : Retours sur Expériences	Jean-Paul VANDERLINDEN	UVSQ		3
		9	Territoires / Politiques d'agriculture durable	Jean-Marc Douguet	UVSQ		3
		10	Energie-Climat-Environnement	Samir ALLAL	UVSQ		3
		11	Méthodes SIG	Sébastien GADAL	UVSQ		3
		12	Concepts et Indicateurs du Développement Durable	Martin O'CONNOR, Joachim SPANGENBERG	UVSQ		3
		13	Méthodes et pratiques participatives (1) Typologie	J.P. Vanderlinden	UVSQ		3
		14	Analyse, gouvernance et gestion intégrée : biodiversité	Martin O'CONNOR	UVSQ		3
		15	Analyse Prospective et Veille	Christelle HUE	UVSQ		3
		17	Indicateurs du DD (2) : La Foire aux Indicateurs	Martin O'CONNOR, Jean-Marc DOUGUET	UVSQ		3
		18	Multimedia Tools (2): Processes of consultation and Deliberation	Jean-Marc Douguet	UVSQ		6
		19	Multimedia Tools (1): Design and evaluation of learning pathways	Jean-Marc Douguet	UVSQ		6

		20	Integrated Analysis & Economy-Environment Modelling	Matéo Cordier	UVSQ		3
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2016							
Université Paris-Saclay(UPSAy)							
Teaching Field	Code & Program	S.I	Course Title	Course Teacher	Participants	Hours	ECTS
Gestion du territoire et Développement local(GETEDEL0)	M2 - Program in Ecological Economics and Environmental Integrated Analysis (EE-EIA)	1	Multimedia Tools (2): Processes of consultation and deliberation	Martin O'Connor(Coordinator)	UVSQ	20	3
		2	Concepts and indicators of sustainable development	Murray Patterson	UVSQ	20	3
		3	Micro-economy, social choice and environmental evaluation	Martin O'Connor	UVSQ	20	3
		4	Environmental economic modelling and sustainable development	Patrick Schembri	UVSQ	20	3
		5	Project or Research Report	NO TEACHER	UVSQ		15
		6	KQA: Measurement and uncertainties	Martin O'CONNOR	UVSQ	20	3
		7	Theory of value and green accounting	Martin O'Connor	UVSQ	20	3
		8	Sustainable development indicators (2) Disseminating knowledge.	Murray Patterson	UVSQ	20	3
		9	Methods and Practices of Public participation (2) Lessons from experience.	Martin O'Connor	UVSQ	20	3
		10	Analysis, governance. and integrated management: biodiversity.	Jean-Marc DOUGUET	UVSQ	20	3
		11	Analysis, governance. and integrated management: biodiversity.	Jane Lecomte	UPSUD	20	3

Master 1 - Gouvernance des territoires et développement local (GETEDELO)

3	Environmental integrated Analysis: special topics	Martin O'Connor	UVSQ	20	
14	Circular economy et Green economy	Murray Patterson	UVSQ	20	3
15	UE dans les autres parcours/UE other Courses	NO	NO		6

The Université Paris-Saclay(UPSay)							
Teaching Field	Program	S.I	Course Title	Course Teacher	Participants	Hours	ECT S
territoire et développement local	Gouvernance de la transition, écologie et	1	Ecologie et écosystèmes	Marc Girondot	Upsud		3
		2	Economie de l'environnement	Patrick Schembri, François Carlier	UVSQ, Upsud		3
		3	Droit de l'environnement	Aude Farinetti	Upsud		3

4	Statistique & Méthode d'enquête en sciences sociales	KATIA RADJA ,	UVSQ, APT		
5	Conférence BASE	Jean-Marc Douguet	School BASE		3
6	Conduite de projet		UVSQ, APT		3
7	Stage				1.5
8	Introduction aux grands cycles de la biosphère dans les territoires	Martin O'Connor	APT, UVSQ		3
9	Analyse des politiques publiques	Cécile Blatrix	APT		3
10	Ecologie, biodiversité, évolution	Nathalie Frascaria	APT, UVSQ		3
11	Agro-écologie : Concepts et pratiques	Hubert Cochet, Jean-Marc Douguet	APT, UVSQ		3
12	Time and Uncertainty	Prof. Martin O'Connor	UVSQ		3
13	Les Systèmes d'information de l'Observatoire des Programmes Communautaires de Développement Rural		UVSQ, APT		
14	Environnement, politiques et action publique	A définir, Cécile Blatrix	APT, UVSQ		3
15	Aménagement et nouvelles mobilités : usages, réseaux, acteurs	Guillaume Bailly	UVSQ		3
16	UE dans autres parcours				

ANNEX 2. 3: PRESENTATION OF TEACHING FIELD INNOVATION

UVSQ: International Professional Master in Management of Eco-Innovation

Eco-innovation is the development of technical and management approaches to the challenge of reducing the environmental footprint of human settlement. Being eco-innovation perception on one's home verdure is no longer enough but Successful eco-innovations solve environmental problems, and create green opportunities To succeed in today's challenging world, global perspectives and cultural aptitudes are essential. Our eco-innovation aims to help you develop your creativity and problem-solving skills in a multi-cultural context and innovative environments. The Program includes one internship program to practical job markets and a term spent practical knowledge, as well as the six months national or International Immersion Project. This practical Program will engage you in a project home or abroad, putting you in real-world situations and developing your understanding of the region's cultural, social, and environment. **This one-year international job oriented degree is conducted in English by a partnership of university and industry-based instructors, aiming to give you the skills and experience needed to join the next generation of eco-innovation entrepreneurs and managers.**

Our International Professional Master in Management of Eco-Innovation's structure is based on a combination of knowledge and hands-on professional experience, designed to offer participants a unique, global perspective on 21st century business world. It is a life-changing choice, on that will be sharpen your critical thinking and analytical skills, heighten your ethical business, environmental awareness, and refine your ability to react efficiently in today's ever-changing business environment. By developing yourself-awareness, the program will teach you how you learn, so that you can confidently face complex situations and develop responsible, transformative leadership qualities.

Program Aims:

- To provide students with the skills and experiences necessary to meet the needs of the next generation of entrepreneurs and eco-innovative managers.
- To learn eco-innovation management from inspiration to solution on ecological problems, technical and social innovation strategies, technologies and applications, knowledge translation and management, environmental and intellectual property law, founding and financing a start-up and more...
- To prepare the participants for the techniques and methods of management in a complex industry which is undergoing massive changes in order to give them the means to integrate quickly the different worlds of the business and to bring an added value to the companies in that area.
- To develop international managers ready to build a sustainable economy
- To develop a spirit of entrepreneurship.
- To understand organizational structures of international firms and businesses
- To Providing insights to international marketing strategies
- To analyzing global management methods, assessments tools for sustainable development
- To improve policy and policy and governance of local or foreign government
- To Innovate by creating, financing and developing a business
- To learning how to use international networks and developing company reputation management
- To Take into account the legal conditions of the Industry including counterfeiting problems

Program Contents:

Eco-innovation Master's Program is characterised by technological development and management

methods with the aim of reducing man's impact on the environment. Eco-innovation Program brings solutions to environmental problems whilst creating commercial opportunities, which necessitates an interdisciplinary approach in that it brings together various elements, including specialised technologies, management techniques, environmental philosophy (ethics), sustainable development and systems of innovation.

The Program offers a valued opportunity for students and professionals to learn and enrich their knowledge in the fields of environment, territory and economy in today's dynamic and competitive world. The Program, totally taught in English, suits students and professionals who either already possess a general knowledge in business or intend to start and pursue their career in business and management.

We welcome applications from around the world regardless of race, religion, gender or financial status and our aim is to build a top quality, exciting, dynamic and diverse class. The Program is composed of a well thought out mix of courses on Intercultural team Management with also Management strategy and analysis in the business world. With integrated seminar and over 20 different nationalities in the classroom, no other academic offers such a multicultural experience. You will learn in the classroom and in internship situations where you will address real eco-innovation management problems faced by our industry partners. You will be guided by a combination of university- and industry-based instructors, studying a total of six eco-innovation modules. During internship terms you will take up a paid internship, addressing a real eco-innovation management problem. Your learning in academic terms will be integrated and applied to a real-life eco-city innovation problem in an Integration Seminar combining group and individual work

The Program includes following six integrated modules with Integration seminar and Internship

- **Module 1. Eco-innovation and competitiveness in a globalizing economy.** [OUTLINE](#)
 - Nature of Eco-innovation
 - Why eco-innovation ? Technical progress, policy and growth
 - Juridical aspects (intellectual Property)
 - Debate (IPCC (Intergovernmental Panel on Climate Change) and the other group will be "Climate skeptics.")
 - Juridical aspects of innovation in sustainable development
 - "Fundamental Issues of Culture & Technology: The Building Blocks"
 - [Case Study](#)
- **Module 2.** Methods and tools for economic and environmental evaluation: [OUTLINE](#)
 - Introduction to valuation and monetary valuation/Accounting and non monetary valuation
 - Multi-Criteria Assessment of Ecosystems and Biodiversity
 - Valuing the Environment: Emissions Trading in the climate change context
 - Eco-innovation prospective tools
 - Responsible innovation
 - Social justice
 - [Case Study](#)
- **Module 3.** Finance and entrepreneurship: Group study for innovative Finance and entrepreneurship project: [OUTLINE](#)
 - Finance and entrepreneurship- Topic1
 - Finance and entrepreneurship- Topic2
 - Finance and entrepreneurship – Topic3

- Entrepreneurship 1
- économie de fonctionnalité
- Entrepreneurship 2
- Case Study
- **Module 4.** Social acceptability: [OUTLINE](#)
 - [Social acceptability](#)
 - Case Study
- **Module 5.** Major scientific challenges and technologies for sustainability: [OUTLINE](#)
 - The CO2 problem in the cement industry
 - The role of ICT in supporting eco-innovation
 - Renewable energies
 - Sciences : Clean Transport
 - Environmental Sciences and Society
 - Risk Assessment and Management
 - Building prospective : various scenarios
 - scenarios prospective
 - Advanced detectors and modelling
 - Case Study
- **Module 6.** Project management & skills development: [OUTLINE](#)
 - Survey Methods
 - Project Management
 - Project monitoring
 - Creativity
 - [Research Methodology](#)
 - [Field Study](#)
 - [Workshop](#)
- Integration Seminar: [GUIDELINE](#)
- Internship/ Individual Study: [GUIDELINE](#)

The first semester focuses on the problems surrounding eco-innovation and the methods available to overcome these. The second semester addresses specialised technologies that can be used today and in the future to confront the problems of eco-innovation through an exam on the application of methods and technologies, Integration Seminar and internship. Following this, students receive individualised assessment in order to improve the skills and knowledge already acquired and identify the weak points of a specific domain in order to become better eco-innovators.

Strengths and career prospects:

The teaching methodology applied to the International Program creates a truly dynamic learning experience, allowing participants to adopt an entrepreneurial mindset and develop the necessary skills. The curriculum is a mixture of lectures, group study, case studies, survey, project-based, Integration seminars and internship. This requires all participants to actively participate in all courses. From classroom learning to internship experience you will gain skills in:

- Analysis of the challenges of eco-innovation in different cities, regions, and countries
- Articulation of the importance of environmental ethics to eco-innovation
- Understanding determinants of national competitiveness and the contribution of eco-innovation to competitiveness
- Application of principles of sustainable development
- Methods of technological and social foresight analysis

- Observation and measurement of environmental change
- Evaluation of innovation systems in energy, transport, construction, and water
- Analysis of environmental law
- Analysis of key factors for success in business management for eco-innovation
- Eco-innovation business plan development
- Integration of intellectual property management into eco-innovation
- Identification of finance options for eco-innovation
- Evaluation of environmental, technical, and financial risk
- Leadership and project management in research, development and demonstration focused on eco-innovation

Moreover, in today's marketplace, employers are seeking to employ staffs who are suitably qualified to undertake their roles and responsibilities. As such, there is an increased need for professional Programs to be job orientated, with an emphasis on training students in the theoretical underpinnings and relevant practical areas to work in the eco-innovation project. It is necessary for applicants to understand that the most important quality valued by employers is experience. When you(graduate of eco-innovation) will apply to environment, energy , resource efficiency , innovation for sustainable development, eco-industry, and green growth sectors - Interviewer or Employers will see that you are:

- The training based graduate of Eco-innovation and you have already conducted eco-innovative projects during your internship with experienced employer or supervisor.

Partner and community networks:

- AgroParisTec, CEA , CNRS, Centra, ENS Cachan, Ecole Polytechnique, ENSAE ParisTech , ENSTA ParisTech, HEC Paris, IHES, INRA , INRIA , INSERM, Institut Mines Télécom (Télécom ParisTech, Télécom SudParis), IOGS, ONERA, Supélec, Systematic , Synchrotron Soleil, Université Paris-Sud
- Universitat Autònoma de Barcelona(UAB)
- Centre de Recherches en économie-écologique, éco-innovation et ingénierie du Développement Soutenable (REEDS)
- European foundation for sustainable territories (Fondaterra)
- CEZ Group
- Albion College
- Alstom
- GDF SUEZ
- Italcementi
- Saur ,
- SNCF

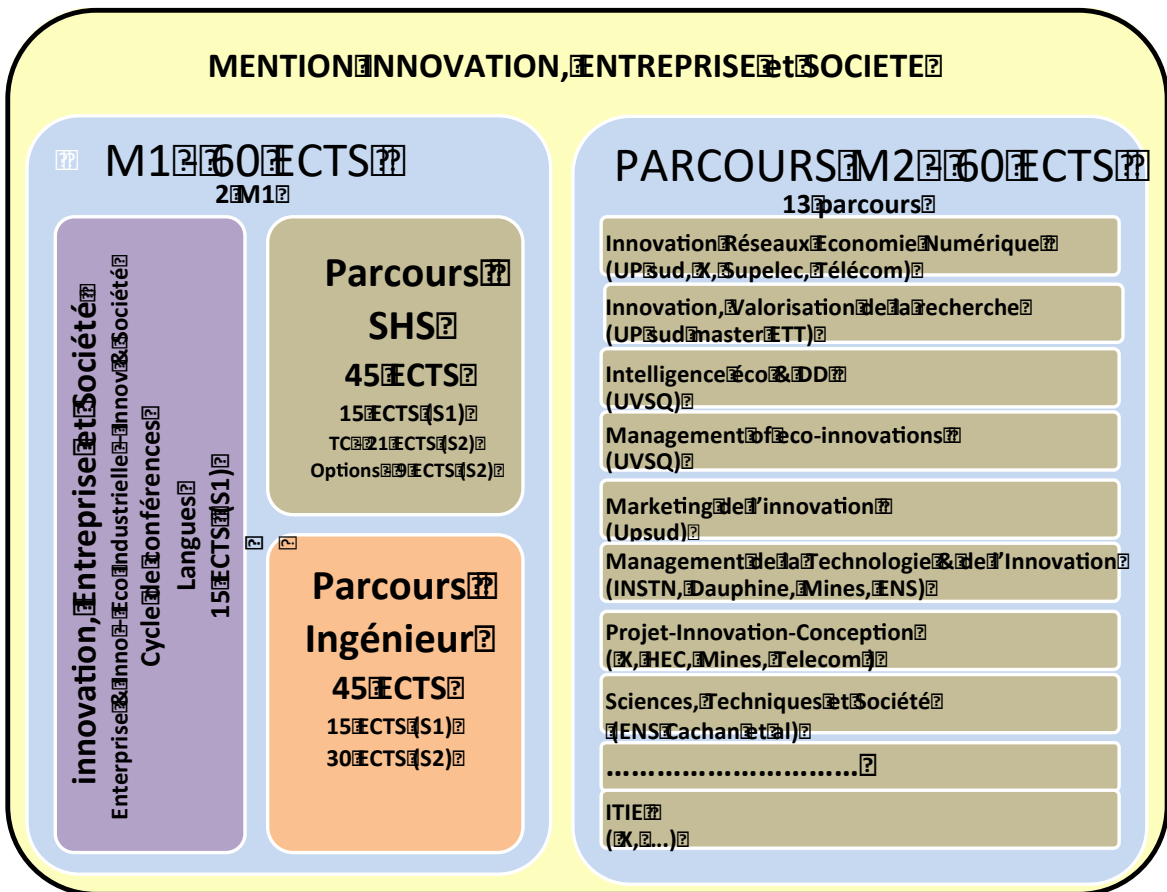
Université Paris-Saclay : Innovation, Entreprise et Société

The Master Innovation, Enterprise and Society aims to bring together all the courses of the University of Paris-Saclay with a mainly SHS approach on the theme of innovation proposed by the 3 universities and 7 schools of the Saclay Plateau. Its aim is to offer SHS students as well as engineering and scientific students high-level training on all aspects related to innovation processes (detection, financing, project management, enhancement, etc.). It is aimed at students with scientific and technological training (universities, engineering schools) - who wish to acquire a dual skills in the social sciences and thus increase their ability to apply their knowledge to socio-economic contexts - than to students economists, managers, sociologists, historians, lawyers who will seek to adapt their social science training to specific technical environments. For engineering students, the continuation of training-specific teachings remains possible.

This mention makes the bet to offer a truly multidisciplinary training, and this from the M1, is one of its originalities. Multi-disciplinarity requires two vectors. First of all, totally new, a common core at the beginning of M1 brings together the different audiences, whether they come from SHS or scientific and technical training, in other words enrolled in the 3 universities as in engineering school (Polytechnique, with possible opening to other schools in the future). The other vector is the diversity of the teachings proposed, which cover the different disciplinary fields of the SHS (economics, management, sociology, law, history).

This original M1 is the unifying pole of this new mention. He has focused the attention of the steering committee at this stage. However, the wish is to continue the work in the future, in two directions: by drawing up proposals for missions and student projects that can be achieved by building multidisciplinary inter-institutional groups, but also by working on possible pooling of M2 purposes to improve their readability and differentiation.

The trades concerned are not only those of management, such as consulting in strategy, economic or prospective intelligence, innovation organization and management, engineering studies, research and industrial development, engineering business managers, but also high-growth occupations such as information technology researchers, digital economy, networks, technical and economic regulation, eco-innovations, or again, at the legal frontier with intellectual property experts, etc. Trades at the crossroads of traditional specialties are also in full development: development or business managers, valuation managers. The courses of the Master IES provide for the most part training and support to entrepreneurship and the creation of start-ups, as well as to the research professions.



SOURCE : Fiche descriptive de Mention de Master préparatoire à la campagne d'accréditation 2015-2020/ Version 4

ANNEX 3 1: DOCUMENTATION OF CHAPTERS 3

Operation EGER 07 of the C3ED laboratory, "NTIC - Environment", phased in from 1999, has addressed in an original way the challenge of exploiting the potential of new information and communication technologies (the NTIC) for research and teaching, particularly in the areas of environmental governance and sustainable development.

ICTs were recognized in this program as a medium, both for the representation of ecological-economic systems and processes, and for the organization of learning and knowledge for educational purposes. We envision ICT as, among others, a vehicle for the enhancement of research, for environmental education, as it's support in processes of consultation and deliberative governance.... Methodologically, this operation had several components, which were closely complementary:

1. A program of research and demonstration of deliberation tools (In English, Deliberation Support Tools), including the conceptual and experimentation of the "Matrix of Deliberation" in successive online achievements.
2. The development of multimedia tools as supports for the sharing of knowledge and for the provision of educational resources (notably, the KerBabel portal);
3. Training and production of educational resources (virtual libraries called Brocéliande and Fangorn);

In this program of research, educational innovation and collaboration, we are committed to creating new multimedia interfaces between science, decision makers, industry and citizens. The three conceptual and technical components were, in parallel, relayed by more "classic" academic and collaborative work activities — namely, scientific publications, the development of collaborative projects, the acceptance of Master's students in internships, piloting doctoral theses...). And finally, Operation EGER 07 also envisioned ICT for the creation, organization and exploitation of geographic spatial data (e.g., geological and ecological classifications, land occupation, climatology, etc.) — potentials that promised to strengthen and renew mapping practices and allowed it to be integrated into dynamic analysis (modeling of scenarios and techniques for representing future possible...). We also use multimedia ICTs as new ways of enhancing scientific research — dissemination and popularization through electronic media and animated visual presentations, etc. In particular, we envision the revolution in the possibilities of multimedia communication and interactive representation and uses in environmental education and as interactive decision-making aids.

Finally, through all these research and service activities (value, educational materials, etc.), the team conducts a permanent reflection on the meaning of the penetration of digital technologies within our societies, both from the South and from the South north.

L'ouverture au monde de l'information est donc à la fois méthodologique et empirique. Elle se fait selon les quatre axes principaux suivants :

- Le multimédia et le traitement de l'information comme outils pédagogiques
- Le multimédia, le traitement de l'information et les NTIC comme objet de formation pédagogique
- Le traitement de l'information et les NTIC comme outils de recherche et de valorisation de la recherche
- Les NTIC comme objet de recherche en économie et management.

The DICTUM RESEARCH PROGRAM

The DICTUM PROGRAM ("Democratic Use of New Information Technologies and Communication to promote the Sustainable Use of Ecosystems and Living Resources") emphasizes the role of representation and management of knowledge to bridge the technical rigour of scientific and economic analysis with the need for public deliberation and communication. In general, we are talking, by neologism, about The Deliberation Support Systems.

This research and demonstration activity has gained its initial dynamism thanks to French and especially European funding. Below are the acronyms for multi-partner projects funded by the European Commission in which members of the EGER 07 team participated or participated in the pivotal period from 2000 to 2004.

ACRONYME	PÉRIODE
5 ^{ème} Programme Cadre	Projets obtenus à partir de 1998
PEGASE	(2000–2003)
GOUVERNe	(C3ED Coordinateur : 2000–2003)
VIRTUALIS	(C3ED Coordinateur : 2001–2004)
AQUADAPT	(2002–2004)
6 ^{ème} Programme Cadre	Projets obtenus à partir de 2003
ALARM	(2004-2008)
SRDTOOLS	(2004-2006)
INCOFISH	(2004-2007)

In this context, we should mention the design and development of two original scientific tools:
 The "Deliberative Matrix" to structure participatory evaluation (multi-criteria and multi-actors) of policies and programmes at local, national and international scales;
 The "Indicator Fair" which, from its first completion in 2003-2004, could be, at the same time, a catalogue of "candidate indicators", a tool for dialogue on scientific quality and on the relevance of indicators according to sites or objectives; an interactive framework for documenting models and representations in virtual reality.

THE UNIVERSITY OF VERSAILLES ST-QUENTIN-EN-YVELINES



Counted amongst the ARWU Top 500 universities, the UVSQ is composed of four main faculties in Sciences, Law & Political Science, Humanities & Social Sciences, and Medicine. There are also two University Technology Institutes (IUT); one School of Engineering (ISTY); an Institute for Languages and International Studies; an Interdisciplinary Institute for Environment, Climate, Ecotechnology and Sustainable Development, (the Observatoire de Versailles Saint Quentin, OVSQ), an Institute for Cultural Studies, a Higher Institute of Management and two Midwifery Schools. Spread over a network of sites on the west of the Paris metropolitan region, the UVSQ is anchored in a territory of exceptional scientific, socio-economic, architectural, patrimonial, and environmental quality.

The UVSQ offers a wide spectrum of programmes, including continuing education and vocational training. The teaching programmes are backed by centres of research excellence in a wide range of disciplines and interdisciplinary specialities including medicine and health, environmental sciences, sustainable development, social science and humanities, law and territorial analyses.

OVSQ INTERNATIONAL TEACHING PARTNERSHIPS

The UVSQ is strong in its international networking. Within the OVSQ, the participating research centres together with the post-graduate teaching partnerships, engage more than 100 centres of excellence for research and teaching in climate and environmental science, ecological economics, environmental politics, governance and sustainability. It offers exchange opportunities to students, via short-term projects at Bachelors and Master level and by prolonged exchanges in doctoral studies. Invited academics contribute to individual modules of the teaching programmes, as well as joint activities at the level of the specialities in the 2nd year programme. There is substantial inter-university collaboration for the development of teaching materials, including on-line resource materials, often drawing from international collaborative research projects. Links with the business world were given a new emphasis through the establishment, in 2004, of FONDATERRA (the European Foundation for Sustainable Territories) and, in 2009, of the International Industrial Chair ECONOVING devoted to all phases along the life cycle of generating and managing eco-innovation.

Coordinator for the Albion-UVSQ Sust-3T Partnership at the UVSQ

Martin O'CONNOR is Professor in Economic Science at the University of Versailles St-Quentin-in-Yvelines (UVSQ) in France. His teaching specialties are economics of the environment; sustainability theory and policy; microeconomics; decision support systems, risks and governance. His research activities span the fields of ecological economics, evaluation, green national accounting, sustainability studies, integrated environmental analysis, energy analysis and water resources governance fields. He is the creator of the KerBabel™ suite of Internet-based knowledge mediation tools and, is currently Director of the international research centre REEDS (Research in Ecological Economics, Eco-innovation and Tool Development for Sustainability), created in 2009 as an evolution of the former C3ED (Centre for Economics and Ethics of Environment and Development) operating from 1995-2009 at the UVSQ.

Email: Martin.O-Connor@reeds.uvsq.fr

L'OBSERVATOIRE DE VERSAILLES SAINT-QUENTIN



The OVSQ — the UVSQ's Interdisciplinary Institute for Environment, Climate, and Sustainable Development

The UVSQ's Interdisciplinary Institute for Environment, Climate and Sustainable Development, the OVSQ, combines three roles of observatory/data clearing house, research centre and institution of higher learning. As such the OVSQ is responsible for leading the Master SETE programme.

The OVSQ is the meeting point between research laboratories that are members of the Institut Pierre Simon Laplace, within the field of earth and planetary science, and research laboratories in the fields of health science and social science and humanities. Among these laboratories the following are key grounding points for the SETE Master programmes:

- ◆ **LATMOS — Laboratoire Atmosphères, Milieux, Observations Spatiales.** Themes include: Physical and chemical processes in the Earth's atmosphere, atmosphere and land surface exchanges, study of planets and small solar system bodies, physics of the heliosphere, of the planets exosphere, and solar system plasmas.
- ◆ **LSCE — Laboratoire des Sciences du Climat et de l'Environnement.** Themes include: Mechanisms of natural climate variability and anthropogenic changes, processes involved in the cycle of greenhouse gas emissions and aerosols, geochronology and geo-markers analysis.
- ◆ **REEDS — The international centre for Research in Ecological Economics, Eco-Innovation & Tool Development for Sustainability.** Themes include: Dynamics of socio-economic and environmental systems; Economic and environmental valuation & sustainability indicators (at micro, meso and macro scales); Eco-innovation strategies and Corporate Social Responsibility; Decision and deliberation support in private and public sector contexts and for collective choice; Monitoring and information systems for socio-economic and environmental values.
- ◆ **CEARCT — The European Centre for Arctic Research.** A trans-disciplinary research centre at the OVSQ-UVSQ, the CEARCT combines physical science, social sciences and humanities, and draws on the fields of expertise and competence of all the research laboratories of the OVSQ at the UVSQ, and also of other faculties of the university. It has a wide network of collaborating universities and research institutes, including the University of the Arctic.
- ◆ **PIFO — Medical School.** Two research teams of the Paris Île de France Ouest medical school (PIFO) who are working on the analysis of the interactions of human health and the environment: (1) the laboratory of physiopathology and diagnosis of microbial infections and (2) the laboratory of Health-Environment-Aging.

FONDATERRA — A UVSQ PARTNERSHIP FOUNDATION

The European Foundation for Sustainable Territories

FONDATERRA is a centre of excellence for research and partnerships for sustainability in a territorial perspective. Three priorities are currently established for its operations:

- Ramifications of climate change at a territorial scale, and associated challenges for regional development, infrastructure and technology choices;
- Participatory governance through state-business-civil society partnerships, notably for territorial development at a regional level;
- Environmental planning, resource management and organisational change.

Established through the alliance of higher education, specialised research institutes, private companies, business federations, publicly owned companies and territorial administrations (village, town & county, and regional authorities), FONDATERRA works for mutual benefits in applied research and education. It is linked across France, Europe and worldwide in a network of centres of excellence on sustainability, territorial governance, research and technology themes.

Contact: Marie-Françoise Guyonnaud, Executive Director of Fondaterra
Email: marie-francoise.guyonnaud@fondaterra.com Website : <http://www.fondaterra.com>

ECONOVING — BUSINESS-UNIVERSITY PARTNERSHIP

International Industrial Chair On “Generating Eco-Innovation”



The PRES UniverSud Paris International Industrial Chair ECONOVING, on “Generating eco-innovation”, is housed within the OVSQ (the UVSQ’s Interdisciplinary Institute for Environment, Climate, Eco-technology and Sustainable Development). This Chair, established in partnership with a group of major industrial groups, pursues the following objectives:

- accelerate the transfer from eco-sciences to eco-technologies and eco-industrial applications.
- anticipate the training needs within the field of eco-innovation
- foster the development of eco-SMEs through the early identification of emerging needs, products and knowledge
- provide an advice regarding the risks and benefits that are associated with eco-innovation based projects.

The Chair ECONOVING is responsible for the Master SETE 2nd year programme on “Managing eco-innovation” and collaborates on European and international teaching partnership initiatives. The founding Chair industrial partners: ADEME, ALSTOM, Italcementi Group, Saur and the SNCF.

Web site: <http://econoving.universud-paris.fr>

Chairholder: Professor Keith Culver. Email: keith.culver@universud-paris.fr

Call for Applications: Senior Professor for the International Chair in "Generating Eco-innovation"

Five major corporate groups — Alstom, GDF-SUEZ, Italcementi, SAUR et SNCF — have linked together with the founding establishments of the PRES *UniverSud Paris* (a federation of research and higher education institutions in the Île de France region of France) to create an International Chair in « Generating Eco-innovation ».

The Chair will be an international pole of excellence for teaching and training, R&D and entrepreneurship aiming to facilitate eco-innovations at all points along the life cycle, from the emergence of an idea to its commercialisation in the market. The official launching of the Chair took place on December 3rd 2008 in the Castle of Versailles, France.

The research programme of the Chair will be developed, in collaboration with corporate partners, around a set of multidisciplinary topics: renewable energy sources, advanced detectors, biotechnologies, clean transport and sustainable mobility, sustainable building (materials, processes, design), eco-efficiency and sufficiency in goods and services production, new technologies and environmental services (waste management, water, space heating, etc.). It centres on the management of eco-innovation, with following objectives:

- Speed up the passage between the various scientific fields of discovery and proof of concept, and the industrial applications of innovations;
- Anticipate and respond to skill requirements in present day and tomorrow's job markets for activities linked to the development of eco-innovations;
- Create eco-businesses on the basis of the new services, products and skill domains that are identified;
- Offer expertise on the spectrum of opportunities and risks linked to an eco-innovative project or investment initiative;
- Build a network of international resources on eco-innovations.

The first intake of students, with recruitment from all over the world, will take place in September 2009.

The Chair brings together, at an international level, the expertise of university teachers and researchers, business and industry leaders, and experts in finance and risk capital. In addition to the Master and Doctoral programmes, a variety of R&D studies and projects will be carried out as joint ventures between the research laboratories of the founding members of the *PRES UniverSud Paris* and partner corporations of the Chair.

The creation of the Chair "Generating Eco-innovation" is a core component in the PRES UniverSud Paris mission of promotion and diffusion of knowledge in society. The five founding members of the UniverSud Paris are : the Université de Paris Sud 11, the Université de Versailles Saint-Quentin-en-Yvelines, the Ecole Normale Supérieure de Cachan, the Ecole Centrale de Paris, and Supélec. The PRES encompasses more than 200 research laboratories covering all scientific fields of eco-innovation, with around 5500 academic staff, 3200 doctoral researchers and 50 000 students.

Professor in Eco-Innovation: Job Description

The Chair holder will be responsible for the direction of a Masters level teaching programme (of about 25 students per year), for a doctoral programme (including supervision of selected doctoral students), and for initiating research in the management of eco-innovation. She or he will pilot cooperative research projects engaging private sector companies and public sector research centres associated with the Chair, with an interdisciplinary perspective covering the full life cycle of eco-innovation, from initial concepts to commercialisation.

This post is intended for an established professor or a senior researcher who has proven excellence in scientific activities and teaching in the field of innovation management.

- **Starting Date (can be negotiated):** 1st September 2009

- **Principal work location:** Versailles (France)
- **Field of Activity:** management of the innovation process
- **Working language:** English, with some French preferred

Preferred Profile:

- Any major field of management or economics of innovation
- Application in fields of environmental performance and sustainable development policy
- Experience in building partnerships with business, industrial and financial partners
- Teaching experience in or around the field of the Chair
- Proven capacity in team building and programme management

Duration: The Chair is awarded for 4 years, with the possibility of renewal at least once. A tenured professorial status at one of the *UniverSud Paris* universities can be negotiated after 2 years in the position.

Special features: The Chair is offered with a high starting salary for the holder, and with a substantial initial budget for establishing a research programme engaging doctoral students, post-doctoral positions and researchers on contract. The Chair holder will work in close association with a small permanent unit made up of:

- an adjoint professor (linked with risk capital and innovation finance actors),
- a adjoint professor (specialist in the economics of innovation and the management of teaching programmes),
- a research officer (closely linked to the network of 200 research centres of the PRES *UniverSud Paris*),
- a lecturer (to be recruited in consultation with the chair holder),
- a bilingual secretary (to be recruited in consultation with the chair holder).

The Chair is endowed with an annual budget for equipment, travel, operating costs and PhD scholarship and post doctoral awards

Responsibilities of the Chair holder:

The Chair holder makes the following engagements:

- to contribute two courses in her or his speciality fields, on a weekly cycle, during the university year (about 60 contact hours per year);
- to give three high profile scientific lectures per year, outside the host institution, and also at least one public lecture in the aim of diffusion of scientific knowledge to a wide public;
- to select the students for the Chair's teaching programmes, oversee their participation in the courses and in the various case studies of their research projects;
- to contribute to the supervision of thesis research initiated in the context of the Chair's programme;
- to develop an innovative and distinctive research programme with an interdisciplinary character, covering the full life cycle of eco-innovation;
- to act as spokesperson and contact point for the partners engaged in the Chair.

Responsibilities of the PRES *UniverSud Paris*:

The Chair partners make the following engagements:

- to take all necessary steps to assure good conditions for the arrival and establishment of the Chair holder in France and at the *UniverSud Paris*;
- to provide good working conditions for the Chair holder and the support team associated with the programme;
- to provide assistance in finding suitable accommodation;
- to facilitate the administrative procedures associated with her or his arrival and stay in France;
- to contribute to the international visibility of the activities of the Chair.

Extraits de :

"Comment Rédiger un Article pour le Blog d'Actualités ?"

Guide de Rédaction à l'attention des membres du C3ED [2008]



Remerciements : Ce document fait partie d'un ensemble qui présente le fonctionnement du Blog d'Actualités et du Catalogue de Partenaires du laboratoire C3ED. Il à été préparé par Christelle HUE avec l'aide de Martin O'CONNOR, Isabelle COLL & Franck LEGRAND (KerBabel™ C3ED), Sylvie FAURE (Relations Internationales UniverSud_Paris), Marie-Françoise VANNIER (UVSQ). © KerBabel™ et C3ED (2008)

A – Qu'est-ce que le Blog d'Actualités du C3ED ?

C – Le format d'un Article

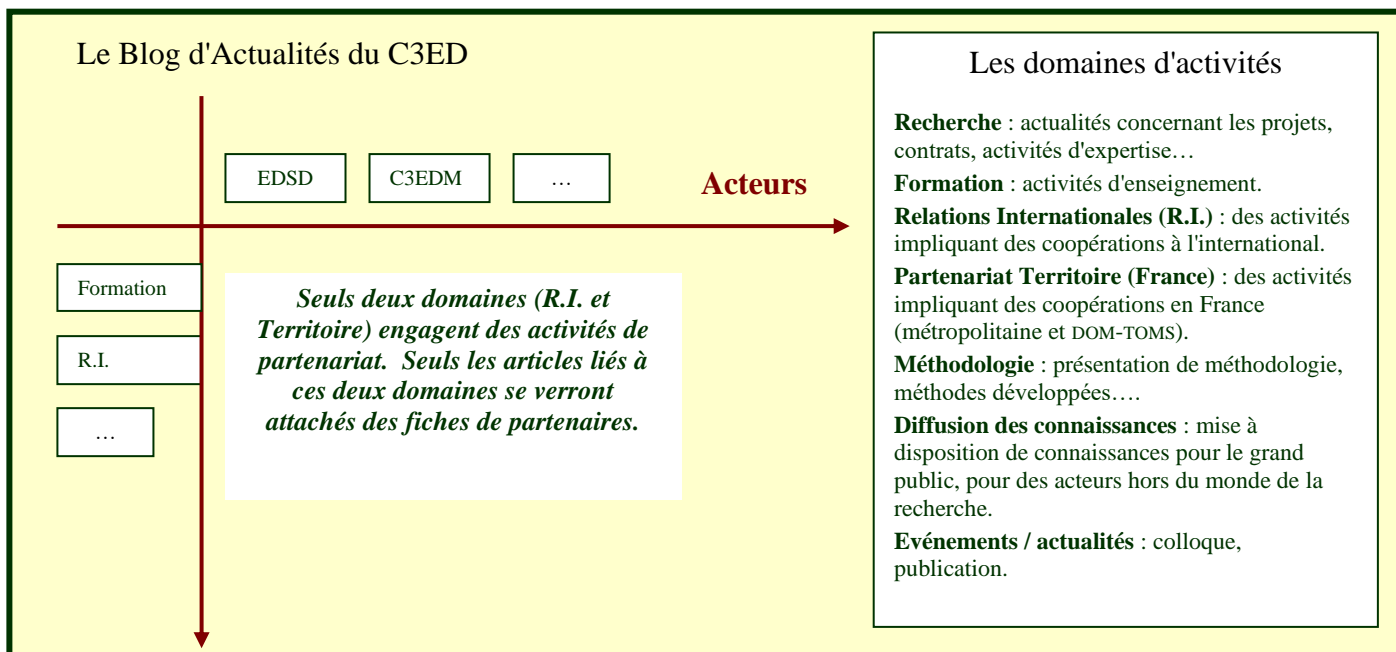
D – Les liens avec les fiches de Partenaire

A – Qu'est-ce que le Blog d'Actualités du C3ED ?

Pour compléter le site web du C3ED, il est mis en place un "Blog d'Actualités" permettant d'afficher sur le réseau les actualités du C3ED se rapportant à vos activités en termes de recherche, formation, partenariats, événements... Certains de ces articles faisant référence à des activités de partenariats se verront attachés des présentations de Partenaires (voir la partie D de ce document).

Ce blog, disponible à l'adresse <http://www.c3ed.uvsq.fr/activities/> est structuré selon une double taxonomie. Les ARTICLES peuvent ainsi s'afficher selon deux axes :

- un axe *acteur* : les articles apparaissent à l'écran selon les acteurs impliqués dans l'activité. Les acteurs possibles sont les différentes équipes du C3ED (EDSD, G-SERR, IACA, MGDD, TRDD) et les équipes sœurs (C3ED-M, C3ED-OA, C3ED-T) ou *Transversal* s'il s'agit d'une activité transversale au C3ED.
- un axe *domaine* d'activité : recherche, formation, relations internationales, partenariat (en France), méthodologie, diffusion des connaissances, événements / actualités.



Exemple d'un Article du Blog d'Actualités sur le website C3ED [2008] Domaines

A titre d'exemple, l'article présentant le *Projet PAT-PRE-AGRI "Patrimoines & Précarités Agricoles"* apparaît ici sur la page d'accueil du Blog d'actualités (C3ED 2008). Il est inscrit dans les catégories "IACA" et "Recherche".

The screenshot shows the C3ED website interface. The main header is "Activités en partenariats au sein du C3ED". The left sidebar contains a search bar and a menu with categories: Diffusions des connaissances, Evènements / Actualités du C3ED, Formations, Méthodologie, Partenariats, Recherche, and Relations Internationales. The main content area displays an article titled "Projet PAT - PRE - AGRI Patrimoine & Précarités Agricoles" with a description and a "Read more" link. Below the article title, the categories "IACA" and "Recherche" are listed. The right sidebar contains a list of categories: C3ED-M, C3ED-OA, C3ED-Tunisie, EDSD, G-SERR, IACA, MGDD, Transversal, and TRDD. A box at the bottom center states: "L'article est inscrit dans les catégories 'IACA' et 'Recherche'". A box at the bottom left is labeled "Axe domaines d'activités" and a box at the bottom right is labeled "Axe acteurs".

Si, depuis la page d'accueil, on clique sur la catégorie "Recherche" à gauche de l'écran, on voit apparaître tous les articles classés dans la catégorie Recherche et donc notre article exemple *Projet PAT-PRE-AGRI « Patrimoines & Précarités Agricoles »*.

Si, depuis la page d'accueil, on clique sur la catégorie "IACA" à droite de l'écran, on voit apparaître tous les articles classés dans la catégorie IACA et donc notre article exemple du *"Projet PAT-PRE-AGRI : Patrimoines & Précarités Agricoles"*.

Si, après avoir cliqué sur la catégorie "IACA" à droite de l'écran, on clique sur la catégorie "Recherche" à gauche de l'écran, on voit apparaître tous les articles classés à la fois dans la catégorie IACA et dans la catégorie Recherche et on retrouve donc notre article exemple *"Projet PAT-PRE-AGRI : Patrimoines & Précarités Agricoles"*.

C - Le format d'un article

Un article doit contenir les informations suivantes :

a) Titre

Le titre d'un article doit comporter au maximum 150 caractères.

b) Résumé (teaser)

Le résumé de l'article doit comporter au maximum 600 caractères. Il présente de manière succincte l'activité que vous voulez afficher. C'est l'information qui sera visible sur la première page par tous.

c) Corps de l'article (body)

Si vous souhaitez compléter le résumé, vous pouvez ajouter de l'information qui sera visible à partir d'un lien "Pour en savoir Plus" sur lequel cliquera le visiteur pour visualiser votre information complémentaire. Cette information complémentaire (corps de l'article) peut contenir environ 3000 caractères maximum. S'il s'agit d'une activité en partenariat, vous pouvez signaler les partenaires associés à cette activité. Ils seront par ailleurs mentionner avec des liens vers leur présentation. Vous pouvez agrémenter votre texte avec des caractères en gras, italique, des puces...

The screenshot displays the website interface for "Activités en partenariats au sein du C3ED". The main content area lists articles. The first article is titled "IACA, Recherche" and "Projet PAT - PRE - AGRI 'Patrimoine & Précarités Agricoles'". A red box highlights the title, with an arrow pointing to the word "Titre". Below the title is a small image of a field and a text summary. A green box highlights this summary, with an arrow pointing to the word "Résumé". Below the summary is a "Read more" link, which is highlighted with a blue box. An arrow points from the text "En cliquant sur ce lien, on accède à l'information complémentaire (corps de l'article)" to this link. The article is attributed to "IACA Recherche". The second article is titled "Projet 'Richesses & Précarité'" and has a similar layout. On the right side, there is a vertical menu with various categories like "C3ED-M", "C3ED-OA", "C3ED-Tunisie", etc. The top right corner has an "Admin" link and navigation options "Les activités" and "Les partenaires".

En cliquant sur le lien "**Read more**", on accède au corps de l'article.

D- Les liens avec les fiches de Partenaire

Lorsque vous rédigez un article qui présente une *Activité de Partenariat*, veuillez indiquer les noms des partenaires impliqués dans cette activité dans le champ "**PARTENAIRES**" prévu à cet effet, et de préférence dans le corps de l'article.

En renseignant le champ "**PARTENAIRES**", un lien est créé vers la base de données des **FICHES DE PARTENAIRE** existantes. Ces fiches présentent les partenaires (nom, adresse, activités, compétences, etc...).

Si la **FICHE DE PARTENAIRE** existe déjà, le nom du partenaire s'affiche, et sa fiche peut être consultée.

Si la **FICHE DE PARTENAIRE** n'existe pas encore, il faut la créer.

Apparaît à l'écran, les différents champs de données qui correspondent à ceux du modèle en format texte de la **FICHE DE PARTENAIRE**. Ce fichier texte est disponible en ligne dans la rubrique « guides ».

énergie).

2. Conduire des évaluations pilotes aux échelles de l'exploitation, au niveau de territoire /sous régional selon les types d'agriculture.
3. Développer une stratégie de communication autour des connaissances, outils, méthodes et résultats de ce projet à partir de supports multimédia et papier.

Ce projet, de par ces développements méthodologiques, revêt un caractère de recherche fondamentale tout comme de recherche – action, de par les expériences et les retours d'expériences, en collaboration directe avec des réseaux d'acteurs agricoles, que ce soit à l'échelle de l'exploitation agricole ou d'un territoire. La connaissance et les capacités du projet ont pour vocation d'aider la réorientation des pratiques agricoles pour une meilleure prise en compte de l'environnement. Ils ont un caractère de biens publics plus que de produits à finalité commerciale.

Coordonnateur responsable du projet : Martin O'Connor, professeur des Universités, C3ED, Université de Versailles Saint-Quentin-en-Yvelines
Email : Martin.O-Connor@c3ed.uvsg.fr

UMR Nancy-Université-INRA
CEMAGREF Bordeaux
BERGERIE
RAD
TRAME
Centre d'Ecodéveloppement de Villarceaux
Ambre Développement

Les partenaires associés au Projet PAT-PRE-AGRI

IACA Recherche



Climate-KIC Education Programme

Masters Programme Website **Technical Proposal (2013)**

© Drafted by: Lisa BOZEK

Climate KIC Education Programme (eLearning Open Source Team),
Centre international REEDS, UVSQ, France

Introduction

The eLearning Open Source team, led by Martin O'Connor, Director of International Center of Research in Ecological Economics, Eco-Innovation and Tool Development for Sustainability (REEDS) at the Université de Versailles Saint-Quentin-en-Yvelines (UVSQ), puts forward in this document, a website solution for the Climate-KIC Academy of Climate Innovation Master's programme website.

The purpose of this document is to explain the suggested solution so that the decision makers of the Climate-KIC Academy of Climate Innovation (ACI) can assess if it meets their needs.

Background

REEDS has employed a freelance developer from the Netherlands to create "internet tools for sustainability" using the Drupal content management system. Essentially these tools are websites.

Two such websites that would be used to support this proposal are:

- OVSQ teaching programmes (code named Yggdrasil)
- OVSQ Partners (not explained in this document)

Yggdrasil - Purpose

This website presents an online catalogue of OVSQ teaching programmes and their associated courses. Visit it at <http://yggdrasil.kerbabel.net/en>

What differentiates this website from others is its ability to create relationships between the content: programme to programme, programme to course and course to course relationships.

Yggdrasil - Look and Feel

The look and feel can be tailored to suit your specific needs.

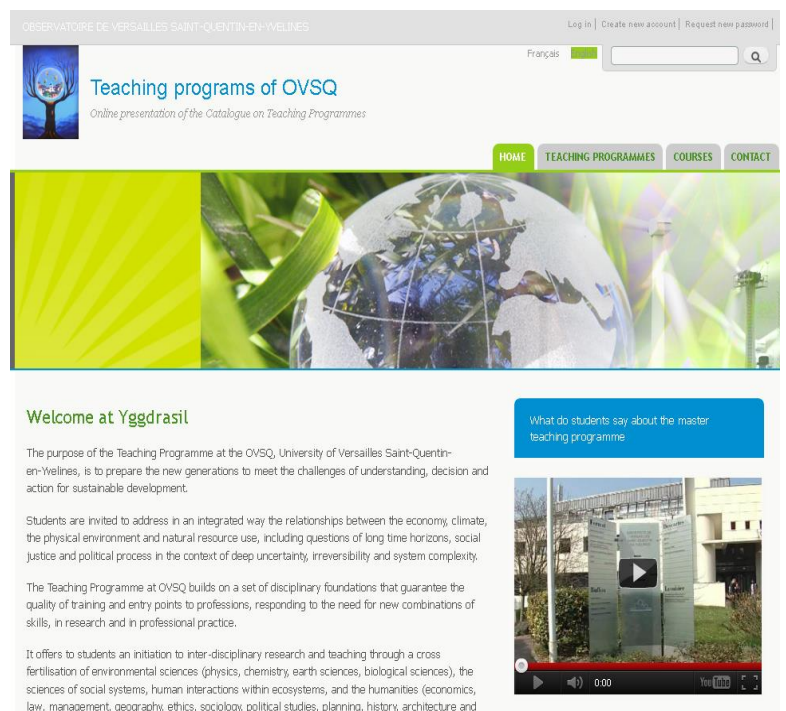
This page demonstrates the current look and feel of the website.

Appearance

- Top navigation: persistent links & branding area
- 3-column layout: body for key info, left and right for supporting info
- Look: simple, uncluttered, professional
- Feel: appropriate use of color provides navigational clues, supports the brand
- Templates use built-in themes from which there are hundreds to choose from.

Navigation

- Consistent navigational elements throughout site
- Prominent, horizontal, logical menu display (tabs)
- Filters for finding information
- Use of left and right columns for supporting information
- Use of breadcrumbs and back links to give user a sense of direction
- Supports multi-media



This page demonstrates the Teaching Programmes home page.

- The **filter** at the top of the page acts as an advanced **search**.
- An alphabetical list of teaching programmes is displayed.

This page details the information page of a Teaching Programme.

The **left navigation bar** demonstrates relationships in action:

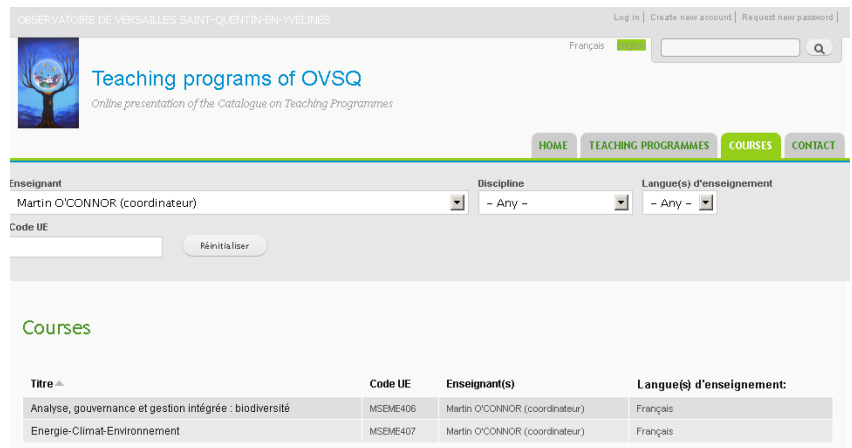
- Current Programme
- List of other Courses in this Programme

The **right navigation** displays:

- A message from the Programme Coordinator
- Related Programmes
- Partner institutions
- Contact information

This page demonstrates the Courses home page.

- The **filter** at the top of the page acts as an advanced **search**.
- The search results are displayed alphabetically.



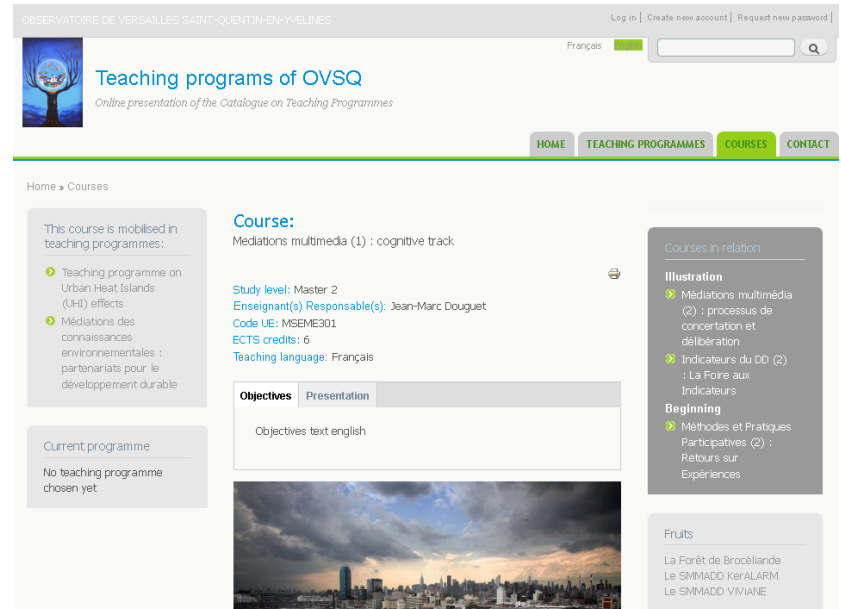
This page details the information page of a Course.

The **left navigation bar** demonstrates relationships in action:

- Other Programmes where this Course is taught

The **right navigation** displays:

- Courses that are related
- Supporting information
- Teacher contact information



Yggdrasil – Functionality

This section explains what the site can do and the content that it offers.

Content

The site offers the following detailed and supporting information for each section:

Programmes

- Title
- Acronym
- Degree
- Institutional code
- Duration
- Prerequisite
- Location
- Teaching language
- Field of study
- Career prospects
- Challenges
- Aims
- Strengths
- Skills acquired
- Search filters: thematic field, type of activity, study level
- Institute responsible for this programme
- Methods and pedagogical tools
- Supporting information:
 - Message from programme coordinator
 - Programme contact info: name, email, photo
 - Related programmes: disciplinary proximity, concept, applied, same teaching language to other programmes in Yggdrasil
 - Related courses: relationships to other courses in Yggdrasil
 - Partners: Select Partners from a drop down menu. These will be imported from NewsReels
 - Supporting videos (Vimeo or YouTube)
 - Supporting links to other websites

Courses

- Title
- Study level
- Institutional code
- Teacher
- Teaching language
- Objectives
- Presentation
- Discipline
- Teaching methods
- Exam format
- Course logistics
- Admin information: ECTS credits, make-up
- Feedback form: email contact

- Supporting information:
 - Programme the course belongs to: one course can be related to many programmes
 - Related courses: concept, illustration, beginning, extension, proximity, language
 - List of (other) courses in the program
 - Contact information (name, contact info, photo)
 - Supporting video, images, documents, links

Content Relationships

- For a Programme:
 - Define the relationship between this programme and other programmes in Yggdrasil.
 - Define the relationship between this programme and the course by choosing the programme this course belongs to. These relationships are presented in the left column.
 - If you switch to another course here you stay in the same programme (martin calls this the pathway). If you switch to another programme the course is mobilised in, you see the same course but switch programme.
 - Relationships are grouped by type: disciplinary proximity, concept, applied, same teaching language
- For a Course:
 - Define the relationship between this course and other courses in Yggdrasil.
 - Choose programmes this course belongs to
 - Relationships are grouped by type: concept, illustration, beginning, extension, proximity, language
 - Add this course to other programmes in Yggdrasil
 - These relationships are shown on the right side on programmes and courses. The system knows what the teaching languages of each course are. If they are different from the course you are watching, they are shown in the cross-language block. If you click on these relationships you visit the suggested course (that may be part of your current programme or not) without losing track of the programme you are in on the left side.

Contact Form

Can send a message to the

- Webmaster or
- Study director

Multi-language Support

- The website has been built to be bilingual but can be unilingual if required.

Social media support

- Possible to interact with ubiquitous social media tools and RSS

Cross Platform/Browser Compatibility

- The website functions exactly the same for the current and previous version of these browsers:
 - Mozilla Firefox,
 - Safari,
 - Google Chrome
 - Internet Explorer
- The site will look the same on all devices, mobile or not. By default mobile devices zoom in on the content area.

Search

- Drupal uses the Apache Solr search platform that offers:
 - Advanced full-text search capabilities
 - Optimized for high volume web traffic
 - Standards based open interfaces - XML, JSON and HTTP

Multi-media support

- Image formats supported: png, gif, jpg, jpeg (<2MB)
- File formats supported: txt, pdf, doc, docx, ppt, pptx, odf (<12MB)
- Video formats supported: Vimeo and YouTube

Content Management

- Authentication for content management administrators: Login, Create a new account, Ask for new password
- 5 administrator roles:
 - Superadmin: can make changes to anything
 - Administrator: can edit all content, add and manage user accounts
 - Programme and course editor: add/edit teaching programs and courses
 - Course editor: can add/edit courses
 - New user: the Administrator must assign a role for each new user
- 140 content editors possible
- Workflow: The workflow module allows the creation and assignment of tasks to node types.
 - Workflows are made up of workflow states: i.e. Draft, Review, and Published
 - Transitions between workflow states can have actions assigned to them i.e. when a piece of content moves from the Draft state to the Review state an email is sent out to the appropriate reviewer.

Data import

- Need a comma-separated format (csv or xml)
- Excel works well for this

Hosting

- The site is hosted by 1&1; managed by REEDS.

Domain name

- All websites hosted by REEDS will have a web address following this format: `http://[websitename].kerbanel.net`
- Redirecting is not recommended for Search Engine Optimization however if you must, 301 redirect is the most efficient and **search engine friendly** method for webpage redirection. It should preserve your search engine rankings for that particular page.

Technical support

1. Who provides it ?
2. When is it available ?
3. How to report a problem?
4. What is the service level agreement?

Search engine optimization

- Drupal's internal architectural structure makes the whole process of web site optimization much easier to manage. Out of the box, it is adequate for SEO, but with a few added modules configured correctly, it is extremely powerful.
- The XML sitemap module has been installed. It helps search engines to more intelligently crawl a website and keep their results up to date. The automated sitemap created by the module can be automatically submitted to Ask, Google, Bing (formerly Windows Live Search), and Yahoo! search engines.
- Meta-tags/keywords can be added to main pages and sub pages.

ANNEX 3.4: RECOMMENDATIONS FOR THE MASTER'S PROGRAMME WEBSITE

Purpose

The Academy of Climate Innovation will create a website that presents an online catalogue of Climate-KIC Master's programmes, and their associated courses, at participating Universities across Europe.

This website will go through different stages of development. Stage I will provide Master's programme information only. Stage II will add PhD programmes.

The look and feel of it should reflect the Climate-KIC brand and integrate with the .org website.

- The website will also detail:
 - Application procedures, including link to
 - Online application form
 - Admission criteria
 - Tuition fees
 - Programme logistics:
 - Year 1 Foundation
 - Year 2 Specialization
 - TheJourney
 - SPARK! inspirational lecture series
 - Project
 - Business plan
 - Internship
 - Research project
 - Mobility of students

Functionality:

Building on the unique capabilities of Yggdrasil, this new website will require relationships to be created between the content so that a student can put together a Master's programme (i.e. programme configurator), based on their preferences, which is offered by the Academy of Climate Innovation (now and in the future). This offering will be based on business rules defined by the Academy.

- The Programme Configurator should create relationships between the following content:
 - Diploma: Masters (2-years)
 - Themes (Climate, Cities, Production, Water):
 - Universities where you can study a theme
 - Programmes and courses offered by these Universities
 - Which semesters you can study
 - Location of participating Universities :
 - CH: ETH
 - DE: TU Berlin, (TU Munich)
 - FR: UPMC, UVSQ, AgroParisTech
 - NL: Delft, Wageningen, Utrecht
 - UK : Imperial College, (Redding)
 - List of Programmes
 - Offered at each University
 - Offered by semester at these Universities
 - List of Courses within each Programme

- Mandatory
- Optional
- Semester location
 - Year 1, Semester 1
 - Year 1, Semester 2
 - Year 2, Semester 3
 - Year 2, Semester 4
- Programme logistics
 - Mobility must be imbedded into the search process
 - Each selection refines the search:
 - Theme
 - Country
 - Programmes
 - Courses by semester

Work Plan Timeline (as proposed in 2012)

ACTION	OWNER	DEADLINE
Write website proposal	Lisa Bozek	Feb 13 th
Proposal approval and contributions	MoC	Feb 14 th
Submission of website proposal to Climate-KIC	LB, MoC	Feb 16 th
Acceptance of proposal and confirmation of functionality	Richard Templer & Eleanor Saunders	Mar 9 th
Scoping of new developments (budget and timeline)	Ellis Hettinga	Mar 16 th
Acceptance of Sub-Contractor proposal	MoC	Mar 19 th
Project kick-off	All	March 23 rd

ANNEX 4. 1: USER GUIDE OF “YGGDRASIL”

Yggdrasil: an online Presentation of Teaching Programmes provided by the Observatoire de Versailles-Saint-Quentin-en Yvelines



SOURCE :

Jean-Marc Douguet, REEDS, OVSQ, UVSQ
Julie Grall REEDS, OVSQ, UVSQ

Yggdrasil is the name of an online catalogue of teaching courses (UEs) and teaching programmes (PFs) from the Observatoire de Versailles Saint Quentin-en-Yvelines (OVSQ) faculty of the Université de Versailles Saint Quentin-en-Yvelines (UVSQ). It is accessible at <http://yggdrasil.kerbabel.net/> . This online catalogue supplies detailed information on the teaching programmes to the university's main site <http://www.uvsq.fr>

This catalogue has been created for the benefit of students and their parents, teaching teams and anyone else interested in the OVSQ's teaching programmes. Material is supplied by teachers and education team members.

Access YGGDRASIL at

<http://yggdrasil.kerbabel.net/>

Introducing the OVSQ:

The Observatoire de Versailles Saint-Quentin-en-Yvelines (OVSQ), born on the first of January 2010, is the only faculty in France to include all three components: Research, Observation and Training.

The OVSQ relies on

- World renowned research centres in natural science, specialising in environmental observations and scientific modelling of natural systems (particularly climate) ; such as LATMOS, LSCE, CEARC, IPSL
- A laboratory for ecological economics, eco-innovation and sustainable development engineering such as REEDS

The OVSQ combines three main missions:

1. To conduct long-term observations to get a better understanding of natural and human systems
2. To study and model these mechanisms
3. To train managers for companies as well as researchers in the fields of environment, territories and the economy.

Challenge #1 : dealing with the complex issues surrounding sustainable development

The multi-dimensional aspects of issues surrounding the environment and sustainable development compels us to combine knowledge and experience from different disciplines. At the OVSQ this challenge has been met by combining a strong focus on individual disciplines with multidisciplinary reflection and an interdisciplinary framework resulting in the provision of more than 30 degrees..

Challenge #2 : Institutionalising this interdisciplinary approach

The OVSQ was created to carry the momentum in this area forward so that students could take full advantage of specialised tuition that goes beyond traditional boundaries.

Challenge #3: facing a new, evolving and dynamic job market

Our students are guided towards employment in the private, public and associative systems. We have put in place proactive assessment systems focused on the demand for 'green' jobs by establishing partnerships in the industrial world, state territorial administrations and with

associations.

The Teaching Programmes:

The OVSQ offers a wide choice of teaching programmes on environment, climate and sustainable development, to train talented people who can respond to the environmental issues of tomorrow.

The **Masters** programmes are at the heart of the educational programme. In the field of Sciences of the Environment, Territory and the Economy there are more than 25 Masters offered in a wide choice of fields of study, of which some are very scientific and theoretic and others are more applied. The master is a university degree gained after two years of study following a Bachelor degree. New degrees are in the pipeline and courses proposed are subject to change as the demand for particular competences emerges.

Sustainability science tools and techniques (IDD) Very interdisciplinary, focused on developing established partnerships at national and international levels.

Planning, energy and territorial ecology (AMENET) focuses on the development of applied studies based on strong workplace partnerships

Environmental sciences (SEN) applies the tools of science to sustainable development.

Environmental and territorial economics and governance (EGET) applies the tools of human and social sciences to environmental issues.

Professional degrees train highly skilled technicians in various dimensions of sustainable development and in their application.

Doctoral programme :

The research centres of the OVSQ welcome doctoral students and are linked to educational institutions that have relationships with the UVSQ.

Post doctoral programmes

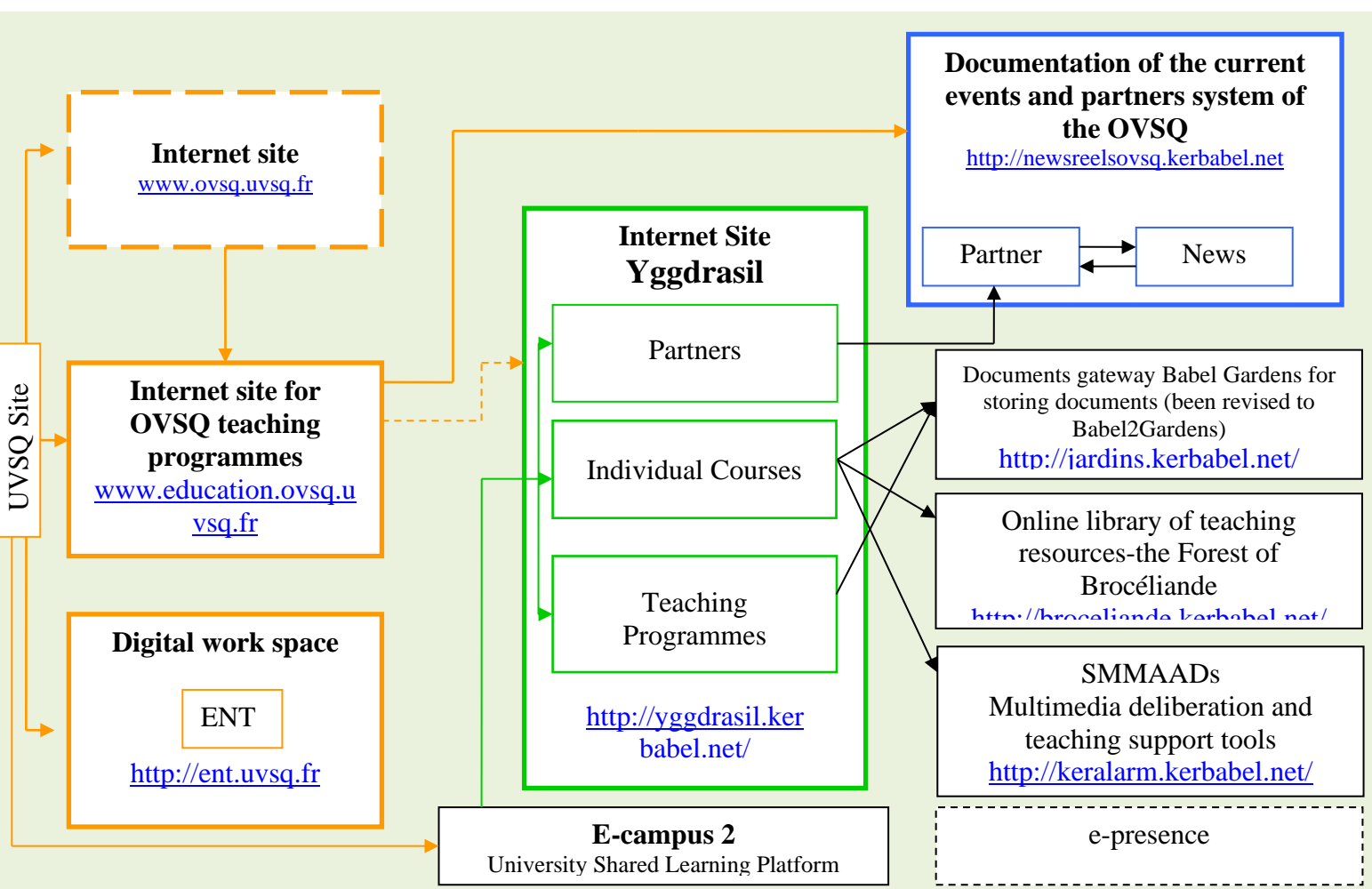
These programmes are under consideration

The Yggdrasil Tree:

In Norse mythology Yggdrasil is a large evergreen ash tree called the Tree of the World. One of its roots guards the source of all knowledge, that's why the OVSQ has chosen it to represent the catalogue of teaching programmes on offer. The internet site Yggdrasil is exclusively dedicated to the presentation of teaching Programmes and courses of the OVSQ. It is of interest to students, teaching teams and anyone else interested in what the OVSQ offers.

How the Yggdrasil Tree fits into the digital environment of the UVSQ

The UVSQ and its OVSQ have several online tools which are integrated so that visitors to these sites/tools can explore from various entry points. For example, a visitor to the *Yggdrasil* teaching programme and course catalogue can do directly to a *Current Events and Partners* site for more information on what that partner does or to the online teaching resources library *The Forest of Brocéliande* to explore information on teaching topics of interest or can go directly to an online collection of support documents/digital objects stored in the *Babel2Gardens*.



Yggdrasil Home Page:

Five navigation tabs provide access from the home page to the key content: Teaching Programmes, Courses, Partnerships, Contact.



Video



A video embedded on the home page presents the UVSQ and OVSQ faculty at the Guyancourt campus. It is in French but shows some views of the campus. It is hoped a video presented in English can be produced.

The home page contains a general description of the teaching programmes and their courses, their objectives and orientations.

Welcome to Yggdrasil

The purpose of the Teaching Programme at the OVSQ, University of Versailles Saint-Quentin-en-Yvelines, is to prepare new generations to meet the challenges of understanding, decision and action for sustainable development.

Students are invited to address in an integrated way the relationships between the economy, climate, the physical environment and natural resource use, including questions of long time horizons, social justice and political process in the context of deep uncertainty, irreversibility and system complexity.

The Teaching Programme at OVSQ builds on a set of disciplinary foundations that guarantee the quality of training and entry points to professions, responding to the need for new combinations of skills, in research and in professional practice.

It offers to students an initiation into inter-disciplinary research and teaching through a cross fertilisation of environmental sciences (physics, chemistry, earth sciences, biological sciences), the sciences of social systems, human interactions within ecosystems, and the humanities (economics, law, management, geography, ethics, sociology, political studies, planning, history, architecture and literature).

At OVSQ, we believe that the key to responding to these challenges is a collective, multi-disciplinary approach. This is reflected in the organisation and structure of OVSQ where we bring together specialists from many different disciplines to provide courses spanning an extensive range of subjects. We also strive to remain relevant and practical through ongoing cooperation with industrial and territorial partners.

OVSQ aims to provide the tools and skills which will equip the current generation to act and make the appropriate decisions to protect our planet for future generations. Our students bring their individual competences, conviction and enthusiasm to these tools and skills to create real value in the professional world.

What do students say about the master teaching programme

Présentation de l'UVSQ

UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES
OVSQ
climat - environnement - société

Visitors guide

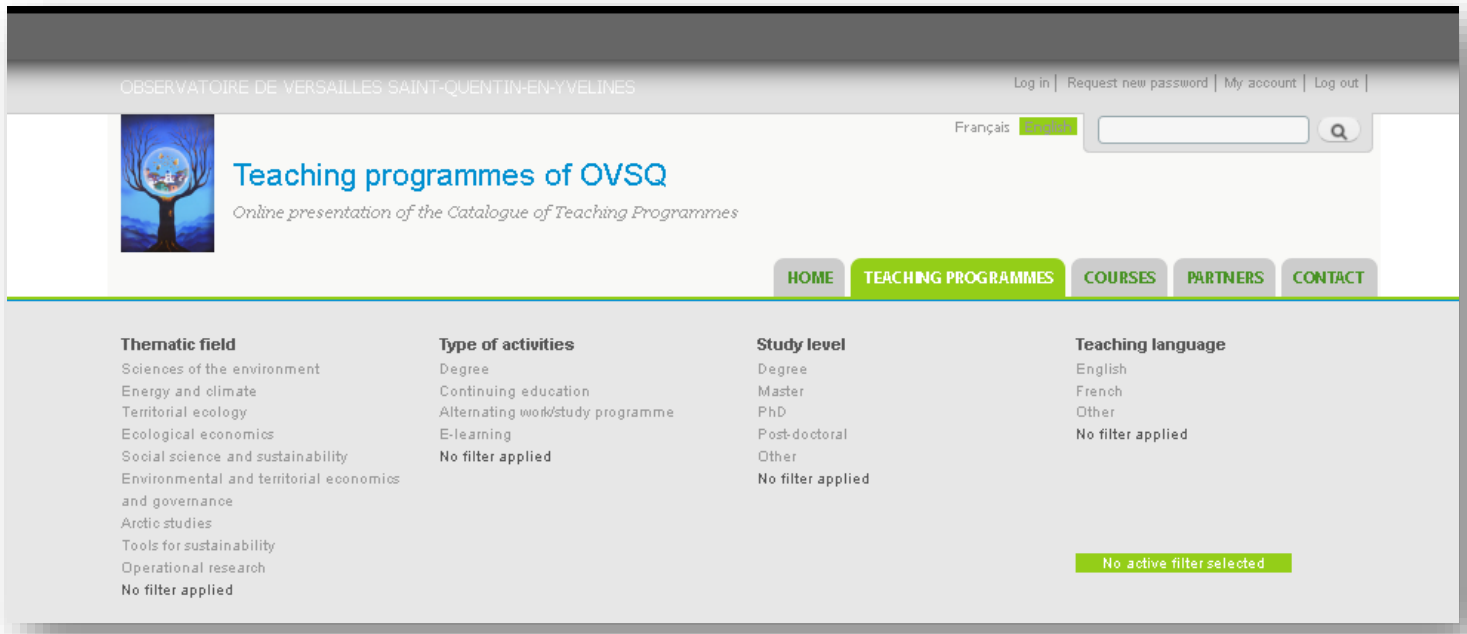
UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES
OVSQ
climat - environnement - société

Disclaimer (c)

Teaching programmes:

This web page is presented in two parts:

- The search engine at the top of the screen which comprises a set of four filters to make finding what you want more efficient. You simply select the filters appropriate to your search by clicking on them.



- The second section where you'll find an alphabetical list of teaching programmes

List of Teaching Programmes

Each programme is presented via four pieces of information:

- A photo associated with the programme may be present (but not always) to make it easier to identify the programme visually beside the title
- The level of qualification/degree such as bachelor, master...
- The teaching language (French and/or English),
- The study field which the programme relates to so that visitors can easily see if that interests them or not.

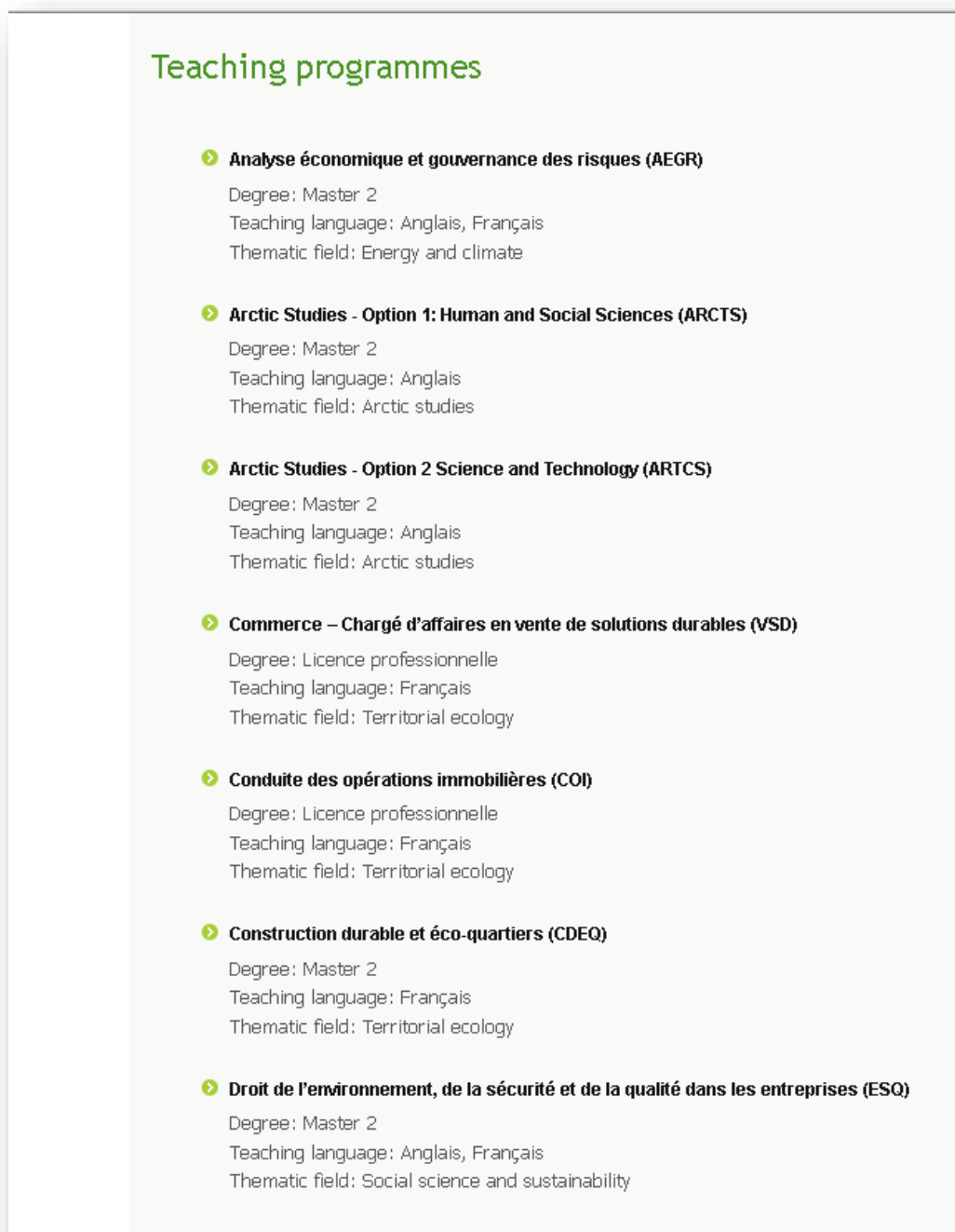
Transversal navigation:

It's possible to cross from the Teaching programme to the teaching courses without clicking on the tabs at the top of the page. You simply click on any active links one of the other on either a programme page or a course page.

The system of filters:

Structured discovery of the teaching programmes

The filters are presented as a table of contents whereby you choose the field of interest, the type of education, the study level and the teaching language in order to target what you're looking for.



Teaching programmes

- ▶ **Analyse économique et gouvernance des risques (AEGR)**
Degree: Master 2
Teaching language: Anglais, Français
Thematic field: Energy and climate
- ▶ **Arctic Studies - Option 1: Human and Social Sciences (ARCTS)**
Degree: Master 2
Teaching language: Anglais
Thematic field: Arctic studies
- ▶ **Arctic Studies - Option 2 Science and Technology (ARTCS)**
Degree: Master 2
Teaching language: Anglais
Thematic field: Arctic studies
- ▶ **Commerce – Chargé d'affaires en vente de solutions durables (VSD)**
Degree: Licence professionnelle
Teaching language: Français
Thematic field: Territorial ecology
- ▶ **Conduite des opérations immobilières (COI)**
Degree: Licence professionnelle
Teaching language: Français
Thematic field: Territorial ecology
- ▶ **Construction durable et éco-quartiers (CDEQ)**
Degree: Master 2
Teaching language: Français
Thematic field: Territorial ecology
- ▶ **Droit de l'environnement, de la sécurité et de la qualité dans les entreprises (ESQ)**
Degree: Master 2
Teaching language: Anglais, Français
Thematic field: Social science and sustainability
- ▶ **Ecological Economics & Integrated Environmental Assessment (EE & IEA)**

Structured discovery of the teaching courses

With search filters on teaching courses you can search by teacher, discipline, language, course code (if you know it), course title

Presentation of a Teaching programme: elements on the page

The image shows a screenshot of a university website page for a teaching programme. The page is titled "Teaching programme: Environmental Knowledge Mediation, Partnerships for Sustainable Development (MEDIATION)". The page layout includes a navigation bar at the top, a main content area, and a sidebar on the left. Red callout boxes highlight specific elements on the page:

- Programme title and general information:** Points to the main title and introductory text of the programme.
- Courses contained in this programme:** Points to the "List of courses" section on the left sidebar.
- Link towards partners associated with this programme:** Points to the "Partners" section at the bottom of the page.
- Links to supplementary information:** Points to the "Attached documents" section, which includes a PDF document titled "Plaquette formation Méiation".
- Contact details:** Points to the "Contact information" box at the bottom right, which provides the name of the Programme Coordinator (Dr. Jean-Marc Douquet), his email address, and the Secretarial Support (Mary-Jane Baulud) with her contact details.
- Message from the tutor:** Points to a green box containing a message from the Programme Coordinator, Jean-Marc Douquet, stating that the programme combines expertise in ICT and environmental awareness.
- List of related programmes:** Points to the "Related Programmes" section, which lists related courses such as "Ecological Economics & Integrated Environmental Assessment" and "Master 1 SETE - Ingénierie du Développement Durable".

Médiation des connaissances environnementales : partenariats pour le développement durable

Domaine SETE

Sciences de
l'environnement,
du territoire et de
l'économie

MASTER MÉDIATION - MENTION INGÉNIERIE DU DÉVELOPPEMENT DURABLE



« Le programme MÉDIATION met en synergie des expertises en technologies de l'information et de la communication (TIC) et en médiations des connaissances environnementales. Le programme pédagogique à l'UVSQ est établi et offert en collaboration avec d'autres universités européennes. »



Jean-Marc DOUGUET, docteur
en économie à l'UVSQ,
responsable du master Médiation



Enjeux & objectifs

MÉDIATION répond au besoin de former les professionnels capables d'articuler, par l'intermédiaire des TIC interactives, l'offre de la connaissance et de la demande, à savoir les informations adaptées aux besoins de décision, de concertation, de gouvernance territoriale. Le programme répond directement aux besoins de médiation de connaissances et de partenariat vivement ressentis par des chercheurs, des entreprises et des organismes de gouvernance. Il s'agit d'un programme de formation interdisciplinaire constitué, d'une part, d'un partenariat à l'échelle européenne, et d'autre part, d'une collaboration avec le centre international de Recherche en Économie-Écologie, Éco-innovation et Ingénierie du Développement Soutenable (REEDS) et de l'Observatoire de Versailles Saint-Quentin-en-Yvelines.

MÉDIATION appuie sa pédagogie sur une adaptation des méthodes d'évaluation multicritères délibératives, fondées elles-mêmes sur des indicateurs. Dotés d'une formation pluridisciplinaire et communicants au service du développement durable, vous serez capables d'analyser la problématique environnementale ainsi que celle du développement socialement durable dans leurs différentes composantes.



Points forts

Tout au long de l'année les étudiants acquièrent une réelle capacité d'analyse et de synthèse. Ils s'ouvrent à une culture pluridisciplinaire et mobilisent de nombreuses compétences.

«Médiation» permet l'apprentissage des aptitudes communicationnelles via le développement de projets dont les objectifs sont :

- Proposer de nouvelles approches d'analyse intégrée des problèmes complexes et établir des démarches de médiation des connaissances environnementales.

- The main content describing the programmes is presented under Challenges, Aims, Strengths, Career Prospects.
- Documents such as a programme brochure can be attached with the option of printing it and a photo illustrating the programme theme or where it is conducted can be added.
- Additional information may also be available concerning teaching methods used by teachers, who is leading the programme etc.


Often there will be a programme brochure attached as a pdf such as...

Courses

The courses page is divided into two sections:

OBSERVATOIRE DE VERSAILLES SAINT-QUENTIN-EN-YVELINES Log in | Request new password | My account | Log out |

Français English



Teaching programmes of OVSQ

Online presentation of the Catalogue of Teaching Programmes

HOME
TEACHING PROGRAMMES
COURSES
PARTNERS
CONTACT

Teacher(s) Discipline Teaching language

Course code Title

Courses

Title ▲	Course code	Teacher(s)	Teaching language:
Mise à niveau fondamentaux (CDEQ)	MPCDE30A	Bailly/Hoyet	French
Achats responsables	MSERS412		French
Achats responsables : supply chain, gestion risques, responsabilité élargie, éthique, chartes	MSERS408	M. Yacine	French
Acoustique	MSENB4	Philippe BOUSQUET	French
Acteurs, cadre institutionnel et territorial du tourisme	MSETD303	Didier RAMOUSSE	French
Aérosols, pollution, climat	MRTEL???		French
Agenda 21 et aménagement (Territoires Durables)	MSEME411	Amaud Comolet, Martin O'Connor	French
Aménagement et mobilité	MSETE221	??	French
Analyse critique d'articles scientifique en anglais	MSSE106	Mathieu RÖY-BARMAN	French
Analyse d'images et proj.informatique	MRTEL305	Gérard Caudal, Laurence Picon et Michel Roux	French
Analyse des données qualitatives et quantitatives	MSEEC114	SOUCARIS Amaud	French
Analyse économique et gestion des risques urbains	MSEGR306	Denis LEVY (IGD)	French
Analyse économique et gestion du risque radiologique			French
Analyse économique et Maîtrise du Risque	MSEGR303	Jean-François VAUTIER (CEA)	French
Analyse et méthodes statistiques	MS2PHXXX	??	French
Analyse et traitement de l'information	MIEDD321		French
Analyse Prospective et Veille	MSEME303	Christelle HUE	French

- At the top of the page is a search function using filters (as previously described)
 - The second section shows a list of courses (papers) arranged in alphabetical order
- As you can see, each course name is associated with a course code to clearly identify the course when enrolling, the teacher is identified as well as the teaching language(s) used.

The following visuals show two course outlines with details...



Home » Courses

This course is mobilised in teaching programmes:

- Sustainability studies: Theories-Tools-Terrains
- Sustainability studies: Theories-Tools-Terrains CERTIFICATE

Current programme

No teaching programme chosen yet

Course:

Introduction to Sustainability: Concepts and Challenges (Keynote seminars)

[View](#) [Edit](#) [Revoke](#) [Translate](#)

Teacher(s): Prof. Martin O'Connor, Prof Andrew French

ECTS credits: 2.5

Teaching language: English

Contact information

martin.oconnor@reeds.ovsg.fr

Objectives **Presentation**

Emergence of the concept of sustainable development. Historical antecedents in the classics and heterodox economic thought. Development and environment; écodeveloppement; alternatives to development. Indicators and norms for SD. System modelling perspectives. Key policy issues: energy; climate, water; biodiversity; sustainable consumption; governance.

Attached documents:

 [Brochure albion.doc](#)



Course structure:

This course is taken in Year 1 of the Albion College students' B.A programme

Classes are held at Albion College USA

More

Education methods:

Classes are held at Albion College. Professor Andrew French is the day-to-day custodial tutor but twice a year Professor O'Connor is on site to give lectures and assist students. The remainder of classes are conducted online via video conferencing with tutors in France.

Individual and group work is expected for assignments.

The screenshot displays the 'Teaching programmes of OVSQ' website. The header includes the OVSQ logo and navigation tabs for HOME, TEACHING PROGRAMMES, COURSES, PARTNERS, and CONTACT. The main content area is titled 'Home » Teaching programmes » Current programme: Sustainability studies: Theories-Tools-Terrains'. It features a sidebar with 'Sustainability studies: Theories-Tools-Terrains' and a 'List of courses' where 'Valuation and Evaluation' is highlighted. The main content area shows course details: 'Course: Valuation and Evaluation', 'Teacher(s): Martin O'Connor', 'ECTS credits: 7,5 pts', and 'Teaching language: English'. It also includes an 'Objective' section with a detailed description of the course content and an 'Attached documents' section with a link to 'Brochure albion.doc'. The course structure is noted as being taken in Year 2 of the Albion College students' B.A. programme, with classes held at Albion College, Michigan, USA.

Partner Tab:

The OVSQ has established a solid network of industrial, regional and university partners which ensures the relevance and practical application of its teaching programme in the market.

Partner contributions can take different forms such as participation in conference cycles. Offering work experience or internships to students enabling them to apply competence acquired in a practical context or making financial contributions to the University to improve courses and teaching programmes and to support initiatives which help students in the first stages of their careers..



The Partners Tab lists all the partners involved in the OVSQ teaching programmes and those linked to its partners.

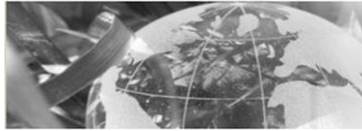
If you click on the first partner you will discover which programmes involve this partner.



The two-pronged function of the partner Profile is to provide visibility showing how member of Programmes work together and with the OVSQ, as well as to provide detailed information on each partner organization.

When you click on Partner link you go through to the Newsreels Partner Profile information stored in the partner online catalogue. <http://partners.kerbabel.net>

A **Partner Profile** available via this catalogue looks like this:



REEDS

Centre international de recherche en Economie écologique, Eco-innovation et ingénierie du Développement Durable

Identity

Address :

Bâtiment Aile Sud, 15 Bergerie Nationale
78120 Rambouillet France

Country :

France

Telephone :

+33(0)1 39 25 31 11

Fax :

+33 (0)1 39 25 31 21

Website :

www.reeds.uvsq.fr

Head of the organisation :

Martin O'Connor, *Director*

Contact details :

Centre international REEDS – OVSQ

Tel : 01 39 25 31 14 Ou 01 39 25 31 15

Fax : 01 39 25 31 21

Contact person :

Martin O'Connor

Contact details contact person :

Martin.O-Connor@reeds.uvsq.fr, Tel. +33 1 39253141

Google map:



Type of activity :

RES-Research

Status :

GOV : Governmental

Partner information categories include:

- Name, address, phone, website
- Senior manager(s)
- Key contact(s)
- Location via a Google map
- Type of activity
- Status
- A short and long presentation on the organisation in French and/or English
- General information on key activities, special strengths, national and international relationships
- Events and activities linked to the partner: a list of links classed by title and date which link to news articles relating to partner activities

The OVSQ is interested in creating and providing access to a partner catalogue/database which will prove useful for some visitors because it:

- Shows the range of institutions collaborating together within the Ile de France region and further afield
- Highlights the teaching programmes necessarily involved in multipartner projects

- May encourage relationships with new partners.

Contact tab:

This tab is reserved for contact with the technical service of the Yggdrasil site or with the director of studies.

This tab is reserved for contact with the technical service of the Yggdrasil site or with the director of studies.

Related websites:

www.Yggdrasil.kerbabel Online catalogue of teaching programmes of the OVSQ

www.seformer.ovsq.uvsq.fr Official site for the OVSQ (can't be found on a Google English search)

www.uvsq.fr Official site of the Université de Versailles Saint-Quentin-en-Yvelines

<http://newsreels-ovsq.kerbabel.net/> Current Events website for the OVSQ

www.broceliande.kerbabel.net Online library of teaching resources

ANNEX 4. 2: THE GARDENS OF BABEL (VERSION 2)

0. PREAMBULE

PREAMBULE

As part of its strategy to document its REEDS business (and prior to 2010, The C3ED) has developed a set of approaches:

The creation of the "Gardens of Babel" (version 1)" which is a knowledge mediation portal for the environment, climate, ecological economy and sustainable development within the C3ED in 2002 (<http://jardins.kerbabel.net/>). The Gardens of Babel has several vocations including:

- o Offer a wide audience a portal of environmental knowledge.
- o Reference all scientific production of the Centre for Economics and Ethics for Environment and Development.
- o Reference the educational resources to which C3ED contributes.
- o Organize scientific and institutional information on the activities of C3ED partners.

Activity of referencing online educational modules as part of the Virtual Environment and Sustainable Development University in 2008

Use OFNOTE for the implementation of the REEDS "scientific production catalogue" in 2010

Metadata systems were constructed in each of the documentation situations (see details of the metadata structures in Schedules 1, 2 and 3)

use:

- DIRECTORS' CR, general meeting, preparatory files
- Student reports
- Communication documents
- Transverse themes
- CEARC
- IP files, description files, applications, vacataires files...
- Administrative and technical information within the OVSQ

1.1 - The level of data sharing

- o Open to all
- o Restricted at the level of different user communities/Research (in the UVSQ or non-UVSQ, for example, in relation to research projects...)
- o Restricted at the level of different user communities/Teaching (in the UVSQ or non-UVSQ, for example, in relation to training programs or in the KIC Climate...)
- o Restricted, if resources are in paid access (for Research/Teaching)

1.2 - Activities

- o Discovery of documents from REEDS/OVSQ's basic documentary knowledge website - free discovery of documents and access rights
- o As fruit (i.e. as a document, website, video... attached to an html page) in an online educational module
- o As fruit in websites (the news website of the activities REEDS/OVSQ (Newsreels.Kerbabel.net), training programs of the OVSQ (Yggdrasil.Kerbabel.net)...)
- o As part of the KIC Climate
- o In the context of research projects or collective activities
- o In multimedia Learning and Assistance to Deliberation (SMMAAD; for example KerAlarm.KerBabel.net)
- o Opportunity to make exports to build business reports, deliverables, bibliographies

1.3 - Communities

- o Researchers
- o Pedagogical

1.4 - Diversity of media to access them

- o Computers
- o Tablet
- o Smartphone

1.5 - What are the search areas?

- o By author
- o per year
- o By object type
- o By keywords
- o By language
- o By "label" type (theme within REEDS, research projects)
- o By title

The list of objects and fields to be informed by object type (from pre-established elements in the use of ENDNOTE within REEDS)

1	2	3	4	5	6
BOOK	BOOK SECTION	BROCHURE	CAHIER REEDS	CONFERENCE PAPER	CONFERENCE PROCEDEEING
AUTHOR	AUTHOR	AUTHOR	AUTHOR	AUTHOR	AUTHOR
YEAR	YEAR	YEAR	YEAR	YEAR	YEAR OF CONFERENCE
TITLE	TITLE	TITLE	TITLE	TITLE	TITLE
SERIES EDITOR	EDITOR	SECONDARY TITLE	SECONDARY AUTHOR	CONFERENCE NAME	EDITOR
SERIES TITLE	BOOK TITLE	PLACE PUBLISHED	CITY	CONFERENCE LOCATION	CONFERENCE NAME
CITY	CITY	PUBLISHER	PUBLISHER	DATE	CONFERENCE LOCATION
PUBLISHER	PUBLISHER	PAGES	VOLUME	SOURCE	PUBLISHER
VOLUME	VOLUME	DATE	DOCUMENT NUMBER	PROJET PERSONNEL	VOLUME
NUMBER OF VOLUMES	PAGES	TYPE OF WORK	PAGES	LABEL	PAGES
NUMBER OF PAGES	ISBN/ISSN	SOURCE	DATE	KEYWORDS	DATE
SHORT TITLE	SOURCE	PROJET PERSONNEL	TYPE OF WORK	ABSTRACT	ISBN
ISBN/ISSN	PROJET PERSONNEL	LABEL	SOURCE	NOTES	SOURCE
SOURCE	ACCESSION NUMBER	KEYWORDS	PROJET PERSONNEL	URL	PROJET PERSONNEL
PROJET PERSONNEL	CALL NUMBER	ABSTRACT	LABEL	LINK TO PDF	LABEL
ACCESSION NUMBER	LABEL	NOTES	KEYWORDS	LANGUAGE	KEYWORDS
CALL NUMBER	KEYWORDS	URL	ABSTRACT		ABSTRACT
LABEL	ABSTRACT	LINK TO PDF	NOTES		NOTES
KEYWORDS	NOTES	LANGUAGE	URL		URL
ABSTRACT	URL		LINK TO PDF		LINK TO PDF
NOTES	LINK TO PDF		LANGUAGE		LANGUAGE
URL	LANGUAGE				
LINK TO PDF					
LANGUAGE					

7	8	10	11	12	13
ELECTRONIC ARTICLE	ELECTRONIC BOOK	JOURNAL ARTICLE	MAGAZINE ARTICLE	NEWSPAPER ARTICLE	PERSONAL COMMUNICATION
AUTHOR	AUTHOR	AUTHOR	AUTHOR	REPORTER	AUTHOR
YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
TITLE	TITLE	TITLE	TITLE	TITLE	TITLE
PERIODICAL TITLE	EDITOR	JOURNAL	MAGAZINE	NEWSPAPER	SECONDARY TITLE
VOLUME	PUBLISHER	VOLUME	VOLUME	CITY	CITY
ISSUE	VOLUME	ISSUE	ISSUE NUMBER	VOLUME	PUBLISHER
PAGES	DATE ACCESSED	PAGES	PAGES	PAGES	COMMUNICATION NUMBER
DATE ACCESSED	ISBN	DATE	EDITION	EDITION	PAGES
SOURCE	SOURCE	SHORT TITLE	DATE	ISSUE DATE	DATE

PROJET PERSONNEL	PROJET PERSONNEL	ISSN	ISSN	ISSN	SOURCE
LABEL	LABEL	SOURCE	ELECTRONIC RESOURCE NUMBER	ELECTRONIC RESOURCE NUMBER	PROJET PERSONNEL
KEYWORDS	KEYWORDS	PROJET PERSONNEL	SOURCE	SOURCE	LABEL
ABSTRACT	ABSTRACT	LABEL	PROJET PERSONNEL	PROJET PERSONNEL	KEYWORDS
NOTES	NOTES	KEYWORDS	LABEL	LABEL	ABSTRACT
URL	URL	ABSTRACT	KEYWORDS	KEYWORDS	NOTES
LINK TO PDF	LINK TO PDF	NOTES	ABSTRACT	ABSTRACT	URL
LANGUAGE	LANGUAGE	URL	NOTES	NOTES	LINK TO PDF
		LINK TO PDF	URL	URL	LANGUAGE
		LANGUAGE	LINK TO PDF	LINK TO PDF	
			LANGUAGE	LANGUAGE	

14	15	16	17	18
RAPPORT DE RECHERCHE REEDS	REPORT	THESIS	UNPUBLISHED WORK	WEB PAGE
AUTHOR	AUTHOR	AUTHOR	AUTHOR	AUTHOR
YEAR	YEAR	YEAR	YEAR	YEAR
TITLE	TITLE	TITLE	TITLE OF WORK	TITLE
SECONDARY AUTHOR	SERIES EDITOR	ACADEMIC DEPARTEMENT	SERIES TITLE	SERIES EDITOR
SECONDARY TITLE	SERIES TITLE	CITY	CITY	SERIES TITLE
PLACE PUBLISHED	CITY	UNIVERSITY	INSTITUTION	CITY

PUBLISHER	INSTITUTION	DEGREE	NUMBER	PUBLISHER
VOLUME	DOCUMENT NUMBER	NUMBER OF PAGES	PAGES	ACCES YEAR
PAGES	PAGES	ADVISOR	DATE	NUMBER OF VOLUMES
DATE	DATE	DATE	TYPE OF WORK	ACCES DATE
SOURCE	SOURCE	THESIS TYPE	SHORT TITLE	DESCRIPTION
PROJET PERSONNEL	PROJET PERSONNEL	SHORT TITLE	SOURCE	SOURCE
LABEL	LABEL	SOURCE	PROJET PERSONNEL	PROJET PERSONNEL
KEYWORDS	KEYWORDS	PROJET PERSONNEL	LABEL	LABEL

ABSTRACT	ABSTRACT	LABEL	KEYWORDS	KEYWORDS
NOTES	NOTES	KEYWORDS	ABSTRACT	ABSTRACT
URL	URL	ABSTRACT	NOTES	NOTES
LANGUAGE	LINK TO PDF	NOTES	URL	URL
	LANGUAGE	URL	LINK TO PDF	LINK TO PDF
		LINK TO PDF	ACCES DATE	LANGUAGE

19	20	21	22	23	24
VIDEO	ELECTRONIC PRESENTATION	GRAIN	MODULE	COURSE	CASE STUDY
PRODUCER	AUTHOR	AUTHOR	AUTHOR	CO-ORDINATOR	AUTHOR
YEAR	YEAR	DATE	DATE	DATE	DATE
TITLE	TITLE	TITLE	TITLE	TITLE	TITLE
PRODUCTION COMPANY	SECONDARY AUTHOR	DATA-ENTRY PERSON	DATA-ENTRY PERSON	STUDY LEVEL	FIELD OF INTEREST
DURATION	No. OF SLIDES	ACRONYM	ACRONYM	COURSE CODE	ACRONYM
PLACE PUBLISHED	VERSION	ACCESS RIGHTS	ACCESS RIGHTS	STUDY LEVEL	ACCESS RIGHTS
ESTABLISHMENT	ESTABLISHMENT	ESTABLISHMENT	ESTABLISHMENT	ESTABLISHMENT	ESTABLISHMENT
PROJECT PERSONNEL	LABEL			PROGRAMME	PARTNERS
ABSTRACT	DESCRIPTION	SUMMARY	DESCRIPTION	DESCRIPTION	DESCRIPTION
NOTES	NOTES	NOTES	NOTES		NOTES
KEYWORDS	KEYWORDS	KEYWORDS	KEYWORDS	KEYWORDS	KEYWORDS
LINK TO VIDEO URL	LINK TO FILE URL	IMAGE	IMAGE	IMAGE	IMAGE
LANGUAGE	LANGUAGE	LANGUAGE	LANGUAGE	LANGUAGE	LANGUAGE
ELECTRONIC RESOURCE NUMBER	ELECTRONIC RESOURCE NUMBER	URL	URL	URL	URL

Source: Documentation des **JARDINS DE BABEL (VERSION 2) [SITE INTERNET DE BASE DE CONNAISSANCES DOCUMENTAIRES DE REEDS/OVSQ]**

1. LE CONTEXTE DE CONSTRUCTION DES JARDINS DE BABEL V2

FONCTIONS	OUTILS	DESCRIPTION DU LIEN AVEC JARDINS DE BABEL V2
Fonctions techniques		
<i>Présentation en ligne des programmes de formation des institutions / consortium</i>	L'Arbre d'Yggdrasil est un système, recourant au CMS DRUPAL, de présentation des unités d'enseignement et des programmes de formations de l'OVSQ http://yggdrasil.KerBabel.net/	
<i>Présentation des partenaires d'enseignement et des activités de partenariat</i>	Le système de profil des partenaires et des activités de partenariat existe comme prototype http://newsreels.Kerbabel.net/	
<i>Bibliothèque en ligne des ressources pédagogiques</i>	La Forêt de Brocéliande est une bibliothèque virtuelle de modules pédagogiques climat, environnement et développement durable. http://Broceliande.KerBabel.net/	
<i>Catalogues des composants pédagogiques des institutions partenaires et des matériels pédagogiques</i>	Les Jardins de Babel (V2)	
<i>Les sites internet et les mondes virtuels à connotations pédagogiques</i>	La suite KerBabel des Systèmes MultiMédias d'Apprentissage et d'Aide à la Délibération (Ex. http://KerAlarm.KerBabel.net/)	
<i>Environnement collaboratif d'apprentissage en ligne</i>	WeConext https://demo.weconext.eu/	
<i>Mécanismes de gestion de la commercialisation des services d'enseignement</i>	WIDDOO...	

2. RETOUR SUR LA DISCUSSION SUR LE DEVELOPPEMENT DU SYSTEME « QWAM » AVEC M. O'CONNOR (7 MAI 2012)

Deux éléments sont identifiés pour composer les Jardins de Babel V.2.

1. **Un outil de gestion des objets** : Nous sommes en relation avec WeConext (<http://www.weconext.eu/>) sur la question de la gestion et le stockage des objets. L'objectif est d'avoir un outil sécurisé pour le stockage des objets (permettant un accès à des communautés diverses) et la gestion des objets (pour y accéder à partir de différents sites internet ou systèmes)
2. **Création des notices et moteur de recherche sémantique** : Avec l'outil QWAM, on répond à la question du référencement. L'outil QWAM nous offre la possibilité de créer des notices (présentant les méta-informations pour les différents objets) et d'utiliser le moteur de recherche sémantique pour une sélection des notices concernant les différents objets stockés dans les Jardins de Babel V2.

Deux catégories d'exploitation sont envisagées :

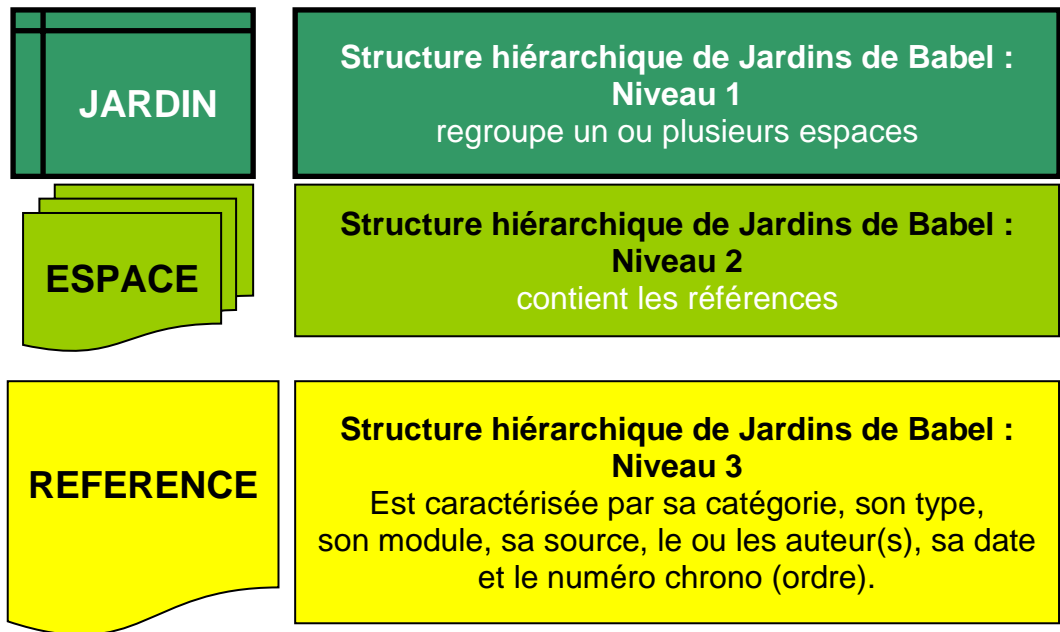
1. L'exploitation et la mobilisation des objets (à partir de WeConext) à partir des supports pédagogiques dans la Forêt de Brocéliande, à partir des SMMAAD, à partir de la présentation des programmes de formation et des unités d'enseignement (Yggdrasil), à partir du site internet KerBabel de Trombinoscope....).
2. L'exploitation des notices pour développer/extraire des catalogues (à partir de QWAM) sur la documentation d'un projet, d'une activité de recherche,... sous différents format (ENDNOTE, .doc ?, xls ?, pdf...)

Deux profils d'utilisateurs :

1. Praticants : idée d'avoir des droits pour modifier, effacer, créer... du contenu
2. Viewers : Accès aux informations accessibles (selon la communauté à laquelle il appartient)

Questions :

- Quels sont les formats possibles pour la création des catalogues à partir du système QWAM ? Comment créer les catalogues de manière assez automatisée (Choix d'extraction des informations, mise en page du catalogue...)
- Il faut travailler sur les logiques et les procédures pour l'interrogation par le public des informations concernant les notices (dans QWAM) : quelles sont les catégories d'information que l'on peut interroger ? quelles sont les informations fournies ?...
- Un travail sur le **référencement contextuel** est à faire. Cela signifie que 'on doit travail la manière dont on accède aux objets et à leur notice. Cette démarche doit être incluse dans le développement de l'outil WeConext, en reprenant la structure en 3 niveaux des Jardins de Babel V.1 (voir graphique ci-dessous).

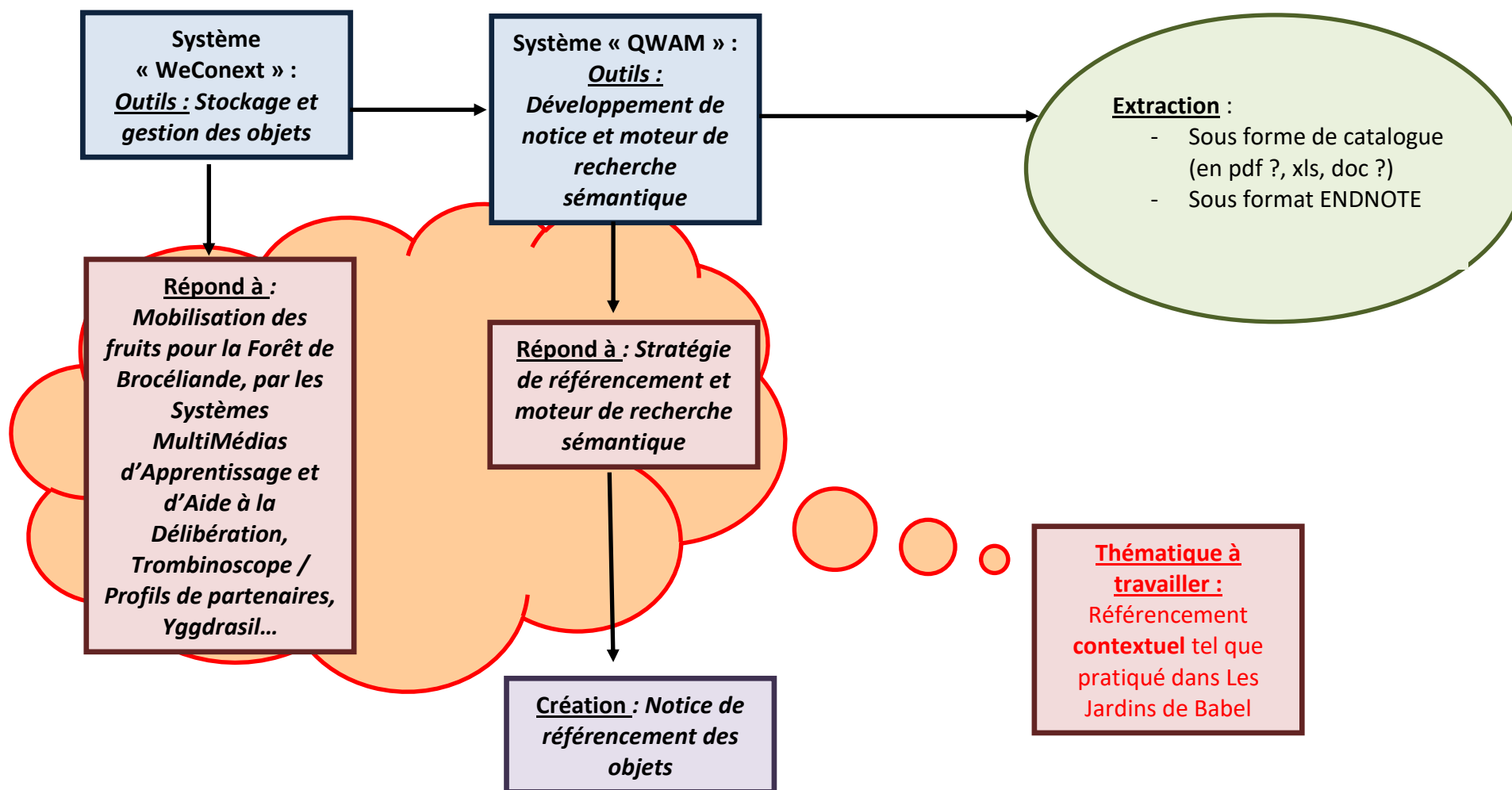


La structure des Jardins de Babel V.1

Les Jardins de Babel présentent une structure à trois niveaux. Les Jardins de Babel sont, dans un premier temps, structuré en Jardins. Chaque Jardin est ensuite décomposé en Espaces dans lesquels se trouvent des références. La structure se veut volontairement symbolique et architecturale. Chaque Jardin dispose d'un ou plusieurs Espace(s) remplis d'objets divers, à la manière d'un paysage qui offrirait des agencements différents (les Jardins) à l'intérieur desquels existent des regroupements (les Espaces) de plantes diverses (les références).

Les droits d'accès sont définis à chaque niveau (Jardin, Espace, Référence). Des droits spécifiques sont aussi déterminés pour chaque utilisateur, qui par défaut, peut voir les documents qui sont en accès libre, mais qui peut avoir un droit de modification sur le document, de gestion d'un espace (droits sur tous les références de l'espace) et/ou d'un jardin (droits sur tous les références de tous les espaces dans ce jardin).

PRESENTATION SCHEMATIQUE DES JARDINS DE BABEL (V.2)



ELEMENTS DE NAVIGATION CONTEXTUELLE

Jardins	Espaces	Références	Commentaires
REEDS Documentation 2010-2014			
	Economie Ecologique		
	Incertitudes, Analyses, Concertations et Aménagements		
	Analyses spatiales et territoriales		
	Veille-Prospective, Logistique et Eco-Innovation		
	KerBabel : Concepts & Réalisations multimédias		
	Environnement-Science-Société		
	MMiDD		
	Panoramix		
	MERLIN		
REEDS Présentation permanente			
	Cahiers de REEDS		
	Rapports de REEDS		
	How to do it		
	Brochure REEDS		
	Fiches de projet		
	Thèses		
	CV		
	Les séminaires de REEDS		
	Les séminaires du Pôle « Chaires »		
Administration / Animation REEDS			
	Animation REEDS		Suivi du personnel, suivi informatique, fonctionnement REEDS,...
	Administration Projets		
	REEDS à la BN		
	REEDS à Guyancourt		
	REEDS à Mantes		
Formations	Formation (Albion, Chine, Licence Eco-énergie,		

	Master EcolInnov agri...) Formation à distance		
Pôle Chaires			
REEDS International			
Les Jardins de la Forêt de Brocéliande			Zone de stockage des fruits de Brocéliande qui n'ont de place ailleurs
Les Jardins de la Forêt de Fangorn			Zone de stockage des fruits de Fangorn qui n'ont de place ailleurs
Les Jardins de Newsreels			Zone de stockage des fruits de Newsreels qui n'ont de place ailleurs
	Newsreels REEDS		
	Newsreels OVSQ		
	Newsreels KerDST		
	Newsreels Jardins de Biodiversité		
Les Jardins d'Yggdrasil			Zone de stockage des fruits de Yggdrasil qui n'ont de place ailleurs
	Yggdrasil de l'OVSQ		
Les Jardins de KerDST			
	KerDST et KIK		Zone de stockage des fruits de KerDST et KIK qui n'ont de place ailleurs
Les Jardins des SMMAAD			Zone de stockage des fruits de SMMAAD qui n'ont de place ailleurs
	Ker-ALARM		Lien vers KerAlarm
	KerVIVIANE		Lien vers KerViVIANE
La Cabane du Jardinier			Galerie Photo et autres éléments de base : Logo, template (UVSQ, REEDS,...)
Projets de recherche			
	ANR/Région : RESILIS, D2SOU...		
	EU : EJOLT, EO-MINER, THESEUS...		
Les catalogues de Babel			
	IJSD		

KIC Climate			
Archives			
	Jardins de Babel 1		
	Site C3ED		
REEDS in OVSQ			
REEDS in DSEM			
REEDS in UVSQ			
REEDS in UVED			
REEDS & FONDATERRA			
REEDS in UPGO			
REEDS in Plateau de Saclay			

Les catégories de méta-données dans les Jardins de Babel (version 1)

META-DONNEES « NIVEAU 1 » D'UN DOCUMENT DANS LES JARDINS DE BABEL (VERSION 1)	META-DONNEES « NIVEAU 2 » D'UN DOCUMENT DANS LES JARDINS DE BABEL (VERSION 1)	META-DONNEES « NIVEAU 3 » D'UN DOCUMENT DANS LES JARDINS DE BABEL (VERSION 1)	COMMENTAIRES
Informations générales concernant le jardin	Espace d'appartenance de la référence		
	Objet associé à la référence	Document	
		Table de matières	
	Date de fin de validité		
Groupe d'utilisateurs de la référence	Interne REEDS, Visiteurs, Interne C3ED		
Informations permettant la création de la clé de la référence	Catégorie de la référence	Produits scientifiques : (brevet, article scientifique, participation à un ouvrage collectif, divers, expertise, monographie, responsable d'un ouvrage collectif, thèse, vulgarisation) Activités : Livrables, documents administratifs, expertise, formation/soutien, partenariat, présentation détaillée, de partenaire, présentation de la composante, résumé, repère bibliographique Symposium : communications... C3ED transversal : Cahier, divers administratif, document du C3ED, newsletter, présentation, rapport de recherche, séminaire Général : , Annuaire – CV, Annuaire-éléments personnels, composants d'un site web, manuel technique – guide d'administration, manuel technique-guide d'utilisation, outils de planning Elearning :	
	Type de la référence	Divers, document téléchargeable, document version papier, Eléments des Jardins de Babel, site internet, logiciel, page html	
	Module de la référence	Module construit par rapport aux thématique du centre de recherche, aux projets de recherche, aux activités pédagogiques....	
	Source de la référence	REEDS, extérieur	
Informations	Date de publication de la référence		

de base de la référence	Version de la référence		
	Auteurs de la référence	Liste d'auteurs	
Informations générales sur le document	Titre du document	FR, EN, Espagnol	
	Numérotation interne du document	FR, EN, Espagnol	
	Sous-titre du document	FR, EN, Espagnol	
	Mots-clé du document	FR, EN, Espagnol	
	Résumé du document	FR, EN, Espagnol	
	Langue du document	FR, EN, Espagnol	
Informations spécifiques sur le document	Document pour le rapport scientifique		
	Document de Rang A		
Informations sur les participants du document	Producteur du document	Liste de Personnels	
	Editeur du document	Liste de Personnels	
	Responsable scientifique du document	Liste de Personnels	
	Assistant scientifique du document	Liste de Personnels	
	Responsable éditorial du document	Liste de Personnels	
	Assistant éditorial du document	Liste de Personnels	
Informations sur le mode d'accès au document	Adresse URL		
	Chemin local du document		
	Localisation		

TYOLOGIE ENDNOTE STANDARD	TYOLOGIE REEDS
Ancient Text	
Artwork	
Audovisional Material	
Bill	
Book	Book
Book Section	Book Section
Case	
Chart of Table	
Classical Work	
Computer Programm	
Conference Paper	Conference Paper
Conference Procceedeing	Conference Procceedeing
Dictionary	
Edited Book	
Electronic Article	Electronic Article
Electronic Book	Electronic Book
Encyclopaedia	
Equation	
Figure	
Film or Broadcast	
Generic	Generic
Government Document	
Grant	
Hearing	
Journal Article	Journal Article
Legal Rule or Regulation	
Magazine Article	Magazine Article
Manuscript	
Map	
Newspaper Article	Newspaper Article
Online Database	
Online Multimedia	
Patent	
Personal Communication	Personal Communication
Report	Report
Statue	
Thesis	Thesis
Unpublished Work	Unpublished Work
Web Page.	Web Page
Unused 1	Brochure
Unused 2	Cahier REEDS
Unused 3	Rapport de recherch� REEDS

Table de nomenclature SOURCE :

REEDS
PARTENAIRE
AUTRE

Table de nomenclature LABEL :

D2SOU
RICHESSSE IDF
FRAGILE
PLANET
EPAMSA
EMPR-PNR

Table de nomenclature PROJET PERSONNEL :

Tania_A.
Richard_L.
Ettien_B.
Matéo_C.
Charlotte_D.

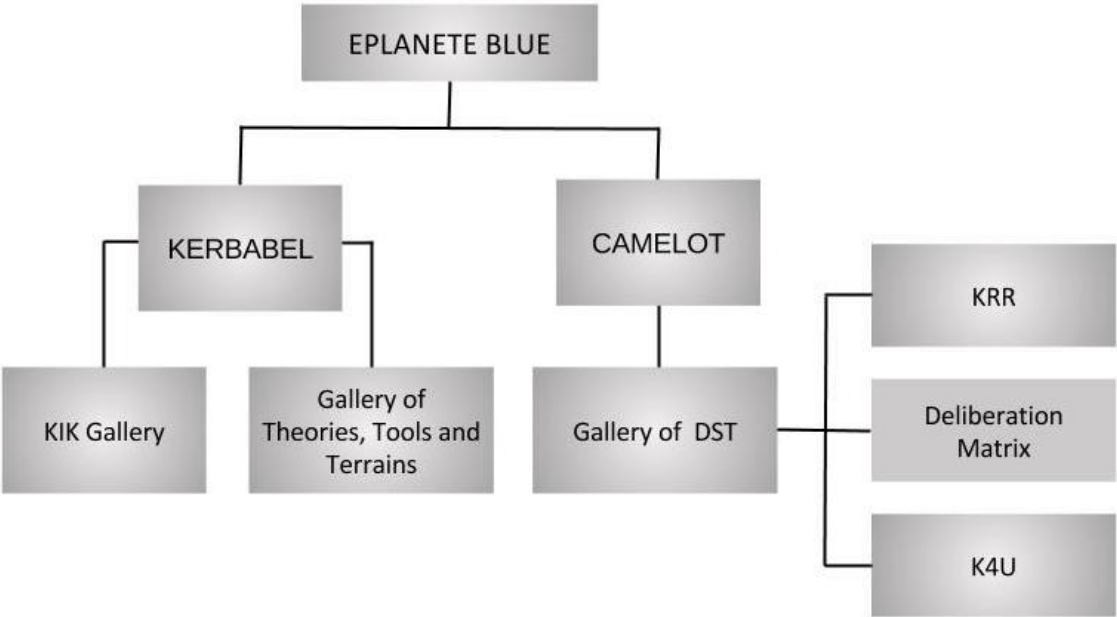
Table de nomenclature LANGUAGE :

ANGLAIS
FRANÇAIS
AUTRE


Les catégories de méta-données dans l'UVED pour les modules pédagogiques

IDENTIFIANT DU CHAMP LOM SUR ORI-OAJ	MÉTADONNÉE FICHE D'IDENTITÉ	CONTENU
2.3	ETABLISSEMENT Entité – Rôle éditeur – fiche établissement (ex : VCard)	
1.2	TITRE DE LA RESSOURCE Une ligne qui exprime la teneur de la ressource	
1.4	DESCRIPTIF <u>4-5 lignes maximum</u>	
1.5	MOTS CLES ? Mots-clés libres, décrivant des facettes de la ressource	
2.3	CREATEURS Entité – Rôle responsable de la ressource	
5.2	TYPE DE RESSOURCE Ex. : Cours, étude de cas, présentation, scénario pédagogique...	
5.6	PUBLIC Niveau Ex. : L3, M1, M2, éventuellement enseignants, secondaire, etc.	
6.1	COUTS (droits) Ex. : Oui, Non (gratuite pour les étudiants inscrits), Non (accès public)	
4.3	URL si site Internet Localisation A remplir si adresse publique	

ANNEX 5. 1: EPLANETE BLUE, THE MAIN GALLERIES AND DOORWAYS MOBILIZED



WELCOME PAGE OF EPLANETE BLUE WITH ALL THE DOORWAYS



ePLANeTe Blue
A multi-faceted approach to Sustainability

TOURNAI

▼ TALIESIN

▼ CAMELOT

FAIRROUND

MERLIN


kerBobol

What is ePLANeTe?


LogIn

Welcome to ePLANeTe

*The ePLANeTe platform (like the Biosphere) is an unfinished business.
So please bear with us (and help us) with its holes and complexities...*




Doorway TALIESIN




Doorway FAIRROUND




Doorway TALIESIN




What is ePLANeTe?



Doorway MERLIN



Doorway CAMELOT



Doorway kerBobol

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12/03/2018
- [Conférence "Qui veut sauver le climat" - 11 février 2018](#)
10/03/2018

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LIST OF INDICATORS IN THE KIKS GALLERY



Les KIKs (Kerbabel Indicator Kiosks)

Objects of this Gallery

Content ▾

User: mariana.littencour@uvsq.fr ▾

List of Indicators

Displaying 1 - 100 of 297

Community

Sustainable Campus ▾ Reset

Community: Sustainable Campus

KIK: KIK Sustainable Campuses


Acronym	Title	Unit of Measure
	Allocation of budget to health and safety	% Of the structure of the budget allocated to health and safety
	Internships and job offers	Statistics on internships and job offers
	% of different nationalities	Number of different nationalities represented in REEDS member
	Absenteeism for occupational illnesses	% of absenteeism for occupational illnesses
	Accommodation statistics	Statistics of accomodation offer/demand
	Actors involved with REEDS	Number of actors involved
	Amount of student grants	Number and amount of student grants

PROFILE OF AN INDICATOR IN THE KIKS GALLERY THE PERTINENCE ANALYSIS

You are in [e2FANET's Doconomy Knowledge](#) -> [Space 1001 \(KIT\)](#) -> [Gallery TT](#) -> [Theories, Tools, Terrains](#)

Objects of this Gallery ▼ Content ▼

User: [mariana.bettencourt@uvsq.fr](#) ▼



Gallery of Theories, Tools, Terrains

FILTERS

OPEN CLOSE

- SOLUTIONS >
- ECOSYSTEM SERVICES >
- ENVIRONMENTAL COMPARTMENTS >
- SCALE AND SCOPE >

View
Edit
Crosslinks

Haute Qualité Environmental

Submitted by mariana.bettencourt on Thu, 07/14/2016 - 10:21

General presentation

Acronyms:

HQE

Description:

HQE (High Quality Environmental standard) is a standard for green building in France based on the principles of sustainable development.

Detailed description:

The Haute Qualité Environnementale or HQE is a standard for green buildings in France, based on the principles of sustainable development first set out at the 1992 Earth Summit. The standard is controlled by the Paris-based Association pour la Haute Qualité Environnementale (ASSO-HQE).

The standard specifies criteria for the following:

- a) Managing the impacts on the outdoor environment
- Harmonious relationship between buildings and their immediate environment
- Integrated choice of construction methods and materials
- The avoidance of nuisance by the construction site

CROSSLINKS

☰ X

- BROUCELVAIDE >
- CASES >
- DST V5 >
- IDEAS & ACTIONS >
- LES KIKS ▼

f Indicator

- Adapting the constructive choices to the building lifetime
- Avoiding air pollution at the construction site
- Avoiding visual pollution
- Choosing building products to limit the building health impacts
- Choosing building products to limit their contribution to building environmental impacts
- Choosing of products, systems and processes whose characteristics are verified and compatible to use
- Considering the site potential climate
- Construction equipment and products environmental impacts knowledge
- Control on modes of transport and favors those who are the least pollutants for optimal functionality
- Controlling of the visual atmosphere by users

Contributions of the indicator

KRR WITH THE LIST INDICATOR SELECTOR BOX TO PERFORM THE PE

Home » Representation Racks » Representation Aile Sud de la BN (Building RR for K4U)

Representation Aile Sud de la BN (Building RR for K4U)

To what group of experts do you belong:

Expert

CAU_Revature CAU_algorithm

EVADES Haute Qualité Environmental LEED BAU_Eurbanlab STARS_MASHC Bio-based building

Aile Sud d... ▾

People	Comfort <input checked="" type="checkbox"/>	+ Add
	Health and... <input checked="" type="checkbox"/>	+ Add Setting up a prevent..
	Work Condi... <input checked="" type="checkbox"/>	+ Add Setting up a quality..
	Ensuring a... <input checked="" type="checkbox"/>	+ Add Act alongside region..
	Land desig... <input checked="" type="checkbox"/>	+ Add
	Promotion .. <input checked="" type="checkbox"/>	+ Add Equal opportunities ..
Planet	Energy <input checked="" type="checkbox"/>	+ Add
	Biodiversity <input checked="" type="checkbox"/>	+ Add

Indicator selector

Indicators of tool :

EVADES

Index of Pertinence
 0 1 4

- Percentage Of equipment in the form of remote collaboration tools
- Act alongside regional and international networks of actors
- Actions to promote diversity
- Creation of a specialized training centre
- Define a sustainable strategy
- Develop and support approaches, methods and learning media
- Development of transdisciplinary research projects
- Dissemination of SD&SR research results
- Equal opportunities policy
- Integration of SD&SR issues in initial training
- Integration of the SD & SR research
- Optimize the treatment and reduction of W.L.E.E.
- Raise awareness
- SD&SR performance assessment
- Setting up a prevention, health and safety policy for users
- Setting up a quality-of-life policy
- Sustainable management system

RÉSUMÉ SUBSTANTIEL

Titre: Mobilisation du portail de médiation des connaissances ePLANETe.Blue pour faire face aux nouveaux défis du développement durable dans les établissements d'enseignement supérieur et de recherche (ESR) dans une perspective d'économie du savoir

Mots-clés: Portail de connaissances; Eco-innovation et durabilité; Défis des établissements d'enseignement supérieur et de recherche (ESR); Évaluation de la qualité; Outils d'aide à la délibération; Économie du savoir

Nous vivons dans un monde en crise, dans une société des savoirs et à une époque où les temps sont marqués par les changements et l'instabilité (Granados, 2015). Dans une société des savoirs mêlée à une économie des savoirs, l'éducation se révèle être la capacité d'être créative dans un environnement d'incertitude, la capacité de gérer correctement la dissonance cognitive qui donne lieu à notre incapacité à comprendre la réalité (Innerarity, 2010). Dans ce domaine, les établissements d'enseignement supérieur et de recherche (ESR) ont conservé des rôles relativement importants face aux grands systèmes sociaux complexes et adaptatifs, comme toutes les autres organisations humaines.

Au cours de la dernière décennie, l'enseignement supérieur dans le monde a été confronté à un certain nombre de défis (Sarker, Davis et Tiropanis, 2010), tels que l'insertion de la thématique de la soutenabilité du niveau des programmes d'enseignement, l'utilisation de méthodes et d'outils permettant de développer des approches pluri-inter et transdisciplinaires (Outils d'aide à la délibération, salle interactive pour des apprentissages collaboratifs...), la mobilisation d'outils issus des Technologies d'Information et de Communication pour améliorer la qualité et diversifier les formes d'apprentissage (Douguet et Ewing, 2007), permettant la conception de cours collaboratifs et innovants, reliant les étudiants à l'expérience de terrain, avec les approches conceptuelles, avec en arrière fond, une mise en évidence par rapport à de possibles opportunités d'emploi liées à l'économie, à l'aménagement du territoire...

La question de la soutenabilité s'exprime également au niveau du campus pour établir un campus durable (campus vert, bâtiment vert, transport vert), de développer des stratégies innovantes et inclusive des ESR. Ces expériences peuvent également faire l'objet d'innovation, tant aux niveaux des environnements d'apprentissage (mise en œuvre de moyens innovants pour l'adoption de nouvelles technologies, transformation de l'éducation vers le portail basé sur les connaissances, renforcement des capacités et l'autonomisation, etc.), qu'au niveau des mécanismes de facilitation de la technologie pour établir des partenariats pour l'éducation entre les acteurs d'un territoire.

Mais la soutenabilité implique une certaine préoccupation pour l'équité ou l'équité intergénérationnelle dans la prise de décision à long terme de toute une société, une certaine reconnaissance du rôle des ressources environnementales limitées dans la prise de décision à long terme, et une utilisation reconnaissable (même peut-être non conventionnelle) de l'utilisation économique des concepts tels que l'utilité instantanée, le coût ou le bien-être intertemporel (Pezzey et Toman, 2002.). Cependant, le souci d'équité intergénérationnelle peut ne pas impliquer l'utilisation explicite du mot « soutenabilité » sous quelque forme que ce soit ; de nombreuses autres formulations sont possibles (ibid, 2002). Elle peut également être assez indirecte, comme dans le cas d'un volet de la littérature axé sur la faisabilité écologique ou physique d'une expansion économique continue avec des ressources limitées (The Survey of Toman and others, 1995). Le développement durable est un modèle d'utilisation des ressources qui vise à répondre aux besoins humains tout en préservant l'environnement afin que ces besoins puissent être satisfaits non seulement dans le présent, mais aussi pour les générations futures (Juhász Csaba, Szöllősi Nikolett, 2008).

Les différentes interprétations du concept de soutenabilité (Bonnett, 2002, 1999; Stables et Scott, 1999; Haque, 2000; Holt et Barkemeyer, 2012; Fischer et al., 2017) s'exprime également sous forme d'un triptyque – Innovation (Mota et Oliveira, 2013), Education (Granados, 2015), Soutenabilité. Malgré les défis d'articulation des trois thématiques ci-dessus, les décideurs aux niveaux national et international ont largement adopté les termes et conditions des meilleures pratiques de l'enseignement supérieur. Alors, comment surmonter les difficultés de mise en œuvre des nouveaux défis de l'éducation, de la durabilité et de l'innovation dans l'enseignement supérieur pour créer une économie de la connaissance ? quels sont les acteurs qui pourraient aider à surmonter ces difficultés ? Les établissements d'enseignement supérieur sont l'un des acteurs qui peuvent aider à surmonter ces difficultés en développant une plateforme de connaissances commune et de nouveaux processus d'évaluation du changement qui constitueront une étape de développement pour les meilleures pratiques des défis de l'enseignement supérieur en termes d'éducation, de durabilité et d'innovation

Cette démarche peut également être mise en perspective par rapport aux objectifs de développement durable déclaré par les Nations Unies en septembre 2015. Ces derniers portent, notamment, sur l'intention de garantir que tous les apprenants acquièrent les connaissances et les compétences nécessaires pour promouvoir le développement durable, par exemple une éducation approfondie sur le développement durable et l'innovation, à la lumière de l'incertitude et des multiples significations des nouveaux défis.

La question centrale de cette recherche scientifique est de savoir de quelles manières, le portail de médiation des connaissances (ePLANETe.Blue) fonctionne comme une opportunité de développer des activités pour répondre aux nouveaux défis de l'éducation, de l'innovation et de la soutenabilité et pour évaluer la mise en œuvre des meilleures pratiques à un niveau supérieur établissements d'enseignement et de recherche (ESR) ? Par ce biais, nous nous interrogeons sur la construction de passerelle de la connaissance pour faire face aux défis à venir de l'éducation, de l'innovation et de la soutenabilité des institutions d'enseignement supérieur, sur comment évaluer la qualité et l'amélioration des performances des établissements d'enseignement supérieur et de recherche (ESR). Cette recherche nous permet de fournir des éléments de réponse à ces questions.

Il existe de nombreuses technologies différentes qui prennent en charge le stockage et la distribution de contenus numériques, notamment. Dans la plateforme ePLANETe.Blue, nous avons retenu :

- ♣ Référentiels numériques basés sur les collections gérées en plein air par l'association d'ePLANETe.Blue
- ♣ Présentation du programme d'enseignement, des ressources pédagogiques, des systèmes de gestion et des magasins de fichiers associés
- ♣ Collections de données de recherche et rapports gérés par l'association ePLANETe.Blue
- ♣ Systèmes de portfolio de documentation
- ♣ Systèmes de stockage de fichiers institutionnels
- ♣ Systèmes de workflow de gestion de l'évaluation de la qualité en ligne via la méthodologie INTEGRAAL,
- ♣ Systèmes de gestion de contenu pour utilisateur déférent.

En entrant par les DOORWAYS, les objets trouvés dans ou à travers les différentes galeries d'ePLANETe peuvent être individuellement de types simples et bien connus, par exemple des fichiers électroniques tels que des photos ou des documents PDF. Ou ils peuvent être plus complexes. Il s'agit souvent de profils de toutes sortes, composés à l'aide de systèmes de gestion de contenu de pointe (par exemple, le CMS « Drupal »). La plupart sont les créations, ou les résultats émergents croisés, du travail d'apprentissage, de

découverte, d'analyse et de documentation des communautés d'utilisateurs. Le résultat global est un réseau évolutif d'objets réticulés - une « modélisation » toujours incomplète de l'activité humaine, à laquelle les utilisateurs contribuent et dans laquelle ils naviguent.

Le contenu de cette plateforme de connaissances peut être disponible pour intégration dans différents départements de l'institution, et peut également être mis à la disposition des collègues et des étudiants d'autres institutions, ainsi que du grand public et les établissements de recherche (ESR) pourraient commencer à exposer une telle plateforme dans des formats de données liés commençant par des informations déjà disponibles sur leurs pages Web. (par exemple, promouvoir l'éducation pour le développement durable) pour relever les défis. Par exemple,

- La promotion de l'éducation pour le développement durable pourrait être soutenue en établissant comment les programmes d'enseignement dans les établissements d'enseignement supérieur se comparent les uns aux autres et identifient les lacunes potentielles que les nouveaux programmes diplômants pourraient combler;
- Objectif de développement durable 4: Vers une éducation de qualité inclusive et équitable et un apprentissage tout au long de la vie pour tous, les stratégies de durabilité de l'enseignement supérieur et la création de valeur stratégique dans l'enseignement supérieur pourraient être des enseignements pratiques orientés pour les prochains jours;
- Les résultats du développement durable des institutions pourraient être plus visibles sur le campus durable, le campus vert; la transformation de l'éducation en un accès équitable au portail de connaissances pourrait permettre de délibérer sur les dispositions relatives au campus et l'inventaire de l'enseignement et de l'apprentissage pour la qualité du programme d'enseignement;
- Le renforcement des capacités et l'autonomisation pourraient être soutenus par un suivi plus efficace des activités des étudiants; Le mécanisme de facilitation de la technologie pour établir des partenariats efficaces pour l'éducation pourrait être plus perceptible pour l'engagement communautaire et l'évaluation de leurs progrès, etc.

Les défis pourraient être abordés en groupes, pourrions-nous examiner les infrastructures de données par groupe pour relever les défis ? Il est clair que le concept innovant d'ePLANETe est une idée très puissante et peut servir de moteur de changement pour les établissements d'enseignement supérieur. S'il est correctement développé, il fait progresser un nombre surprenant d'objectifs et répond à un éventail impressionnant de défis où les étudiants changent, leurs styles d'apprentissage changent et les technologies pour répondre à leurs besoins changent.

Les chapitres de la thèse sont organisés de la manière suivante :

Le Chapitre 1 porte sur l'approche intégrée de l'éducation, de l'innovation et de la durabilité dans la perspective de la société et de l'économie de la connaissance. Il décrit les principaux enjeux de l'éducation, de l'innovation et de la durabilité à travers la taxonomie de l'OCDE et de l'UNESCO. Il traite également les questions triangulaires de l'éducation, de l'innovation et de la soutenabilité dans une perspective de société du savoir et d'économie de la connaissance

Le Chapitre 2 analyse différentes initiatives autour des enjeux futurs de l'éducation, de l'innovation et de la soutenabilité à l'Université Versailles Saint-Quentin-En-Yvelines (UVSQ) et à l'Université de Paris Saclay (UPSaclay). Ce chapitre étudie, d'une part, l'évolution de la situation de UVSQ jusqu'en 2013 et, d'autre part, les initiatives actuelles et futures d'UPSaclay pour faire face aux défis à venir de l'éducation, de

l'innovation et de la soutenabilité. On se concentre principalement sur l'enseignement autour des questions de développement durable et sur la soutenabilité au niveau du campus de l'UVSQ et de l'UPSaclay. Pour acquérir une compréhension des actions menées actuellement à l'UVSQ et à UPSaclay, des études de cas pratiques seront présentées dans ce chapitre

Le Chapitre 3 présente la plateforme innovante de médiation de connaissances environnementales, en économie écologique et en développement durable, nommée ePLANETe.blue. Ce chapitre décrit les nouveaux terrains de l'économie de la connaissance pour faire face aux nouveaux défis de l'éducation, de l'innovation et de la soutenabilité. De plus, ce chapitre présente le concept et les fonctionnalités émergentes d'ePLANETe.blue en tant que programme d'innovation contribuant aux objectifs de soutenabilité dans l'enseignement supérieur tel que développé au cours des années 2000-2015. Une des fonctionnalités originales de l'utilisation des Technologies d'information et de communication dans le domaine de l'environnement est de développement d'un outil d'aide à la délibération.

Le Chapitre 4 présenter l'application de la DOORWAY innovante d'ePLANETe.blue, TALIESIN, pour établir des partenariats de connaissances pour la soutenabilité. Il est à noter que ePLANETe.blue est une plateforme collaborative en ligne qui vise à soutenir une grande variété de formes d'apprentissage et de partage de ressources pour l'apprentissage, et met l'accent sur la communauté et la convivialité. Dans une perspective locale / mondiale, elle cherche à inciter à de nouvelles expériences d'apprentissage collaboratif, de réseautage social et de partage des connaissances concernant la biosphère et la soutenabilité, et à offrir des outils d'aide au débat et à la délibération portant sur les dimensions sociales, politiques, technologiques, économiques et environnementales de la soutenabilité.

Le Chapitre 5 propose une évaluation de la qualité des programmes de formation dans le domaine de la soutenabilité à l'aide d'une démarche innovante. Deux études de cas sont proposées, une au niveau l'UVSQ – Programme de formation MEDIATIONS -- et une autre au niveau de l'Université Paris Saclay – Mention Gestion des territoires et développement local. Ce chapitre examine les défis de l'évaluation de la qualité des modèles de programme d'enseignement dans l'optique de la triple articulation – Innovation, Soutenabilité, et de l'éducation, à partir de la mobilisation du portail de connaissances ePLANETe.blue.

Le Chapitre 6 discute de l'opportunité de mobilisation des communautés de connaissances dans un processus d'évaluation d'un campus durable: Dans ce chapitre, nous cherchons à montrer comment les développements actuels des TIC à travers les «réseaux sociaux» peuvent être la base d'un apprentissage collaboratif à grande échelle, de la réputation et de la responsabilité, soutenant la co-construction de solidarités sociales autour des objectifs et des pratiques des campus durables en ce qui concerne les communautés d'engagement, la méthodologie d'évaluation et de Responsabilité sociale des organisations/Entreprises, les stratégies de campus et les réseaux sociaux pour l'aide à la délibération.

Enfin, le Chapitre 7 propose une démarche originale et expérimentale d'auto-évaluation de la contribution de la plateforme ePLANETe.blue, dans les établissements d'enseignement supérieur et de recherche dans une optique d'économie de la connaissance. Dans ce chapitre, nous démontrons et évaluons la plateforme ePLANETe.Blue en termes de pédagogie, d'apprentissage et de soutien de projet des établissements d'enseignement supérieur et de recherche pour les scénarios de meilleures pratiques.

En définitive, l'utilisation d'ePLANETe.blue devient de plus en plus évidente que la clé du progrès compatible avec la durabilité, en particulier en ces temps de défis du 21e siècle pour les établissements d'enseignement supérieur et les établissements de recherche (ESR), est l'innovation associée à l'éducation. Un nouveau système-cadre basé sur ces piliers devrait être la seule solution pour construire une économie où les principales valeurs sont liées à un monde plus durable et à une meilleure répartition des richesses.

Cela pourrait reposer sur le développement et la disponibilité d'outils qui aideront à relever efficacement ces défis. Pour aller de l'avant, il faut une gouvernance institutionnelle, des politiques sur l'exposition de l'évaluation de la qualité institutionnelle qui pourraient relever les défis de l'enseignement supérieur (c'est-à-dire l'éducation, la soutenabilité et l'innovation), envisager de révéler une plateforme ou un espace de connaissances à partager entre les institutions et quelle plateforme ou espace ne devrait pas être partagé. Sur la base de cette classification, les recherches futures pourraient impliquer des études de cas et des expériences pour tester l'efficacité de cette classification pour relever les défis à venir.

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