Cooperation in horticulture : three experiments

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COOPERATION IN HORTICULTURE: THREE EXPERIMENTS

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by

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Abstract

In a highly competitive international economic environment, cooperation is a crucial factor in fostering competitiveness. Although France is a major agricultural powerhouse, the French horticultural industry is vulnerable and subject to tough European competition. Despite significant public and private initiatives to stimulate collective action, cooperation in the industry remains very weak, and value capture in the supply chain is unbalanced between the different players in the industry. While there are numerous studies in the literature on the characteristics and specific features of horticulture, there are very few on the behavioral characteristics of the industry's players when it comes to cooperation.

This thesis, consisting of three empirical studies, has several objectives. The first is to define the factors behind the low level of cooperation in the horticultural industry. The second is to characterize the determinants to identify the obstacles and the levers to be implemented to overcome them. Finally, the last objective is to discuss the types of collective action that would enable players in the sector to capture a larger share of the value to promote sustainable cooperation. Our studies focus on the case of horticulture in France. We use data from field experiments that mobilize strategic interaction games whose choices reflect social dilemmas, such as the prisoner's dilemma game where individual interest is confronted with collective interest.

The first chapter shows the existence of a typical profile of horticulturists who can be mobilized to set up and develop collective actions. However, this first study also reveals a cooperative behavior hindered by the «better than average» bias. Professionals in the sector consider themselves to be more cooperative than others, when in fact they are not. Our second experiment involves them in a situation of common good in the context of environmental and biodiversity preservation. We show that group identity initially increases cooperation, while attitudes towards collective action in the context of group identity have more lasting impacts.

Finally, to understand what might encourage cooperation in the industry, we designed a field experiment in the context of open innovation. We compared the behavior of professionals regarding risk-taking and value-sharing. This third study enables us to understand the obstacles to cooperation in the context of uncertain outcomes of collective action and to explain the motivations for overcoming them. We also discuss types of collective action to promote reciprocity for sustainable cooperation in the industry, such as taking free

rider behavior into account when carrying out collective action. We show that, despite its necessity, cooperation remains limited, the obstacles are essentially psychological, and taking it into account in the implementation of public and/or private collective actions increases cooperation.

Keywords: collective action, cooperation, field experiments, horticulture, non-cooperative games

Résumé

Dans un environnement économique international fortement concurrentiel, la coopération est un déterminant clé pour favoriser la compétitivité. Alors que la France est une puissance agricole majeure, la filière horticole française est vulnérable et subit une très forte concurrence européenne. Malgré des actions publiques et privées significatives pour stimuler les actions collectives, la coopération reste très faible dans la filière, et la capture de la valeur dans la supply chain est déséquilibrée entre les différents acteurs de la filière. S'il existe dans la littérature de nombreuses études sur les caractéristiques et les spécificités horticoles, il en existe très peu sur les caractéristiques comportementales des acteurs de la filière face à la coopération.

Cette thèse, composée de trois études empiriques, vise plusieurs objectifs. Le premier est de définir les facteurs expliquant la faible coopération dans la filière horticole. Le deuxième est de caractériser les déterminants pour mettre en lumière les freins et les leviers à mettre en œuvre pour surmonter les obstacles. Enfin, le dernier objectif est de discuter des types d'actions collectives pour permettre aux acteurs de la filière de capturer une part plus importante de la valeur pour promouvoir une coopération pérenne. Nos études sont concentrées sur le cas de l'horticulture en France. Nous utilisons des données d'expériences de terrain qui mobilisent des jeux d'interactions stratégiques dont les choix reflètent des dilemmes sociaux, comme le jeu dilemme du prisonnier où l'intérêt individuel se retrouve confronté à l'intérêt collectif.

Le premier chapitre montre l'existence d'un profil type d'horticulteurs à mobiliser pour mettre en place et développer les actions collectives. Mais cette première étude révèle aussi un comportement coopératif entravé par le biais du «meilleure que la moyenne». Les professionnels de la filière se jugent plus coopératifs que les autres, alors qu'en réalité ils ne le sont pas. Notre deuxième expérience les place dans une situation de bien commun dans un contexte de préservation de l'environnement et de la biodiversité. Nous montrons que l'identité de groupe permet dans un premier temps d'augmenter la coopération, tandis que les attitudes envers l'action collective dans le cadre de l'identité de groupe ont des impacts plus durables.

Enfin, pour comprendre ce qui pourrait encourager la coopération dans la filière, nous avons conçu une expérience de terrain ayant pour contexte l'innovation ouverte. Nous avons comparé le comportement des professionnels face à la prise de risque et au partage

de la valeur. Cette troisième étude permet de comprendre les obstacles à la coopération dans le cadre de l'incertitude des résultats des actions collectives et d'expliquer les motivations pour les surmonter. Nous discutons également des types d'actions collectives pour promouvoir la réciprocité pour une coopération pérenne dans la filière, comme la prise en compte des comportements de free rider dans la réalisation d'action collective. Nous montrons que malgré sa nécessité, la coopération reste faible et que les freins sont essentiellement de type psychologique et que sa prise en compte dans les mises en place des actions collectives publiques et/ou privés augmentent la coopération.

Mots clé: actions collectives, coopération, expérimentations, horticulture, jeux non-coopératifs

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Ngoc-Thao Noet,
Angers, 15 octobre 2023

À ma maman,

À Elric-Toàn et à Mina,

Cette thèse est la vôtre.

Preamble

This thesis is a thesis on articles. It has several objectives. The first is to define the factors explaining the low level of cooperation in the horticultural sector. The second is to characterize the determinants to identify the obstacles and the levers to implement to overcome them. Finally, the last is to discuss the types of collective action that would enable players in the sector to capture a greater share of the value and promote sustainable cooperation. Through this leading thread, the three empirical studies can be read independently of others, each shedding additional light on our research questions[1].

First, we used an empirical-inductive methodology to define our research questions. To test our hypotheses, we then carried out experimental studies based on a hypothetico-deductive methodology.

In the first stage, we conducted an exploratory analysis using an empirical-inductive methodology. This is our introductory section, presenting the hypotheses of this thesis. Regarding methodology, we carried out a field survey using free, semi-structured interviews. This is an exploratory approach. The aim is to capture the participant's subjective point of view, communicated in his or her own words Roberts (2020). This first part mobilized 83 professionals, who took part in 44 free interviews, 21 semi-structured interviews, and two group meetings. The results showed that the main obstacles to cooperation are psychological. We identify several hypotheses: trust, belief in each other's strategic behavior, group identity, and finally, the importance of results/outcomes in beliefs and perceptions of cooperation. Besides the fact that this survey enabled us to formulate our hypotheses, it is original in that, to our knowledge, there has been no investigation into the beliefs and perceptions of players in the industry. Regarding the methodological

[1]This may unfortunately lead to repetitions of some general information. We apologize in advance to the readers.

approach used and the importance of the data collected, we thought it would be interesting to share this study in the form of an article. The introductory part of this thesis is therefore singular as it is also in the form of an article.

Based on the results of this initial investigation, we feel that field experiments are an appropriate way of testing presumed hypotheses. For this reason, in this second stage, we use the same methodology and mobilize the tools of game theory to carry out the three experiments that make up the three parts of this thesis.

We focused on the case of horticulture in France. From the very beginning of our research, professionals showed an interest in our project. As a result, our first experiment benefited from a financial contribution from a professional organization. For the three experiments, we received a total of €3,550 (€1,500 for the first experiment (BHR and UFR), €800 (GRANEN and UFR) for the second, and €1,250 (GRANEM and SFR Confluences) for the last. These three studies were run between September 2022 and September 2023.

Throughout this process, we made sure that professionals correctly identified the objectives and results of our experiments. At the same time, we published articles in Le Lien Horticole, the leading magazine read by 5,000 horticulturists. This confirms the originality of such studies in agriculture and with professionals. Howerver, we recognize that they are not entirely familiar with this type of study. The advantage of online experiments is that they help us reach professionals who, without online surveys, would not have participated. This enabled us to achieve a response rate of around 9% for the various surveys, and many opened the questionnaires but did not respond. We wanted to take advantage of the Salon du Végétal in Angers in September 2022 and prepare a survey in a dedicated room so that professionals could participate. Although they were all at the trade show, they didn't show up. Online experiments are therefore the right format to reach individuals who are very busy and pressed for time. Our three experiments can be summarized as follows: The first chapter shows the existence of a typical profile of horticulturists who can be mobilized to set up and develop collective actions. However, this first study also reveals cooperative behavior hampered by the «better than average» bias. Professionals in the sector consider themselves to be more cooperative than others

when in reality they are not. Our second study places them in a situation of common good in the context of environmental and biodiversity preservation. We show that group identity initially increases cooperation, while attitudes towards collective action in the context of group identity have more lasting impacts. Finally, to understand what might encourage cooperation in the industry, we designed a field experiment set in the context of open innovation. We compared the behavior of professionals regarding risk-taking and value-sharing. This third study enables us to understand the obstacles to cooperation in the context of uncertain outcomes of collective action and to explain the motivations for overcoming them. We also discuss types of collective action to promote reciprocity for sustainable cooperation in the industry, such as taking free rider behavior into account when carrying out collective action.

We show that, despite its necessity, cooperation remains limited, the obstacles are essentially psychological, and taking it into account in the implementation of public and/or private collective actions increases cooperation. While this thesis aims to answer specific research questions, it is also open to other avenues for future research.

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General introduction[2]

Context

Cooperation is a key element for the survival and competitiveness of companies (Balliet and Van Lange, 2013; Biró et al., 2016; Robotka, 1947). It potentially enables them to generate economies of scale, reduce risk-taking, organize themselves by forming alliances, increase their capacity for innovation, or penetrate new markets (Bernard, 1992; Biró et al., 2016; Lamani et al., 2015; Samoggia et al., 2022).

Nevertheless, the reports of FranceAgriMer (2020, 2022a) show that France is lagging behind its main European competitors in the horticultural sector, Dutch and German being the leaders. This lag is explained especially by the low level of cooperation between players (trade or logistics groups) and professional organizations, as shown by the industry's membership rates. Only 13% of French horticulturalists belong to a professional organization, compared with 80% in the Netherlands and 60% in Belgium and Germany (FranceAgriMer, 2022b).

The question is: why do horticultural professionals cooperate so little? Moreover, to achieve significant results, the actions implemented must be able to be capitalized on. Cooperation must not be a one-shot deal, but a lasting one that allows experience and learning to take hold. The second question is: once cooperation has been initiated, how can it be sustained?

[2]The author expresses his gratitude to Ivan Dufeu for his methodological contribution to this introduction.

This study investigates more precisely how cooperation is understood and represented by the diversity of players in the horticultural sector, as well as the links made between cooperation and their collective actions, with the objective of identifying perceived leverages and obstacles. The study is intended to be exploratory. The first step is to restrict the research object to define new directions for our work. This will then enable us to identify an appropriate method to detect the degree of cooperation, and understanding the motivations, levers and obstacles in adopting cooperative behaviors. Our work takes in as a field survey in the sense of Paillé and Mucchielli (2016) i.e., research involving personal contact with subjects. This is carried out *in situ* via observation of practices as well as interviews. The use of an inductive methodology ensures that cooperation can be studied in the field, with the smallest possible bias. From a theoretical point of view, the standard model of economic theory is based on a traditional representation of the individual as *homo œconomicus*, a fictitious being whose sole objective is to maximize personal satisfaction. In this framework, cooperation is ruled out, since individual rationality, implying the selfish interest of individuals, is in contradiction with group rationality (Hardin, 1968; Olson, 1965). Earlier in the 1950s, authors such as Herbert Simon and Maurice Allais began to challenge this assumption of rationality, both empirically and theoretically. Individuals do not seek to maximize their utility all the time, cognitive biases remain existent (Dawes et al., 1977; Kahneman et al., 1991; Kahneman and Thaler, 2006; Kahneman and Tversky, 1979; Tversky and Kahneman, 1974). Numerous works, such as Dawes and Thaler (1988) show that they are naturally cooperative, even when reciprocity is not possible. This is the case, for example, in experiments using the prisoners' dilemma game, in which the game is only played once. The rate of cooperation is around 50%.

In the horticultural industry, this rate of cooperation remains very low (FranceAgriMer, 2020). One of the arguments cited is that the structure of the sector is defined

as complex, atomized and is involving a large number of players[3]. Moreover, horticultural products are alive, perishable and fragile. Unlike industrial or agri-food products, they cannot be processed, which means that the finished marketed product marketed is the product of the growers themselves. Producers have to match as closely as possible to consumer expectations, which makes coordinating the value chain quite challenging. Cooperation is therefore necessary to improve competitiveness and gain access to different markets. With their independent culture, horticulturists are used to dealing with all issues on their own, without the help of outside experts (Deffontaines, 2014; Mesnel, 2017). As a result, cooperation within the industry remains very low. However, a study by Blondel and Widehem (2006) shows that horticulturalists are no more individualistic than fruit and vegetable producers, who are in a similar sector.

Understanding the micro-foundations of cooperation is the key in order to identifying the leverages and barriers of cooperation in the sector. While there are many studies on the characteristics and specificities of horticulture (Justin et al., 2009; Kapusta et al., 2015; Leroux et al., 2014), to our knowledge, there are none on the beliefs and perceptions of cooperation in horticulture.

This paper is structured as follows. After a brief definition of the concepts of cooperation and collective action, as well as the concepts of beliefs and perceptions, section 2 introduces the elements of analysis of the horticultural sector. Section 3 explains our research context and methodology. Section 4 describes the results. Finally, section 5 concludes and puts into perspective potential hypothesis for confirmatory researches to remove obstacles and accentuate motivations for cooperation in the horticultural sector.

[3]The horticultural sector as a whole involves 52,000 companies, 186,000 jobs and sales of 15 billion euros (FranceAgriMer, 2023).

Conceptual foundations

Cooperation

Why do human beings tend to cooperate with others, and why do they accept to be dispossessed in order to share? The question of cooperation has inspired numerous books and articles in disciplines and fields as diverse as warfare (Bauer et al., 2016; Huth, 1988; Walter, 2006), social evolution (Rand and Nowak, 2013; Trivers, 1971), cooperation in animals (Chia and Dubois, 2017; Dugatkin, 2002; Stevens, 2004), psychology (Dawes, 1980; Tajfel et al., 1971), management (Chow and Chan, 2008; Li et al., 2014; Richards et al., 2021) and, of course, economics (Axelrod, 1984; Chaudhuri, 2011; Dal Bó and Fréchette, 2018; Dawes and Thaler, 1988; Fehr and Schmidt, 1999).

In a group, *the homo-œconomicus* will first seek to maximize his individual interest and will exclude cooperation, as soon as he observes a contradiction between his individual interest and the interest of the group (Olson, 1965). It results the most in Hardin's (1968) tragedy of the commons. Yet cooperation within groups is a key factor in the stabilization and survival of society (Axelrod and Keohane, 1985; Fehr and Rockenbach, 2004). In economics, cooperation is studied theoretically (Kolm, 1984a; Nowak and Sigmund, 2005; Olson, 1965; Robotka, 1947) and empirically (Bohm, 1972; Embrey et al., 2018; Kreps et al., 1982; Locey and Rachlin, 2012), from general models based on preferences «for others» (altruism (Andreoni, 1990; Bolle and Kritikos, 2006; Croson, 2007; Fehr and Rockenbach, 2004), trust (Charness et al., 2011; Duffy et al., 2013; Glaeser et al., 2000), inequality aversion (Fehr and Schmidt, 1999) or risk aversion (Charness et al., 2013; Teyssier, 2009), reciprocity (Bolton et al., 2021; Bowles and Gintis, 2004; Breitmoser, 2015; Falk and Fischbacher, 2006), and individuals' beliefs about the behavior of others punishment (Gächter and Herrmann, 2011; Masclet et al., 2003; Noussair et al., 2015;

Gallo et al., 2022) or reputation (Axelrod and Dion, 1988; Charness et al., 2011; Cooper et al., 1996; Kamei, 2017).

Robotka (1947) pointed out that by the beginning of the 20th century, much of the literature about cooperation already reflected the idea that it was shaped above all by practical experience and was a matter of applied economics. For example, work in agricultural economics analyzes the problems of competitiveness faced by cooperatives as they expand their markets. The first idea is that cooperation between players is a way of producing a large-scale organization, characterized by a process of vertical or horizontal integration in the value chain.

Secondly, a cooperative is defined as a community of interests of individuals who get together voluntarily to face together the obligations, risks and costs of economic activities inherent in the structure (Robotka, 1947). It is therefore first and foremost an association of human beings who agree to assume mutual obligations in order to obtain mutual benefits in the performance of certain functions common to their economic activities.

However, the simple desire to join forces to achieve common goals is no guarantee of the effectiveness and success of such organizations. Olson (1965) shows that unless the number of individuals in the group is small, or unless there is coercion, or some other specific devices to make individuals act together, rational and self-interested individuals will not act to achieve the common or collective interest, but they will tend to promote their own self-interest. Cooperation is therefore subjected to several conditions, and other factors, such as the group size. It introduces the idea of sub-groups, as well as the distinct objectives inherent in each of these groups.

Kolm (1984a) introduces motivation and analyzes cooperation in terms of reciprocity groups. It is the reciprocal link that enables cooperation to be sustained over time. For a company, reciprocity improves productivity and consequently, competitiveness. Motiva-

tion, for Kolm (1984a) refers to preferences, but above all, it determines behaviors which are influenced by the facts and the actions of each individual. Cooperation can only be translated into a stable state through a give-and-take relationship, i.e., a reciprocal loop. It is therefore linked with equality, equity, and reciprocity between the parties. This relationship can be direct (gift/counter-gift between two individuals), but in no way precludes an indirect relationship (I_1 gives to I_2 who in turn gives to I_3 ...I_n gives to I_1). Whatever n is, I_n makes a gift (which here is the counter-gift) to I_1. I_1 is therefore guaranteed to receive the counter-gift. This scenario by no means excludes altruism, since the value of the counter-gift is not necessarily equivalent to the value of the gift.

Explaining the behavior of individuals through social preferences is particularly appropriate in the framework of strategy games. Numerous empirical studies, using games such as the Prisoner's Dilemma and the Public Good Game, have revealed individuals' social preferences such as altruism, trust, aversion to inequality and reciprocity. Generally speaking, these studies show that, unlike *homo œconomicus*, individuals are naturally cooperative (Perc et al., 2017; Rand and Nowak, 2013), even when reciprocity is not possible, as in «one-shot» experiments: the rate of cooperation is around 50% in the prisoner's dilemma (Dawes and Thaler, 1988; Heuer and Orland, 2019).

Cooperation is therefore a complex concept. Understanding the factors that underlie it, and why and how an individual (and even more so a social group) will have an interest in cooperating or not, is an important issue for current researches.

A first definition is given by Alós-Ferrer and Garagnani (2020). They describe cooperation as an act of contributing to a common, mutually beneficial goal[4], even if selfish behavior would be individually more profitable, regardless of whether others decide to cooperate or not. The question of choice naturally leads to the mobilization of game

[4]Alós-Ferrer and Garagnani (2020) explain the fundamental difference between cooperation and prosocial motivations such as altruism or fairness, which refer to individual preference, whereas cooperation refers to the achievement of a common goal. Cooperation is therefore an act, not simply a will and a motivation.

theory to answer questions concerning cooperation (Diekert, 2012).

Castañer and Oliveira (2020) add that, unlike coordination, which enables us to work towards a common goal, cooperation refers to the attitudes, behaviors and results that are linked to its implementation and realization.

In our study, cooperation is defined as the pooling of resources and activities of independent firms in the implementation of a common objective, which results in the realization of a collective action (McCarthy et al., 2004). Cooperation can take different forms: horizontal (with competitors), vertical (with customers or suppliers), or institutional (with research or promotion organizations) (Belderbos et al., 2004; Biró et al., 2016).

Collective action

Collective actions form the construction and stability of firms (Robotka, 1947). This dimension is important, since the main problems firms are facing, are problems of public good. Issues are mainly based on collective choices, but in which the individual is considered as the key instigator whose actions may produce negative externalities for the group (Elster, 1985) as demonstrated by environmental problems (Gulliver et al., 2022). Individuals encounter a social dilemma. They can either contribute to collective action spending time and effort, or either take advantage of the situation opportunistically, i.e., not contribute while benefiting from the efforts of those who do.

Collective action must therefore aim to improve the utility of an entire group, rather than that of one or a few individuals (Hess and Ostrom, 2007; Ostrom, 2009, 2010). In the case of a company, economic success depends on the ability of agents to cooperate for the common good, which sometimes means refraining from individually profitable actions, in order to work for the benefit of the group (Olson, 1965).

Hardin (1968) argues that when individual and collective interests are in conflict with

each other, the standard assumption is that rational agents are unlikely to cooperate. They are often trapped in an inevitable process that ends in the «tragedy of the commons»[5].

This thesis contradicts real-life observations. Numerous studies show that people can show solidarity, help each other, pay their taxes, don't cheat, and voluntarily contribute to voluntary actions (Ostrom, 2000). Researches are attempting to reduce the gap between the standard prediction of self-interested *homo œconomicus* and the real situation where cooperative behavior is common practice. Game theory shows that individuals are cooperative and voluntarily contribute to public goods (Ahn et al., 2009; Bohm, 1972; Falk et al., 2019a; Ledyard, 1995; Li et al., 2017). The paper of Bohm (1972) is considered to be the first field experiment to use the public good game. With a test carried out by the research department of the Swedish Broadcasting Corporation, on a random sample of 605 people, the author shows that individuals are willing to contribute to the public good even if it goes against their own self-interest. More recently, studies using social norms such as group membership suggest a contribution rate of around 50% of their initial endowments (Kandul and Lanz, 2021), thus confirming the results generally found in the literature on public-good games (Chaudhuri, 2011; Ledyard, 1995). Individuals may therefore have the will to overcome collective action problems.

Concretely, for the horticultural sector, we define collective action as the action of individuals[6] who seek to promote collective interests ahead of their own personal interests (Van Zomeren and Iyer, 2009).

[5]In his article, Hardin (1968) uses the example of communal land that shepherds share to graze their cows. While each new cow owned by a shepherd brings him a high return, it costs him very little, since the use of the land is free, shared, and accessible to all. So, it's in his interest to maximize the number of cows he owns. However, if all the shepherds maximize, the communal land will no longer be able to produce enough grass to feed even a single cow. This inevitably leads to everyone's ruin. This is the unavoidable tragedy of the commons.

[6]In this article, the individual is defined as a unit, which can be represented by a firm. The context of this study is the horticultural industry, with very small structures. Decisions are therefore taken by the manager alone, and the individual merges with the firm.

Beliefs and perceptions

In cooperative behavior, numerous experiments have shown that individuals contribute more to the public good than pure self-interest can explain (Bohm, 1972; Dawes and Thaler, 1988; Ledyard, 1995). Fischbacher and Gächter (2010) point out that, in addition to individuals' preferences for cooperation, they are also influenced by their beliefs, particularly their beliefs about the behavior of others. The authors show that 55% of cooperators cooperate if they believe that the other is cooperating too.

The effect of belief is more specifically isolated and explained in the context of the beauty contest game, which shows situations where individuals make decisions, but whose outcome depends on the actions chosen by others (Sutan and Willinger, 2009). The classic example is speculative markets. Phenomena that appear irrational could be due to the rational behavior of individuals who expect others to behave irrationally (Ho et al., 1998).

More generally, beliefs and perceptions go back to the research on conditional cooperation with Sugden (1984) who uses reciprocity to explain the voluntary provision of public goods. Individuals cooperate because they believe there will be reciprocity.

This conditional cooperation is based on individuals' beliefs and perceptions about the actions of others. Two phenomena in particular can influence it: the path dependency effect, driven by the role of the leader, and group favoritism.

Gächter and Renner (2018) explain that individuals' behavior depends both on the example set by the leader, but also on their beliefs about the actions of others. Leaders play a key role as they strongly shape the beliefs and initial contributions of their followers. Altruistic behavior, as in the case of charitable giving, is highly dependent on beliefs about how others behave. Leaders, such as executives or politicians serve as models for what is considered appropriate and can thus shape their followers' beliefs about the behavior of others. In their study, Gächter and Renner (2018) show that leaders who behave too

selfishly (avoiding taxes, consuming unjustified privileges, accepting bribes, etc...) can incite people to do the same and can nurture people's beliefs that others will do the same. In the same way, if the leader behaves as a positive role model, the opposite behaviors manifest themselves. Conversely, when beliefs are instituted, the path dependency effect appears, and followers give more weight to the past behavior of other followers than to the leader's current action. This effect is extremely strong. Once beliefs are established, they are very difficult to change.

Moreover, if group favoritism increases cooperation (Chen and Li, 2009), Ockenfels and Werner (2014) show that beliefs about the actions of others impact cooperation. The authors confirm the results of previous studies (Brewer and Gardner, 1996; Guala et al., 2013; Yamagishi and Kiyonari, 2000) on group favoritism and specify that this favoritism strongly depends on individuals' anticipation of each other's beliefs and perceptions of each other's actions. Individuals expect generalized reciprocity (Yamagishi and Mifune, 2008; Yamagishi and Kiyonari, 2000). If they perceive that it might not happen, cooperation is stopped.

The effects of beliefs and perceptions need to be considered in the cooperative behavior of players in the horticultural industry, in particular the cultural anchoring linked to the path dependency effect.

Horticultural sector

In 2021, the French horticulture, floristry and landscaping industry represents 52,000 specialized companies, 18,600 jobs and sales of 15 billion euros. It is characterized by a wide range of professions (nurserymen, horticulturists, wholesalers, florists and landscape gardeners, to name a few) and a substantial number of products (around 100,000 items on sale) (FranceAgriMer, 2022a). The industry is fragmented and complex. Horticultural

products are highly technical and capital-intensive[7]. As a result, horticultural production crosses the boundary between agriculture and industry. France has a very good «production tool» compared to its European competitors. However, it lags behind mainly in terms of R and D and production capacity (FranceAgriMer, 2020). Overall, France's competitiveness is not performing as well as that of its main European competitors. The causes are twofold. The industry is essentially focused on the domestic market. As one of the European Union countries with a large market and high per capita consumption, it faces competition on its domestic market. The balance of trade is therefore structurally in deficit, reaching -1.075 billion euros in 2021, with imports amounting to 1.158 billion euros (FranceAgriMer, 2023).

One of the decisive factors in France's competitiveness is the organization of the industry, i.e., the focus on cooperation between players and professional organizations. However, there is an imbalance of power between the different players in the value chain. The first example is explained by the plant product itself. The finished product for sale is simple since the plant is provided at best by simple sales packaging. Potted plants are sold in a plastic or terracotta container and a growing medium such as peat, bark, or potting soil. To be able to supply the product for sale, the firms that produce them must be interdependent, since it cannot be offered for sale without a pot or substrate. Horticultural producers are therefore dependent on pot and substrate firms. However, these firms are multinationals, with a varied, international customer base, compared with the more fragmented horticultural production sector, made up of smaller companies. The latter therefore has little market power over the former two (Widehem et al., 2006).

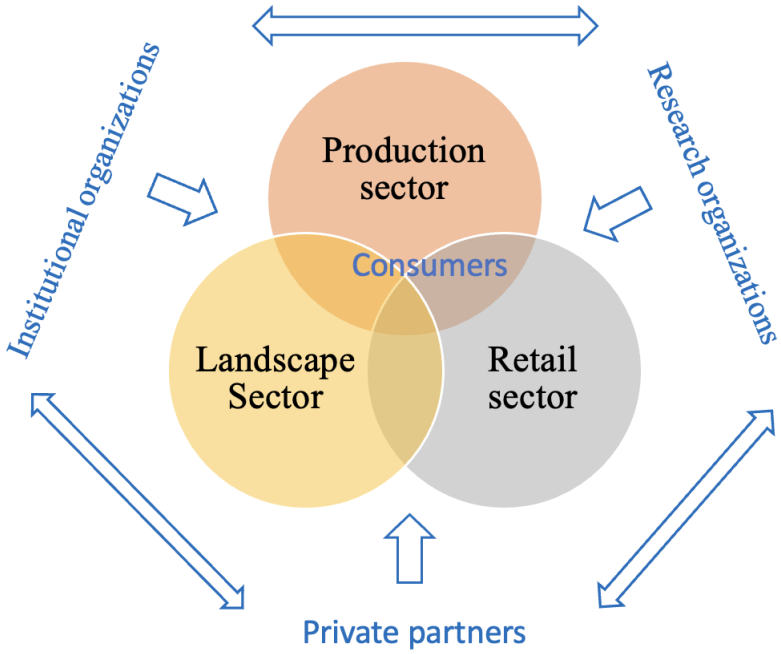
This asymmetry of bargaining power can also be observed in the value chain between distribution and production. The distribution sector is extremely concentrated[8]. With

[7]For example, one hectare of greenhouses requires an investment of around 1 million euros. (Source based on interviews).

[8]Garden centers represent 1,610 of the 16,672 companies in the retail sector, but account for 3.12 billion

the development of central purchasing groups, florists and garden centers are leveraging their market power over growers. Power relations between the various players are asymmetrical (Herzberg et al., 2022; Sexton, 2013), with well-known issues such as margins and back margins (Kopp and Sexton, 2021). However, for all firms to survive, producers or landscapers must be allowed to capture a share of the value chain. Horizontal cooperation[9] can then be a decisive factor in achieving better economic performance (Biely et al., 2022; Biró et al., 2016; Graubner et al., 2011; Yuan et al., 2019).

Figure 0.1: Links in the value chain



Better cooperation between industry stakeholders can make collective action possible. The first example is the action taken by the interbranch during the Covid-19 crisis. The stakeholders in the sector gathered themselves behind the interbranch to define a common

euros in sales, or 41.6% of total sales. The InVivo Retail group alone has 1,700 outlets, with the Gamm vert, Jardiland and Delbard brands, and the jardineries du terroir, and accounts for 50% of specialist distribution sales. The total number of players is therefore only 5 (Botanic, Truffaut, Jardin et Saisons, Espace Émeraude), giving them market power.

[9]In this paper, we define horizontal cooperation as the pooling of resources and activities between firms in the same sector (producers and producers, distributors and distributors, landscapers, and landscapers), and vertical cooperation as the pooling of resources and activities between firms in different sectors. For example, we consider horizontal cooperation to be the grouping together of producers in the form of GIEs (Groupement d'Intérêt Économique) or agricultural cooperatives for marketing purposes.

objective. This action enabled horticultural products to be recognized as essential commodities, making it possible for stores to reopen and enabling companies in the sector to overcome the crisis. In a second example, cooperation between growers in the Anjou region led to the creation of a new logistics organization, the Végésupply platform, bringing together four horticulturalists and nurserymen[10]. The purpose is to reduce transport costs through actions designed to fill trucks more fully, cope with seasonal peaks, and improve the management of goods flows between greenhouses and garden centers. The first example is a one-time response to the Covid-19 crisis. In the case of Végésupply, a member withdrew following the liquidation of his company. There was no replacement. However, Végésupply has not increased the number of member producers since its creation, since no other producer has joined the group.

As these examples show it, many new cooperation initiatives are being launched in the sector and they are numerous. However, they are often one-time initiatives, struggling to develop or even running out of steam and disappearing. While studies do exist on the characteristics and specific features of horticulture (Justin et al., 2009; Kapusta et al., 2015; Leroux et al., 2014), to the best of our knowledge, there has been no in-depth investigation of the beliefs and perceptions of stakeholders in their day-to-day realities. This study aims to fill this gap. To do so, we focus on phenomena in real, uncontrolled situations.

Research context and methodology

Exploratory methodology using an empirical-inductive approach

Cooperation is one of the key factors in a company's competitiveness (Balliet and Van Lange, 2013; Biró et al., 2016; Robotka, 1947). It is a function of company performance, which

[10]Namely: Fleuron d'Anjou, JCT Plants, Gaignard Fleurs and Pépinières Charles Detriché.

in turn is a function of motivation, investment, and perceived obstacles.

To understand how industry professionals see collective action and cooperation (Williams and Nadin, 2012), as well as their links with their company's competitiveness, we are mobilizing an exploratory research methodology, based on an inductive approach (Thomas, 2006), and mobilizing the technique of unstructured and semi-structured interviews. To identify the micro-foundations of cooperation, our approach is qualitative in nature. To paraphrase Kvale (1996), it is an «attempt to understand the world from the subject's point of view, to unfold the meaning of peoples' experiences, to uncover their lived world before scientific explanations». The aim is to capture the participant's subjective point of view, communicated in their own words and described in a very specific detail to a researcher, who must put aside what they think and know about the experience described (Roberts, 2020). The free and semi-structured, non-directive interviews bring to light new dimensions not yet explored, a new angle (Blais and Martineau, 2006). The aim is to obtain in-depth, non-standardized information (Adhabi and Anozie, 2017; Baxter and Eyles, 1999; Guion et al., 2011), i.e. their representation of cooperation and collective action, as well as their motivations, expectations and obstacles encountered in the field.

In the same way, data analysis mobilizes the general inductive approach proposed by Thomas (2006) in three phases: reducing the data (Blais and Martineau, 2006), to identify categories (Paillé and Mucchielli, 2016), and producing new knowledge. The analysis grid is constructed «by hand», using Excel to code the data (Blais and Martineau, 2006; Teerikangas, 2012). All interviews were transcribed onto Word. Unlike Teerikangas (2012), who continued the coding process with Word to highlight emerging themes, we used Excel to identify segments, which enabled us to define the first categories, then the emerging categories with sub-categories (Thomas, 2006). 65 interviews with 50 professionals and 2 meetings with 43 professionals (for a total of 83 people) were conducted to

carry out the coding (Table 1). Interviews lasted between 45 and 90 minutes, depending on the interviewee, and were mostly transcribed via Teams, with double-checking via Word dictation/transcription.

Table 0.1: Coding process adapted from the approach proposed by Thomas (2006)

Text data	Text segments	Segment labels	Categories	Category model
	⟶		⟶	
185 pages	562 segments	179 labels	12 categories	4 main features

Description of interviews and meetings

We have selected producers, retailers, landscapers, and institutional and private partners in the horticultural sector.

Table 0.2: Description of interviews and meetings

Sector	**Total number interviews N=65**	**Type of interview**		**2 Meetings N=43**
		Unstructured N= 44	**Semi-structured N= 21**	
Producer	34	19	15	40
Distributor	1	1	0	1
Landscape	5	1	4	0
Private partner	10	10	0	0
Institutional organization	15	13	2	2

In addition to the main actors of the industry, we also felt it relevant to interview stakeholders who contribute directly or indirectly to the value chain. To obtain this broad panel, we interviewed private partners such as banking organizations (4 people), logistics (1 person), strategy consulting firms (2 people), as well as institutional bodies (8 people) such as research laboratories, trade unions and the Vegepolys Valley competitiveness cluster.

For recruitment purposes, a list of companies was compiled from exhibitors at trade shows such as the international SIVAL[11], Salon du Végétal[12] and Paysalia[13], BHR members and companies with the «Fleurs de France» and «Plante Bleue» labels. This list

[11]SIVAL receives 700 exhibitors and 26,000 visitors.
[12]The Salon du Végétal receives 260 exhibitors and 8,000 visitors, 2022 figure.
[13]Paysalia receives 1481 exponents and 28 889 visitors, 2021 figure.

includes 940 companies from the production, marketing, and landscape sectors. Institutional and private partners were approached according to their job title on the social network recommendations.

Table 0.3: General characteristics of participants

	Type of interview		**2 Meetings**	**2 Meetings**
	Unstructured	**Semi-structured**	**N= 42**	**N= 43**
	N= 29	**N= 21**		
Position				
Managers	16	18	37	40
Employees	9	2	4	1
Other	4	1	1	0
Gender: Male	23	18	32	0
Ages: 45 <	23	11	32	2

This diversity of participants provides a representative picture of the industry as a whole. 29 professionals responded in the first phase of open interviews and recommended us to their peers, facilitating positive responses to our interview requests. The final sample comprises 82 people, 10 women and 72 men. The average age was 50, with a standard deviation of 11.12. Of the 60 non-organization participants, 16 are under 45 and can be considered «young entrepreneurs», and 44 have more experience. All work in professions representative of the industry. Except for the professionals from institutional organizations, almost all of them hold managerial positions, enabling them to make strategic decisions (Appendix A). For qualitative studies, the heterogeneity of the sample and/or of the data (some crucial data were obtained from only one subject (Dukes, 1965)) validate its size (Baxter and Eyles, 1997). Our sample of 82 participants is significant, but we recognize the representative bias since participants self-identified as volunteers.

Data collection techniques

Prior to data collection, a series of themes was developed to guide the research. The interview guides (see Appendix A) were designed in the form of a questionnaire, 6 themes for cooperation and 8 themes for collective action. The meetings were presented as a time for discussing, exchanging and sharing on the themes of «competitiveness» and «how to work together». The questions were asked in an open-ended way, so that each participant was free to answer and put their own words to these different concepts. In the course of the interviews, the respondents went into greater depth on the key themes, initiating discussion and validating the relevance of the research question.

The interviews were conducted over a period of more than a year and a half from December 2021, by video-conference, and lasted in average, 90 minutes. Meetings lasted 90 minutes each. Most interviews were recorded and transcribed (60 out of 65 interviews, or 92%).

As this is an exploratory study, the general interview framework is the same, regardless of the participant's position in the value chain. The interviews were conducted in two phases, with the first 44 interviews conducted in a free-form format, and the remaining 21 interviews conducted in a more focused manner.

For all the interviews, we asked them to talk about the industry in general, and how they perceived the different behaviors of the players involved. We then asked them about their daily lives, encouraging them to describe the relationships they have with their partners, and implicitly, whether they have set up collective actions or not. For the unstructured interviews, themes were addressed in a general way, such as the horticultural situation, the idea of individual and/or group strategy, moments of cooperation and/or non-cooperation, situations encouraging cooperation and situations of non-cooperation, such as innovation, and finally, their relationships with the various players in the horti-

cultural sector. For the semi-structured interviews, the themes were discussed in greater detail: actions in the field, project experiences, benefits, drawbacks, types of obstacles, hindrances, reasons for the success or failure of joint projects, and project ideas for working together.

These interviews enabled us to transcribe 185 pages, identifying 562 text segments, 179 labels for 12 categories and 4 main models (Appendix A).

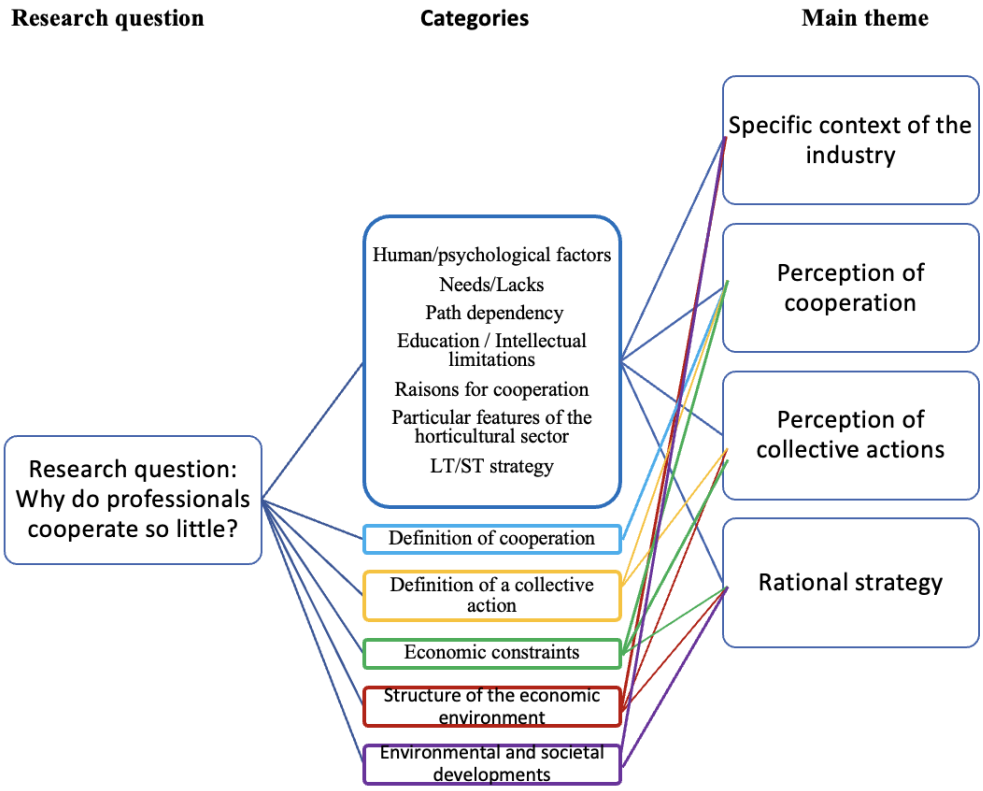
Results: interview analysis

The categorization of the segments shows a tangled web of explanatory factors, confirming the complexity of the situation (Table 4). The same sub-categories appear several times in the 4 main themes which explain the cooperation and collective actions of the industry's players. The explanatory factors are linked. For example, education explains the context of the industry (the industry's lack of appeal makes it difficult to recruit young people), but also the perception of cooperation, collective action, and rational strategies (intellectual limitations inhibit players from projecting long-term strategies and anticipating the future). Of the 12 categories, 7 are shared with the 4 thematic general. Professionals expressed their needs and the lack of the industry (need and lack of information, external contacts, exchange, pooling, etc....), path dependency, education in the sector, human and psychological obstacles, the various reasons for cooperation and non-cooperation, the particularities of the horticultural sector and, finally, strategic behavior in these situations to explain the context of the sector, their perception of cooperation and collective action, and the strategies employed.

Generally speaking, the mention of cooperation and collective action is closer to the psychological and human responses (174 out of 562, or 31% of tags). The following categories, such as path dependency, needs and lack, or factors relating to the particularity

of the horticultural sector only appear on between 10% and 13% of labels (Table 5).

Figure 0.2: Plural Concepts



Note:Each category can contribute to several main themes. Contributing links are indicated by the color of the category. For example, the «economic constraints» category in green contributes to three main themes: «perception of cooperation», «perception of collective action» and «rational strategy».

Table 0.4: Label frequency analysis

Categories	Total
Human/psychological factors	174
Path dependency	76
Needs/Lacks	65
Particular features of the horticultural sector	59
Reasons for cooperation	51
Education / Intellectual limitations	44
Structure of the economic environment	33
LT/ST strategy	30
Economic constraints	10
Definition of a collective action	9
Environmental and societal developments	8
Definition of cooperation	3
Total	**562**

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
Specific context of the industry	**Needs/Lacks**	«And then there's a lack of information, in any case, to reach us. From the outset, these organizations should have been able to guide us through the more technical aspects of plants.» (a landscaper)
	Path dependency	«It's a lot of the old families, in fact, who run the nurseries. So, you see, old conflicts. Things don't move.» (a producer)
	Education / Intellectual limitations	«There's a lack of awareness in France of what we're capable of doing. There isn't a single French player who thinks that we can also sell for export. Today, we're all thinking about downsizing, even though the market is worth 2 billion in sales and we're importing at 50%.» (a producer)
	Environmental and societal developments	«They think they don't need it to evolve. But I think it's essential in today's society. I think we need to move forward, to get up to speed. All the paperwork, the one-off documents, the stuff... We're not up to speed at all. I mean, if we don't have anyone to guide us on this kind of thing, we risk running into problems because we're not aware of the laws, we're not aware of anything.» (a producer)
	Human/psychological factors	«Today, our buyers and customers always have the feeling that they can find something better elsewhere than in France.» (a producer)
	Reasons for cooperation	«And in fact, it's the difficulties to which we're subject that are going to make us regroup, but not necessarily in anticipation. We're clearly behind on irrigation, on disease, on everything. In fact, we've got our noses to the grindstone, and when we really get our heads under water, we make a decision. Instead of saying, I've got 5 years to put this in place...and I'll do it in 2 years, I'll do it in 3 years... In fact, we always do it when we have no choice.» (a producer)

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
	Particular features of the horticultural sector	«Farming circles are silent, self-sufficient circles. One of the strengths of the peasantry is its autonomy. The dynamic of identity is very strong in the agricultural world.» (a private partner)
	Structure of the economic environment	«Who informs and who distributes? We don't know who reads them etc.? Too much information... we're drowning in information, and we don't read it anymore.» (a producer)
		«The producers of pottery, packaging etc... do whatever they want. They increase prices by 20 to 30%. We have to try to get together.» (a producer)
		«There are a lot of small structures with very little credit outstanding (€125,000).» (a private partner)
Perception of cooperation	**Needs/Lacks**	«How do you make room for the landscape designer in the decision? At this stage, it's not at all easy to get someone to call on us for a choice of landscaping. Politicians and technicians don't necessarily have the reflex to call on a landscape designer.» (a landscaper)
		«They're members of the horticultural circle precisely to share experiments, share experiences, get out of isolation because they suffer from a big word called isolation.» (a producer)
	Economic constraints	«If there's an incentive to cooperate, it's only financial.» (a private partner)
		«It's all a question of whether or not companies see the value in it. What counts is the sales it will generate.» (Distribution)
	Definition of cooperation	«As long as you have a common project, you're ready to contribute something to it, whether in financial or intellectual terms, and you're capable of working with a certain degree of transparency. Collective action is only beneficial if everyone has something to gain. Avoid the unspoken. Transparency.» (a producer)
		«Cooperation on a need we have, a relationship we need to have with administrations to advance concerns that are different between what we have in mind, and what the administration has in mind.» (a producer)

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
	Path dependency	«We don't know each other very well. Horticulturalists don't visit each other. There's a diversity of production, the work of horticulturists is very technical, with diverse and varied skills, and maybe we're self-sufficient. The horticulturist's mentality is special.» (a producer)
	Education / Intellectual limitations	«What about the competition? Next year will tell us, but I think the overall reflection is more of a producers' reflection and we don't have enough of a reflection.» (a producer)
	Human/psychological factors	«So, I don't think everyone has the same mentality in this business. But frankly, of all the people I know, I like you, I'm a good friend, but on the other hand, Bah, I don't tell you everything.» (a producer)
		«Every time I've tried, we've hit a wall. And it costs. It's expensive in the end after all. You lose a bit of your identity, you end up with failures.» (a producer)
	Reasons for cooperation	«What brought us together in the beginning was economic necessity.» (a producer)
		«Whatever the sector, players are looking to group together to benefit from advantageous taxation.» (a producer)
	Particular features of the horticultural sector	«There's also a generational issue. Generations that were family and rather very agricultural, with very closed notions.» (a producer)
	LT/ST strategy	«Cooperation is necessary because you need peripheral vision.» (a producer)
Perception of collective actions	**Needs/Lacks**	«The basic idea is that nurserymen pool their resources (this goes back 50 years). Each company had to make a total contribution. There was no boom because each company had its own sales force. » (Distribution)
	Economic constraints	«For a company, I'm there to make money. So, I'm willing to get involved if I can get a return on my investment.» (a producer)
	Definition of a collective action	«It's the opposite of individual action. In our field, companies have a name, a history, we make an addition of individuals but not a homogeneous body.» (a producer)

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
		«It's a common discourse, a common force. A steamroller for advancing towards a common goal. A common support to move forward. Without common action, our industry and our profession risk dying. We're going to suffer even more than we already are. We're too alone. Collective action has only one goal: success. Collective action that has to die is useless.» (a producer)
		«Collective action means taking part in making something happen.» (a producer)
		«For me, there's no business in collective action. It's only unionism, in other words, collective thinking, like obtaining watering exemptions during the drought. I can't think of anything else. Collective action means obtaining measures from public authorities to make our task easier rather than more complicated.» (a producer)
		«I was born into the company. It's a family business. So, I'm the 10th generation.
	Path dependency	But that's not why I want to be the biggest nurseryman in France or Navarre or whatever. Anyway, I live very well as I am, and that's enough for me.» (a producer)
	Education / Intellectual limitations	«The people presenting the project weren't able to convince or weren't audible enough, having an audience that was either imbued with the approach or not.» (Distribution)
		«Meetings are difficult to set up. We have people with know-how but not necessarily vision.» (a producer)
		«Whereas in the horticultural sector. You have structures that are committed, but they're only half committed, and then they say well no. So, commitment is never total and complete, and the collective structure suffers from this weakness.» (a producer)
	Human/psychological factors	
	Particular features of the horticultural sector	«And then she referred me to the DT, to what's-his-name, to all sorts of things.» (a producer)
		«There's been a change, an evolution. The previous generation devoted their lives to the company, while Generation Z did not. As far as managers are concerned, the company must serve the manager's life. The trade-off is family life». (a private partner)

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
	LT/ST strategy	«There's a market that's evolving. The bottom line is that horticultural producers see themselves as competitors.» (a producer)
Rational strategy	**Needs/Lacks**	«We've got to stand our ground, and I don't think we should be afraid of liar's poker because I think it's going to, it's going to go to the loss of our businesses.» (a producer)
	Path dependency	«When they've experienced difficulties, to bring in money and not pay them. Managers look for solutions on their own. Companies are run in a very individualistic family way. For many years, there was no cooperation, with people who never worked together. On the whole, family stories have prevailed for too long.» (a private partner)
	Education / Intellectual limitations	«There's no synergy, no awareness of the issues. There's no identification of subjects. Horticulturists would gain in quality of analysis if they gained in height.» (a producer)
	Environmental and societal developments	«What takes time is explaining to everyone before it's understood. It takes a long time to act, because of the heterogeneity of the players involved. Information takes a long time.» (a producer)
	Human/psychological factors	«I think it's going to evolve because mentalities are changing. It used to be that the old-timers didn't want to reveal any of their secrets. I still have some in the group. You always have to keep secrets and secrecy, secrets that serve no purpose whatsoever. At some point, you have to communicate.» (a producer)
	Reasons for cooperation	«But joining a cooperative also means losing your business. In a cooperative, there's a value of solidarity. There may also be independent producers who don't necessarily want to lose their freedom, and therefore refuse to join the cooperative.» (a private partner)
	Particular features of the horticultural sector	«Complementary.» (a producer) «There's also an industry size effect.» (a private partner)

Table 0.5: Themes and categories analyzed (translated from French).

Theme	Categories	Example
		«There's a real generation shock. Why do they come to meetings? Because for some things, they can't do it alone. Federating internally and differentiating externally. They're members of a collective that federates them, but they're competitors in the field.» (a private partner)
	LT/ST strategy	«There are some who are very resistant to the idea of cooperation because they want to keep their way of producing, keep everything to themselves, hoping to crush others a little. There are people like that. That's not how I see things. And I don't think that if you say to yourself: Oh no, I'm not going to cooperate... Yes, I'm going to stay like this. And at the same time, I'm going to pocket some money.» (a producer)

General perception of the industry

Generally speaking, the industry is characterized by its own specific features. They describe it as «fragmented», «complex», «with many players and organizations», which according to their feelings, creates a sense of confusion, firstly in the allocation of roles, and secondly in the links between the various players in the sector. They feel that there are too many institutional organizations: «there are too many organizations» and «the organizations are too different», and they find it hard to know who does what. Needs and lacks are contradictory. They say they receive information, only it is too much, and therefore «don't read» it, while at the same time looking for information because they «need it to evolve». The relationship with professional organizations is ambiguous. The organizations have a role to play in providing help and support, but not knowing whom to turn to, they end up «fending for themselves». This raises the issue of the meaning given to organizations: Who are they? What do they want to do? What and who are they for? Professionals perceive the organizations as state-mandated players. According to them, they are «on the sidelines» of the industry, so they don't really know it. They are described as experts, technicians who are specialists in their fields, but who have neither an overall vision, nor the capacity to take account of real-life situations in the field. So, there is a lack of interest in the organizations. Professionals say that the organizations seek to forge as many links as possible, but only to justify their *raison d'être*, i.e., to respond as much as possible to bids from the Ministry. They are not there for the producers.

Professionals therefore struggle to find external help and information does not reach them. They feel that the large number of organizations involved requires a great deal of energy, both to find the information they need, and to ensure that the collective work is really effective. The subjects to be dealt with are scattered all over the place, so there are no results. They join organizations with skepticism, and don't participate. They

say they are not very active and prefer to wait to see if others contribute. Isolation is not broken and the effect of path dependency on beliefs evolve with difficulty, confirming the literature (Gächter and Renner, 2018) «Maybe we're self-sufficient». Finally, while everyone expects others to contribute, in the end, no one does. We recognize here elements inherent to the diffusion of the responsibilities of Darley and Latane (1968).

The horticultural community is defined by professionals as a «hushed» environment, where everyone works «in their own backyard». Attached to a strong «peasant culture», the companies have a history, but as a result, the sector is seen as a composition of «an addition of individuals and not a homogeneous group». Today, they explain that they want to cooperate in order to «stand strong», faced with difficult environmental contexts, such as complex regulatory developments and negotiations in which power is asymmetrical (e.g., with pottery or packaging producers).

At the same time, the professionals say that they indeed observe a mutation in the industry, with the arrival of «young entrepreneurs» who are «shaking up mentalities». They note an inter-generational gap in strategies, practices, relationships and day-to-day behavior. Professionals use the term «young people» to refer to young entrepreneurs under 45 who take over the family farm or setting up their own business[14], and «the ancients» to refer to other farmers.

However, an analysis of label frequencies (Appendix A) does not reveal any differences in perception. Both groups tend to mobilize the same concepts in the different themes addressed. Regardless of which group they belong to (<46 or >45), professionals report the same difficulties and the same descriptions of the context in which they perform their jobs. For example, they explain that the obstacles to cooperation are human, not technical («it's a human thing»). Different generations believe the same thing.

[14]In this study, all the «young» farmers interviewed are taking over the family farm.

There's also a logic of circles and social embedding. Horticultural sector is described as still attached to a history, agricultural at first, but above all shaped by a few families (Gaignard, 2016; Pavie, 2013). Professionals (both in production and landscape) recognize that they don't work together. According to them, this culture of «non-cooperation» stems from cultural roots. Relationships are formed within the family circle and become professional. The history of horticulture is carried by a dozen or so families, the «old» families in the regions, who see it as their *pre-carré*. People who have never worked together have not acquired the habit or reflex of turning to others. This circle logic, observed in the Anjou horticultural cluster, is explained by a resilient architecture within which friendly, professional and family relationships merge and intertwine (Leroux et al., 2014). The family anchorage is therefore very present. The majority of «young entrepreneurs» declare that they are taking over the business created by their parents, grandparents or great-great-...-grandparents. For some, they represent the tenth generation. Family roots are still very much present. These statements corroborate the literature. Amisse et al. (2013) mention the social embeddedness of individuals in Anjou and speak of an inheritance that is passed down from generation to generation, and which relies on the horticultural rent. Leroux et al. (2014) explain that the rules governing this horticultural organization are co-produced by key players, who are charismatic leading horticulturists belonging to very old horticultural family lines.

Lastly, professionals mention the decline of the industry, citing the decline in horticultural businesses, problems with business transfers and problems of skills acquired, to be acquired, or to be brought in («We don't have any young people anymore. In Tuscany, being a nurseryman is an institution. In France, it's a dead end»). Professionals feel that they are misunderstood and that they are facing «agri-bashing». They mention the need to communicate to raise the profile of the industry. This need is only correct within the industry itself. They recognize that the lack of communication does not create trust, and

can even lead to mistrust: «Today, we don't communicate with each other. We're more competitors than colleagues» (29 mentions). This perception of the other prevents them from initiating collaboration naturally: «You work in your backyard. Everyone's happy. We don't steal each other's customers. There's a big lack of communication between us».

Nevertheless, they are well aware of the need to work together. Cooperation is a key element in the survival and competitiveness of VSEs: «Without joint action, our industry and our profession is bound to die. We're going to suffer even more than we already are. We're too much on our own.»

Cooperation

For professionals, cooperation is first and foremost a means of «standing strong» in an increasingly regulated and competitive economic environment. In the ranking of labels (Appendix A), the «need for strength» comes third out of 22 labels, just behind «individual culture» and the «culture of independence» of the sector. This change in mentality and willingness to provoke cooperation is evolving with the renewal of businesses by young managers, most of whom are trained in higher education (i.e., Institut Agro Rennes-Angers, École Supérieure des Agricultures), or who come from another sector. The «young managers» explain that they have «other ideas», and unlike their predecessors, who «were really very closed-minded», they want to cooperate in order to «make weight», not to passively endure, and to make the sector visible and stronger («to limit the decline of the sector, because we are in a declining sector»).

Furthermore, professionals represent cooperation as a «pooling» of financial and human resources. Because the degree of maturity of cooperation varies from one individual to another, professionals express two different types of cooperation: institutionalized or informal. They speak of institutionalized cooperation through actions initiated and directed by a third-party organization (Leroux et al., 2014), such as a trade union, the

interbranch or a private partner, which acts as a trusted third party. Without this intervention, cooperation is neither conceivable nor possible: «cooperation is possible through neutral third parties rather than between peers». In this case, the subjects are technical, such as sharing technical know-how (cultivation, watering, etc.). Cooperation is initiated by third parties such as ASTREDHOR. When initiated by individuals, cooperation is primarily economic in nature. It is conditioned by economic and financial interest and an expectation of reciprocity (Table 6). It must not be coercive and must come from individuals who naturally want to work together: «my global vision of cooperation and humanity, I tell myself that in fact, if we do things together, we go further together». They refer to concrete actions. Cooperation means developing joint actions.

Cooperation is not conceptualized as a long-term strategy, since the motives that define it are of a material nature («economic necessity», «financial interest», «if everyone has something to gain»), and psychological obstacles («the unspoken», «transparency», «knowing the other well», «avoiding casting errors»), with the fear that past failures will be repeated («every time I've tried, we go to the wall»).

Collective action

As a result, collective actions must first and foremost respond to an economic constraint. Professionals point out that «they're in it to make money». They see collective action as a response to an individual strategy («I'm willing to take the plunge if there's a return on my investment»).

They express a desire to group together only when faced with specific problems and/or difficulties. They explain that, today, they are reactive rather than proactive: «We always do it when we have no choice.»

But faced with a changing, demanding and complex economic and societal environ-

ment, professionals point to the need to build collective actions on a long-term strategic plan rather than short-term visions: «without joint action, our industry, our profession, risks dying».

They define collective action as «having only one goal, which is success». As the industry changes, the perception of collective action is both long-term («collective action can't be something ephemeral»), and short-term, i.e., projects, one-off achievements, on specific subjects, and therefore, an expectation of rapid return on investment: «if everyone is pulling in the same direction, we can see that the project can move forward. The notion of the collective remains very much on the surface, and psychological obstacles are not far away: «meetings are difficult to set up», «commitment is never total and complete, and as a result, the collective structure suffers from this weakness».

Collective actions are therefore likened to projects, with a start date and perhaps an end date, depending on the interest that companies may find in the collective. This process corresponds to a mode of coordination and collaboration rather than cooperation in the sense of Alós-Ferrer and Garagnani (2020). By blending cooperative and competitive relationships, it conditions members' collective ability to create and appropriate new resources (Amisse et al., 2013).

Obstacles and levers

Cooperation and collective action do exist in the industry. Professionals cooperate, but it's not natural. They mention the cultural barrier. The key words that stand out are culture of independence, absence of a culture of cooperation, absence of a group culture, absence of a culture of cooperation. One participant even evoked a Latin culture: «we have a Latin culture, it's a single man who carries out a project». The obstacles appear to be at least psychological in nature. Of the 50 people interviewed, 38 said they were primarily human. One professional explained that decisions are taken based on «feelings»,

«fear of losing one's identity», «mistrust». Cooperation is not stabilized by both strategic myopia («energy costs are 0, but mutualization hasn't worked. I can't explain it») and path dependency («working alone in your own backyard», «resentment», «family stories»).

But faced with an uncertain and complex economic environment, cooperation should be initiated, and yet it doesn't emerge: «it should be easy, and it isn't». One explanatory factor is the absorption capacity of the sector's VSEs. Most companies are very small. The participants mention: a scattering of topics, problems assessing the degree of urgency, a lack of maturity («producers are not ready to cooperate»). The absence of a «philosophy of cooperation» was explained by education («If you scratch the surface, you'll see that it's a question of education»). Some even refer to a limit to intellectual capacity, resulting in a lack of hindsight, a lack of vision, a lack of strategy. Strategic myopia explains why the notion of cooperation eludes them.

Awareness of the economic stakes and of cooperation as a response to competitiveness is well established and has been reinforced by the Covid-19 crisis, which has given new relevance to cooperation. Consequently, there are two sides to the story, from producers and landscapers alike. Although they are all aware of the need to cooperate, the human barrier remains very much present in their beliefs and perceptions of cooperation and collective action. «Colleagues» are portrayed as «competitors», and their attitude is hostile: «We're not cooperating, we're acting like sharks». Above all, they are company managers. Cooperation is not a question of company size but is perceived solely as a matter of economic interest: «for reasons of economic viability». The aim must be to generate sales: «Above all, what we're looking for is sales, the survival of the company, in an uncertain context.»

There is a real consensus that the obstacles to cooperation are above all human factors. The degree varies according to past experience, ranging from «I've been put off» to

«today, I don't think it's possible for me personally to pursue cooperative ventures with colleagues». For some, cooperation has «already shown all its limits», since thinking about cooperation is not «recent story». Professionals explain that cooperation is indeed necessary, but it can be achieved without it, because «it's costly in the end after all. You lose a bit of your identity, you end up with failures, you're forced out of a market when you were trying to get in». The risk is far too great for the expected return.

The economic approach has suppressed the «common peasant sense». However, despite everything, the world of plants is a world of passionate people, with values and convictions. Whatever the focus of the interview, participants always come back to the human factor, and the duality between «being part of the team» and the «economic approach». Professionals from institutional and private organizations give concrete examples of contradictory behavior. For example, all horticulturists know that you should not plant geraniums or tomatoes before the hard frosts of March. Today, geranium and tomato plants can be found on sale before heavy frosts («it's an aberration»). Conversely, Botanic chain was the first chain to stop selling crop protection products before anyone else. They also stopped putting flyers in letterboxes back in 2004, at a time when retailers were still communicating by means of flyers. By being pioneers, they have paid dearly for their values and convictions. They set themselves a course of action that they stuck to. These examples show that professionals don't always maximize. Some economic choices are also made in favor of the collective.

Conclusion

If there are obstacles to cooperation, they are not insurmountable. The interviews did not reveal any factors specific to industrial, technological or agronomic characteristics. They are above all human, based on social preferences such as altruism, egoism, and reciprocity

or on individuals' beliefs about the behavior of other members, such as the expectation or anticipation of the other's contribution.

Collective actions exist in the sector, such as the recycling of used professional horticultural pots (VALHOR, 2023), but remain limited. In our view, removing the psychological obstacles to collective action would help to stabilize them or make them more sustainable.

Limits

The interviews were conducted using a unstructured and semi-structured methodology. The participants were given very little guidance during the interviews, allowing us to capture the participant's subjective point of view, communicated in they own words. This study is original, firstly because of the scarcity of studies in horticulture involving people working in the field, and secondly because we are using an exploratory methodology to gather new data. One limitation remains the number of interviews, 83 in all, but which did not allow us to cover the whole of France. We had no participants from the Bretagne, Grand Est and Provence-Alpes-Côte d'Azur regions. Future research with wider coverage could be envisaged to ensure the robustness of the results.

Despite the great care taken to ensure that this panel is representative of the industry, the large number of different occupations meant that this study could not cover all the different situations, such as florists, wholesalers, or independent garden centers. However, the number of interviews is valid for a qualitative study, since sample size is not an essential criterion (Dukes, 1965), although we recognize a representative bias since the interviewees volunteered and were not specifically selected by us.

Perspectives

The results of the interviews highlight behavioral constraints and can therefore be measured using a well-defined experimental protocol. In none of the 65 interviews were factors

specific to industrial, technological or agronomic characteristics mentioned. This is surprising in the horticultural sector, given the real-life examples. For example, in the case of the creation of a logistics platform, it would be advisable to have farms that are not too far from the location of the platform, which presupposes farms that are close to each other. However, in regions such as Auvergne Rhône Alpes, they are very far apart, which is less the case in Pays de la Loire. However, this argument was not mentioned.

As far as concrete examples of collaboration are concerned, the participants mention a very limited number of examples. Most mentioned the problem of logistics and/or pot recycling. On the other hand, they all agree on the need to join forces, to form a «block», to be a force for proposal and opposition. Cooperation is the result of a constraint. It's about reaction, not anticipation. They react by anticipating what the other is going to do or what the other has done, which explains the «urgent» nature of cooperation. They cooperate faced with crises and obstacles. The collective has an interest because there is first and foremost an individual interest. There's a need to cooperate because they're going through the same difficulties: «we're all panicking, but we're all working in our own backyard». We can assume a preference for the present and an aversion to risks («fear or blockage of projecting oneself with the other partner»).

The barriers are clearly social preferences (altruism, egoism, reciprocity) and people's beliefs about the behavior of other members, such as the expectation or anticipation of the other's contribution. Professionals are willing to cooperate at first, but perhaps in the end there's a tendency to free ride. The customer-supplier relationship is behavioral. The strategy game framework can be used to explain how individuals behave in the face of social preferences. Mobilizing games such as the prisoner's dilemma and the public good game reveals social preferences like altruism, trust, inequality aversion or reciprocity, or individuals' beliefs about other members' behavior like punishment or reputation.

Finally, experimental economics has evolved in recent years. Cumulative empirical and theoretical advances are important in establishing causal relationships between key variables, while field surveys enable researchers to observe how experimentally controlled changes in key variables affect individual behavior in a natural social environment (Gneezy and Imas, 2017; Harrison and List, 2004; List, 2008; Viceisza, 2016).

Field experiments would therefore help to test the presumed hypotheses. The barriers and levers identified in this study are of a psychological nature, since they clearly relate to social preferences (altruism, egoism, reciprocity) and individuals' beliefs about the behavior of other members, such as the expectation or anticipation of the other's contribution.

Interviews show that professionals cooperate, but «commitment is not total». Analysis of label frequencies (Table 5) reveals factors such as path dependency (which explains strategic myopia), awareness of a need and a lack (of different kinds in the present ranking, such as need/lack of information, hindsight, understanding, risk-taking etc.). Cooperation is correlated with a level of education that helps neutralize strategic myopia and visualize a profitable long-term strategy. The interviews also specified that this needs to exchange, to break out of isolation and to cooperate corresponds to a problem of company size («When they're too small, it's a notion that escapes you, and when they're too big, they don't need it anymore»). The first hypothesis is that cooperation increases with education and confidence in collective action but decreases with company size.

From this perspective, the question we need to ask is: what is the profile of cooperating individuals? The transcripts show the existence of psychological barriers such as fear of the other, fear of the hold-up phenomenon, strategic myopia, cognitive dissonance, and failure dynamics. The interviews also reveal group behavior based on a circle phenomenon, and a certain aversion to risk, with a preference for the present.

Consequently, individual strategies are chosen in the short term, to the detriment of collective actions whose results are situated in a long and uncertain timeline. Organizations can play the role of trusted third parties to facilitate cooperation, but there is a lack of clarity about both their positioning (who does what), and their meaning (do they really help?). Lacking the ability to reach them, professionals explain that they end up resolving difficulties on their own. In terms of public works policies, organizations can rethink their connection with the field by taking a bottom-down rather than a bottom-up approach, and going out to meet them even more, rather than waiting for requests to come in.

For future research, the prisoner's dilemma framework and the public good game can be mobilized, while a design using the mechanism of Holt and Laury (2002) could measure risk aversion and present preferences.

Appendices

Appendix A

General introduction

Liste of participants

	Sector	Company	Type	Position in the company	Interview type	Interview duration
1	Institutional organization	VALHOR	Inter-branch	Project manager	Unstructured	45 minutes
2	Institutional organization	ASTREDHOR	Institutional organization	Coordinator manager	Unstructured	45 minutes
3	Institutional organization	Plante&Cité	Institutional organization	Project manager	Unstructured	45 minutes
4	Institutional organization	VEGEPOLYS VALLEY	Institutional organization	Project manager	Unstructured	45 minutes
5	Landscape	SUD PAYSAGES	Landscape company	Company director	Unstructured	90 minutes
6	Producer	SERRES DU BADERAND	Horticulture	Company director	Unstructured	45 minutes
7	Producer	Fleuron d'Anjou	Cooperative	President	Unstructured	140 minutes
8	Private partner	ARKENAOS	Consulting firm	Company director	Unstructured	60 minutes
9	Private partner	Horti Trace logistique emballages	Logistics / packaging	Company director	Unstructured	120 minutes
10	Private partner	CA ANJOU MAINE	Bank	Business manager	Unstructured	60 minutes
11	Institutional organization	insea	Union	Company director	Unstructured	60 minutes
12	Private partner	mélilot consulting	Consulting firm	Company director	Unstructured	60 minutes
13	Private partner	CA ANJOU MAINE	Bank	Business Manager	Unstructured	60 minutes
14	Producer	Bressse Productions	Nursery	Company director	Unstructured	240 minutes
15	Producer	Ribouche pépinières	Nursery	Company director	Unstructured	45 minutes
16	Institutional organization	verdir	Syndicate	Director	Unstructured	60 minutes
17	Producer	Pépinières MULTIBAIES	Nursery	Company director	Unstructured	60 minutes
18	Producer	GROUPE MEUNIER	Horticulture	Company director	Unstructured	120 minutes
19	Producer	Gamaflor	Horticulture	Company director	Unstructured	60 minutes
20	Producer	PUTHOD PÉPINIÈRES	Nursery	Company director	Unstructured	60 minutes
21	Producer	Fleuron d'Anjou	Cooperative	Company director	Unstructured	60 minutes
22	Producer	Grandiflora	Nursery	Company director	Unstructured	120 minutes
23	Private partner	CA ANJOU MAINE	Bank	Director	Unstructured	60 minutes
24	Private partner	BHR	Private organization	Director	Unstructured	180 minutes
25	Producer	LAFORET plants • production • innovation	Nursery	Company director	Unstructured	45 minutes
26	Institutional organization	verdir	Syndicate	Chairman	Unstructured	60 minutes
27	Distributor	Jardineries & Animaleries de France	Syndicate / Distribution	Other	Unstructured	180 minutes

		Jardiland				
28	Institutional organization	université angers	Institutional organization	Teacher-researcher	Unstructured	45 minutes
29	Institutional organization	L'INSTITUT agro Rennes Angers	Institutional organization	Student	Unstructured	30 minutes
30	Producer	Les Serres De Chloé	Horticulture	Company director	Semi-structured	60 minutes
31	Producer	Les Serres de Pécarrère	Horticulture	Company director	Semi-structured	60 minutes
32	Producer	CROUX	Nursery	Company director	Semi-structured	45 minutes
33	Producer	OVALIE VEGETAL SARL	Horticulture	Company director	Semi-structured	60 minutes
34	Producer	PÉPINIÈRES DRAPPIER	Nursery	Company director	Semi-structured	45 minutes
35	Institutional organization	LeFresne RESO'THEM Un collectif pour accompagner la transition agroécologique	Institutional organization	Other	Semi-structured	105 minutes
36	Producer	VACHER HORTICULTURE	Horticulture	Company director	Semi-structured	95 minutes
37	Institutional organization	L'INSTITUT agro Rennes Angers	Institutional organization	Other	Semi-structured	35 minutes
38	Landscape	GRAENN	Landscape company	Company director	Semi-structured	60 minutes
39	Producer	Pépinières l'Orme Montferrat	Nursery	Company director	Semi-structured	30 minutes
40	Landscape		Landscape Designer	Company director	Semi-structured	30 minutes
41	Producer	LES SERRES DE BUTRY	Horticulture	Company director	Semi-structured	25 minutes
42	Producer	Samson HORTICULTURE	Horticulture	Company director	Semi-structured	30 minutes
43	Landscape	Chloris PAYSAGE	Landscape company	Company director	Semi-structured	45 minutes
44	Landscape	Atelier CLAP	Landscape Designer	Company director	Semi-structured	30 minutes
45	Producer	Pépinières Guillot-Bourne II	Nursery	Commercial	Semi-structured	35 minutes
46	Producer	JAVOY	Nursery	Company director	Semi-structured	45 minutes
47	Producer	Passionnés de nature L'Allavoine	Nursery	Company director	Semi-structured	95 minutes
48	Producer	Elle Flutre	Nursery	Company director	Semi-structured	75 minutes
49	Producer	Pépinières DUTOUR	Nursery	Company director	Semi-structured	40 minutes
50	Producer	HORTENSIA FRANCE HF	Horticulture	Company director	Semi-structured	60 minutes
51	Institutional organization	verdir	Syndicate	Project manager	Meeting	N/A
52	Producer	Bresse Productions	Nursery	Production Manager	Meeting	N/A
53	Distribution	sessile	Distributor	Employee	Meeting	N/A
54	Producer	LAFORET plants • production • innovation	Nursery	Company director	Meeting	N/A

55	Producer	JARRY	Horticulture	Company director	Meeting	N/A
56	Producer	Le jardin de Flora	Nursery	Company director	Meeting	N/A
57	Producer		Nursery	Company director	Meeting	N/A
58	Producer	A. RAMBERT Horticulture	Horticulture	Company director	Meeting	N/A
59	Producer	Jardins d'Engandou	Nursery	Company director	Meeting	N/A
60	Producer	GreenField	Horticulture	Company director	Meeting	N/A
61	Producer	BIOPLANTS	Horticulture	Sales technician	Meeting	N/A
62	Producer	Chastel Pépinières	Nursery	Company director	Meeting	N/A
63	Producer	BELLARD CROCHET	Horticulture	Company director	Meeting	N/A
64	Producer	Végéflor	Horticulture	Company director	Meeting	N/A
65	Producer	Pépinière du Bocage	Nursery	Company director	Meeting	N/A
66	Producer	CERDYS	Horticulture	Company director	Meeting	N/A
67	Producer	Damien VIVIER Pépinières	Nursery	Company director	Meeting	N/A
68	Producer	Aux Serres du Forez	Horticulture	Company director	Meeting	N/A
69	Producer	scrive	Nursery	Company director	Meeting	N/A
70	Producer	ABADIE Horticulture	Horticulture	Company director	Meeting	N/A
71	Producer	Pépinières de Vildé	Nursery	Company director	Meeting	N/A
72	Producer	Domaine de Chapelan	Nursery	Company director	Meeting	N/A
73	Producer	PÉPINIÈRES et PAYSAGES d'elle	Nursery	Company director	Meeting	N/A
74	Producer	LANNES & Fils	Horticulture	Company director	Meeting	N/A
75	Producer	ROUY	Nursery	Company director	Meeting	N/A
76	Producer	Détriché	Nursery	Company director	Meeting	N/A
77	Producer	DÉSIR DE JARDIN	Nursery	Company director	Meeting	N/A
78	Producer	JARDINERIE FRIMONT	Horticulture	Company director	Meeting	N/A
79	Producer	bourgogneplantes	Horticulture	Company director	Meeting	N/A
80	Producer	OTTENWAELDER FRÈRES	Horticulture	Company director	Meeting	N/A
81	Producer	BIOPLANTS	Horticulture	Company director	Meeting	N/A

Interview grid and topics to be covered.

- Themes «cooperation»: Unstructured interviews
  Interviews are conducted freely. The aim here is to identify the perceptions of the industry's players regarding cooperation. Topics covered include:
  - The horticultural situation
  - Horticultural strategy
  - Moments of cooperation and non-cooperation
  - cooperation incentives and non-cooperation situations
  - Innovation challenges and examples such as license trading
  - The different players in the horticultural sector (their organization, their actions regarding to reciprocity, the existence or non-existence of a reciprocal link in the sector, etc. . .).
- Theme «Collective action»: Semi-structured interviews
  The interviews are semi-structured. Here, we analyze the understanding of collective actions for plant industry professionals. Topics covered include:
  - Competitiveness and the elements of competitiveness
  - Interactions in the industry
  - Working with other players
  - Project experience
  - Benefits, drawbacks, types of obstacles and disincentives
  - Reasons for the success or failure of joint projects
  - Project ideas for working together.
  - Other comments...
- Themes «Cooperation and collective action»: Exchange meetings
  Topics covered include:
  - Sharing experiences
  - Working together
  - Problems in the field
  - Possible improvements
  - Discussion and exchange

Theme analyzed by code

The following table is a translation of the French verbatim into English for this thesis.
This is a detailed transcription of the verbatims collected. width=!,height=!,pages=-

Transcription results

Table A.1: Labels by sector

Sector	Producer	Lands.	Retail	Partn.	Institut.	Meeting	Tot.
Individual culture	23	2	4	10	7		**46**
Culture of independence	14	3		7	1	1	**26**
The need for strength	14	1			3	4	**22**
Human brakes	14		1	1		2	**18**
Distribution concentration	11			1		3	**15**
Cooperation out of necessity	10	1			1	3	**15**
The generation gap	4	3		5	3		**15**
Cooperation by constraint	10		1	1	2		**14**
Bad experiences	11				1	1	**13**
Identifying the purpose of Inst.	8	3	1	1			**13**
Intellectual limit problem	7		4	1		3	**11**
Free rider	8					2	**10**
Cooperation by interest	8		1				**9**
Need for understanding	1			4	1	2	**8**
Collective culture	3			1	4		**8**
Have a common goal	7		1				**8**
Expectation of reciprocity	7				1		**8**
Coop. by complementarity	7						**7**
Def. of a collective action	6				1		**7**
Lack of communication	3	2		1	1		**7**
Lack of environmental clarity	3			3	1		**7**
Need for exchange	3	3					**6**
Fear of the free rider	5					1	**6**
Problem of company size	3	1		1	1		**6**
One-off actions	2			1	2		**5**
Need for a trusted third party				5			**5**
Need to know yourself	3			1		1	**5**
Competitors before colleagues	2	2				1	**5**
Path dependency	5						**5**
Cooperation for the sake of it.	5						**5**
Lack of confidence	2			1		2	**5**
No risk sharing	3		2				**5**
No information	3	2					**5**
...							...
Global total	**334**	**50**	**20**	**68**	**46**	**44**	**562**

Note: In red, the 3 labels most frequently cited by professionals interviewed

Table A.2: Analysis by category

Modelled categories	Categories	Prod.	Landsc.	Ret.	Partn.	Instit.	Meeting	Tot
General description of the industry	Needs/Lacks	5	2		1			8
	Path dependency	5			2			7
	Education / Intellectual limitations	2			3	1	2	8
	Environmental and societal developments	2	2	1				5
	Human/psychological factors	1	4			1	2	8
	Raisons for cooperation	1				1		2
	Particular features of the horticultural sector	19	4		5	5	1	34
	LT/ST strategy	1						1
	Structure of environ. Eco.	16	1	1	4	1	4	27
Total		**52**	**13**	**2**	**15**	**9**	**9**	**100**
Perception of cooperation	Needs/Lacks	14	7		2	2		25
	Economic constraints	3		1	1		1	6
	Definition of a collective action	2						2
	Definition of cooperation	2			1			3
	Path dependency	9			5	3		17
	Education / Intellectual limitations	1					2	3
	Human/psychological factors	23	4		2	5	3	37
	Raisons for cooperation	26	1		1	2	2	32
	Particular features of the horticultural sector	4				2		6
	LT/ST strategy	3		1				4
Total		**87**	**12**	**2**	**12**	**14**	**8**	**135**
Perception of collective actions	Needs/Lacks	6	4	2			3	15
	Economic constraints	2						2
	Definition of a collective action	4		2		1		7
	Path dependency	9	1		1	1		12
	Education / Intellectual limitations	2		2	1			5
	Human/psychological factors	36	8	5	2	5	3	59
	Raisons for cooperation	10						10
	Particular features of the horticultural sector	3	1		2	1		7
	LT/ST strategy	11	1	3		1		16
	Structure of environ. Eco.	1						1
Total		**84**	**15**	**14**	**6**	**9**	**6**	**134**
Rational strategy	Needs/Lacks	8	1		3	2	3	17
	Economic constraints	2						2
	Path dependency	22	4		9	4	1	40
	Education / Intellectual limitations	12			12	2	2	28
	Environmental and societal developments	1	1				1	3
	Human/psychological factors	47	2		7	4	10	70
	Raisons for cooperation	4					3	7
	Particular features of the horticultural sector	5	2		4	1		12
	LT/ST strategy	6		2		1		9
	Structure of environ. Eco.	4					1	5
Total		**111**	**10**	**2**	**35**	**14**	**21**	**193**
Global total		**334**	**50**	**20**	**68**	**46**	**44**	**562**

Table A.3: Analysis by «generation»

Category grouping	Categories	≤ 45	>46	Total
General description of the industry	Particular features of the horticultural sector	**19**	**14**	**33**
	Structure of the eco.	**17**	**5**	**22**
	Needs/Lacks	6	2	8
	Path dependency	6	1	7
	Education / Intellectual limitations	5	1	6
	Human/psychological factors	1	**5**	6
	Environmental and societal developments	1	3	4
	Reasons for cooperation	1	1	2
	LT/ST strategy	1		1
Total		**57**	**32**	**89**
Perception of cooperation	Human/psychological factors	**15**	**19**	**34**
	Reasons for cooperation	**19**	11	**30**
	Needs/Lacks	13	**12**	25
	Path dependency	**15**	2	17
	Particular features of the horticultural sector	3	3	6
	Economic constraints	3	1	4
	Definition of cooperation	3		3
	LT/ST strategy	3		3
	Definition of a collective action	2		2
	Education / Intellectual limitations		1	1
Total		**76**	**49**	**125**
Perception of collective actions	Human/psychological factors	**26**	**25**	**51**
	LT/ST strategy	**7**	6	**13**
	Path dependency	5	7	12
	Needs/Lacks	1	**9**	10
	Raisons for cooperation	6	4	10
	Particular features of the horticultural sector	4	3	7
	Definition of a collective action	3	2	5
	Education / Intellectual limitations	3		3
	Economic constraints	2		2
	Structure of the economic environment	1	1	
Total		**57**	**57**	**114**
Rational strategy	Human/psychological factors	**37**	**23**	**60**
	Path dependency	**28**	**11**	**39**
	Education / Intellectual limitations	**19**	**7**	**26**
	Needs/Lacks	7	7	14
	Particular features of the horticultural sector	8	4	12
	LT/ST strategy	3	4	7
	Raisons for cooperation	3	1	4
	Economic environment structure	1	3	4
	Economic constraints		2	2
	Environmental and societal developments	2	2	
Total		**106**	**64**	**170**
Grand total		**296**	**202**	**498**

In red, the 2 or 3 most-cited labels per generation, also corresponding to the total number of responses.
In green, among the most-cited labels in the category but not corresponding to the 2 or 3 most-cited responses in the total.

Table A.4: Analysis by education

	Categories	Before Bachelor degree	Master degree and up	Total
General description of the industry	Particular features of the horticultural sector	**15**	**18**	**33**
	Economic environment structure	**10**	**12**	**22**
	Needs/Lacks	5	3	8
	Path dependency	4	3	7
	Education/Intellectual limitations		6	6
	Human/psychological factors	1	5	6
	Environmental and societal developments	1	3	4
	Reasons for cooperation		2	2
	LT/ST strategy	1		1
Total		**37**	**52**	**89**
Perception of cooperation	Human/psychological factors	**17**	**17**	**34**
	Reasons for cooperation	11	**19**	**30**
	Needs/Lacks	**14**	11	25
	Path dependency	6	11	17
	Particular features of the horticultural sector	2	4	6
	Economic constraints	2	2	4
	Definition of cooperation	2	1	3
	LT/ST strategy	2	1	3
	Definition of a collective action	2		2
	Education/Intellectual limitations	1		1
Total		**59**	**66**	**125**
Perception of collective actions	Human/psychological factors	**30**	**21**	**51**
	LT/ST strategy	**6**	**7**	**13**
	Path dependency	4	**8**	12
	Needs/Lacks	7	3	10
	Reasons for cooperation	7	3	10
	Particular features of the horticultural sector	4	3	7
	Definition of a collective action	3	2	5
	Education/Intellectual limitations	2	1	3
	Economic constraints	1	1	2
	Structure of the economic environment	1		1
Total		**65**	**49**	**114**
Rational strategy	Human/psychological factors	**33**	**27**	**60**
	Path dependency	12	27	39
	Education/Intellectual limitations	4	22	26
	Needs/Lacks	5	9	14
	Particular features of the horticultural sector	3	9	12
	LT/ST strategy	4	3	7
	Reasons for cooperation	1	3	4
	Economic environment structure	4		4
	Economic constraints		2	2
	Environmental and societal developments	1	1	2
Total		**67**	**103**	**170**
Grand total		**228**	**270**	**498**

In red, the 1 or 2 most-cited labels per generation, also corresponding to the total number of responses.
In green, among the most-cited labels in the category but not corresponding to the 1 or 2 most-cited responses in the total.

Chapter 1

What factors explain the low level of cooperation?[1]

[1]This chapter is based on an original paper co-authored with Serge Blondel accepted for publication in the journal Revue Économique. It is translated from French for the thesis.

1.1 Introduction

Although France is a major agricultural power, its trade surplus of €7.8 billion masks a number of vulnerable factors. We focus on horticulture in the French definition, i.e., ornamental horticulture, as opposed to the English sense, which includes all garden crops (hortus), such as fruit and vegetables. This agricultural sector is one of the most vulnerable, since it is structurally import-oriented, and has posted a trade deficit (€ -0.9 billion in 2019) since the 1970s (FranceAgriMer, 2019, 2008; Viguier, 2006).

Moreover, horticulture is facing a twofold pressure: an increasingly stringent environmental and societal regulations in agriculture (Ministère, 2020, 2018, 2022), as well as the increasingly consumers who are more respectful of the environment, and are becoming consumer-citizens (Orenga, 2022).

Compared to its main competitors (the Netherlands, Germany and Belgium), France is less competitive. With a coverage rate[2] of 6.9% in 2019, it is lagging behind in its ability to conquer markets (weak control of its distribution circuit, as well as the organization of the industry (FranceAgriMer, 2020). To overcome this problem, better cooperation between industry members, including professional organizations, can improve economic performance (Knack and Keefer, 1997; North, 1994; Ostrom, 2010; Ostrom et al., 1999).

Cooperation will be defined here as actions generated within a network, or the ability to organize collectively around common projects (McCarthy et al., 2004). The creation of Groupements d'intérêt économique et environnemental (GIEE)[3] projects is a concrete example of a collective approach. In the Ministry of Agriculture and Food Sovereignty's 2019 GIEE census, out of a total of 494 projects, horticulture (including MAPs[4]) accounts

[2]Ratio between the value of exports and imports. It can relate to a single product or to all trade in products (goods and services) (INSEE definition)

[3]A GIEE is a project accredited by the French Ministry of Agriculture, with the aim of promoting collective approaches to economically and environmentally efficient agriculture.

[4]MAPs: Medicinal and aromatic plants (MAPs)

for 9 GIEEs, or just 0.8% of horticultural farms. By comparison, there are 35 GIEEs, or 2.4% of farms in the fruit and vegetable sector, a sector with farms of equivalent size[5].

Better economic performance is generated by the existence of a high level of reciprocity, thus creating more cooperation (Knack and Keefer, 1997). Algan et al. (2013) also argue that reciprocity is one of the strong motivations for fostering cooperation in peer production environments. While there are many studies on the characteristics and specificities of horticulture (Justin et al., 2009; Kapusta et al., 2015; Leroux et al., 2014), as well as on the cooperation of members in the industry, there is no study, to our knowledge, on the reciprocity of members. This article aims to define the factors which explain low cooperation within the horticultural industry, and to identify elements that promote cooperation thought reciprocity.

Reciprocity as the basis of all social relationships (Gouldner, 1960; Kolm, 2008), can be defined in three main forms. Reciprocal altruism (Binmore, 2006; Trivers, 1971) explains reciprocity in terms of self-interested behavior based on social norms. The individual is motivated only by his or her own self-interest, and reasons on a model of social interaction with an indefinite horizon, as in real life. Altruism therefore exists only in its reciprocal form, as individuals incorporate future social interactions into their behavior. Secondly, cooperation can also arise from purely self-interested strategies. Reciprocity can then be understood as cooperative behavior first, followed by «Tit for Tat» (Axelrod, 1984; Bowles and Gintis, 2004; Gintis, 2004). In this case, cooperation does not necessarily lead to reciprocity, since it is conditional on the other's response. Finally, Kolm (1984b) defines reciprocity as a give/gift relationship, without any obligation. Reciprocity requires linked transfers in both directions, without constraint, reflecting the desire to pursue a relationship based on equitable exchanges. This stable state enables the temporal dimension, and the construction of the social bond establishing the loop of reciprocity.

[5]For the total number of farms, see the 2020 Agricultural Population Census.

However, we can't be sure of the other's cooperation without giving first. It's all about giving and trusting (Camerer, 1988). We sacrifice immediate benefits for the sake of the relationship.

So how do we define cooperation between players in the horticultural industry? By mobilizing the public good game, we attempt to capture the factors why individuals engage in cooperated behavior. We identify the factors (obstacles and motivations) that allow the cooperation to reach a stable state. In a paid online survey, the participants reveal themselves to be cooperative, but then a bias appears: they judge themselves to be more altruistic than others. This effect explains why collective actions are not sustained. Knowing the typical profile of horticulturists involved in professional organizations would enable us to mobilize them in collective actions.

The next three sections will describe the horticultural sector and our methodology, then they will discuss the data, and present the empirical results, and finally, they will conclude, and suggest avenues for future research.

1.2 Horticultural context and experimentation

1.2.1 The horticultural sector needs to evolve

The industry covers the production, and retailing of horticultural products[6], as well as services provided by landscape contractors. In 2019, it represented a market with sales of €15.4 billion, 186,000 jobs, and 52,000 companies.

Since 2012, the horticultural market has become tense for producers. The causes are both structural (falling demand from households and local authorities, rising logistics costs), and cyclical (VAT rate increases in 2012 and 2014 from 5.5% to 10%). Horticulturists have been weakened. From 2003 to 2019, production sector lost 56% of its companies,

[6]Horticultural products are defined as flowers, cut foliage, potted and bedding plants, nursery plants, flower bulbs, seeds and floral seeds.

Table 1.1: The horticultural industry in 2019

Sector	Number of companies	Number of jobs	Billion € of T/Ob
Production sector	2 936	16 581	1,4
Retail sector	17 643	55 909	7,5
Landscape sector	31 200	113 200	6,5
Total	51 779	185 690	15,4

20% of sales, and 47% of jobs[7]. However, the sector still accounts for 7.9% of agricultural employees.

To stem the tide of international competition, we need to focus on non-cost competitiveness, and shift the battleground from price to quality by offering high value-added products, and move from a strategy of cost domination to one of product differentiation (Bernard, 1992; Gillot et al., 2022; Porter et al., 1993). This transformation cannot take place on an individual level, but on a collective one. Cooperation makes it possible to build an approach whose common result is greater than the sum of individual results (Reinhard et al., 2022). It can be conceived horizontally with competitors, vertically with suppliers or customers, and institutionally with research organizations or professional groups (Belderbos et al., 2004). If Blondel and Widehem (2006), compared with the fruit and vegetable sector, conclude that horticulturalists are no more individualistic than others, yet the sector remains highly atomized and disorganized. Accompanied by a culture of independence, horticulturists are used to dealing with all issues on their own, without the help of outside contributors (Deffontaines, 2014; Mesnel, 2017). As shown by the Végésupply[8] project in logistics, between recognizing the need and taking action, collective actions take time to materialize, they remain highly localized, and that most of the time they fail.

[7]Source: CER France, VALHOR reconstituted.

[8]The Végésupply project brings together four companies to create a shared logistics chain (IT flows, transport, etc.). The construction phase was only completed at the end of 2015.

1.2.2 Methodology

We use the artefactual experiment method (Harrison and List, 2004), where a decontextualized experiment is applied to field actors. This external validity is justified because the subjects are in their natural environment, thereby retaining their identity, and social context (Gneezy and Imas, 2017). Although our problem can be compared to that of Angeon et al. (2013) our study is similar in approach to that of Falk et al. (2019a), with farmers in Rajasthan, who also combined games, and discussions. This dual approach enabled them to facilitate debate on possible solutions, and gain a better understanding of cooperation models.

With natural field experiments, although 3.5 times less numerous than laboratory experiments (Card et al., 2011), we can capture important features of the real world (List, 2008), and complement laboratory experiments Levitt and List (2007).

Qualitative analysis using open interviews

The first part, a qualitative analysis carried out through a series of open interviews with industry professionals (25 interviews from December 2021 to the end of June 2022), enabled us to adjust our hypotheses by capturing the issues in the field. Three topics stand out: strategy, mindset change, and cooperation. Having a strategic vision remains one of the main challenges facing the industry. Faced with international competition, distribution concentration, and rising logistics costs, everyone recognizes the need to have a long-term vision, to know where to go, and how to get there. The second topics is self-criticism. Their own managerial posture is recognized as no longer being suited to running tomorrow's operations. A change of mindset is needed to become more of a manager, and not just a producer. All these aspects point to the need for cooperation between members in the sector. Through these exchanges, cooperation appears to be increasingly

essential, particularly in times of crisis or difficulty, when individuals naturally turn to the collective. If horticulturists are independent, and manage their problems alone, faced with events such as the Covid-19 crisis, they have become aware of the need to cooperate (VALHOR, 2021). Despite this, taking action is rarely considered. While cooperation is conceivable, the idea of switching back to competitive mindset is not far away, and cooperation is therefore not stable (Noireaux et al., 2020). Reciprocity does not set in. A certain skepticism about collective action is apparent, with too few participants or too high a financial and time investment. Individuals who participate find that they always encounter the same members, and that groups do not renew themselves (Barr et al., 2014).

So, our first question is: what is the profile of the individuals who go from recognition to action by involving in collective action?

Following Barr et al. (2014) in Albania, and Bluffstone et al. (2020) in Nepal, our hypothesis is that the most egoistic individuals are the least involved in collective actions, in this case, mainly led by the sector's institutions. We then hypothesize that cooperation results from self-interested strategies, and tends towards conditional cooperation as conceived by Rabin (1993). Players will contribute according to their perception of other players' contributions. As a result, the individuals who anticipate the highest amounts from other players are those who have the most confidence in the other players in the supply chain, as well as in institutional bodies. The second question is: how do they see their partners in the industry? The Better-Than-Average-Effect (BTAE) (Alicke and Govorun, 2005) reveal the existence of a tendency to evaluate oneself more favorably than one's peers, and reflects the bias for which a majority of individuals judge themselves to be «better than average» (Alicke et al., 1995; Zuckerman and Jost, 2001; Alicke and Govorun, 2005; Sedikides and Gregg, 2008). Here, individuals will tend to think they are more altruistic, and cooperative than others, when in fact they are not. Our hypothesis

is that the amount of the realized contribution should be higher than the amounts they anticipate from the other players.

Quantitative analysis by mobilizing the public good game

The public good game is one of the most widely used standards for modeling questions concerning the existence of a common good (Dufwenberg and Kirchsteiger, 2004; Geanakoplos et al., 1989; Rabin, 1993). The mechanism of voluntary contribution to the provision of public goods helps to understand the emergence of cooperation. Like the prisoner's dilemma, this game stages the conflict between collective, and individual interests. The framework is more general, and measures the degree of cooperation, whereas the prisoner's dilemma is played by two players with only two options each.

Formally, N ($N \geq 2$) players take part. Each has an endowment D which he can divide between a collective investment Y_i ($i = 1, 2, .., N$), and private investment $D - Y_i$. There is thus a public good $\sum_{i=1}^{N} Y_i$ which is multiplied by a factor k ($1< k < N$), then divided into N equal shares, whatever the stakes, between the N players. This gives us the individual winnings G_i for each player i ($i = 1, 2, .., N$):

$$G_i = (D - Y_i) + \frac{k}{N} \sum_{i=1}^{N} Y_i \tag{1.1}$$

and the overall gain $G = \sum_{i=1}^{N} G_i$ for all players:

$$G = ND + (k - 1) \sum_{i=1}^{N} Y_i \tag{1.2}$$

The drive for individual gain leads to putting nothing into the public good, with each person collecting only D, the initial contribution. Conversely, the social optimum is obtained when all endowments are poured into the public good, which maximizes G, with everyone then earning $k.D$.

Individual maximization leads to non-contribution, since for each contribution, each will only benefit from a share of the whole (Hardin, 1968). Free rider behavior is the dominant strategy, and leads to the only equilibrium. If individuals behave selfishly, they try to benefit from the public good by avoiding, as far as possible, contributing to its financing. This is a social dilemma, since the group would be better off if everyone contributed their full share to the public good. From 0 to D put into the public good, the amount invested measures the degree of cooperation, from nil to total. Note that repetition of the game encourages cooperation, and a further study using a non-cooperative game will complete our analysis, since in reality collective actions are the result of repeated decisions (chapter 2).

The first public good games in field experiment are those of Bohm (1972). His test, carried out by the research department of the Swedish Broadcasting Corporation on a random sample of 605 people, concluded that individuals may be willing to contribute even if it goes against their own self-interest. Subsequent work in the laboratory has shown that in one-shot versions, there are more contributions than the equilibrium of the game would predict. Participant groups most often contribute between 40% and 60% of their endowment (Chaudhuri, 2011; Ledyard, 1995). These contributions contradict *homo œconomicus*, and raise the question of the heterogeneity of motivations. One of the dominant explanations for this deviation from dominant strategies is based on social preferences, i.e., individuals' intentions (why they contribute: altruism, cooperation, reciprocity), and beliefs about other players' intentions (whether or not they anticipate others' contributions).

The level of education helps to better understand the issues at stake and is an explanatory factor for cooperation in the industry. Additionally, structures that are large enough can cope with different events on their own, without needing anyone else. Our hypothesis

H1 is that individual contribution increases with education, and confidence in collective action, and decreases with company size. Defrancesco et al. (2007) have shown that farmers' beliefs have an effect on their behavior towards agri-environmental programs. We hypothesize H2 that anticipated contribution increases with education, and confidence in collective action, and decreases with increasing firm size. Finally, individuals who invest in professional organizations give their time to the collective. Our hypothesis H3 is that trust in professional organizations increases with contributions.

1.3 Experimental data

1.3.1 Sample

The list of firms was compiled from exhibitors at plant trade shows such as SIVAL, Salon du Végétal, Paysalia, BHR[9] members, as well as companies with the «Fleurs de France» and «Plante Bleue» labels. This list includes 940 firms in the horticultural industry: production sector, retail sector, and landscape sector.

1.3.2 Survey

The experimental protocol was recorded on the AsPredicted platform prior to data collection[10].

The survey was conducted online. A link was provided to fill in the questionnaire, and answer anonymously. We opened the survey on October 19, and reached our expected 80 responses (or 8.5%) by November 2, 2022. Our survey was remunerated to ensure incentives for decisions. Participants played in groups of four. This survey is a replication of a first survey (January 2022), with 89 participants but in hypothetical winnings. Average winnings were €16,938, for a prize pool of €10,000. On this initial basis, dividing the

[9]Bureau Horticole Régional, a French advisory service for horticulturists and nurserymen
[10]$https://aspredicted.org/4RR_TB3$.

winnings by a thousand, with a budget of €1,500, and an average winnings calculation of €17, we anticipated 80 participants. The two experiments were similar in every respect, apart from the stakes in the public good game, which were a thousand times higher in the first survey in hypothetical winnings (Blondel and Noet, 2022b).

57 participants gave the name of their company, which was optional. 23 participants left comments on their perception of the organizations, and the value chain, while 49 (61%) wanted to receive the results, which is significantly more than the 48% in the first survey in January with hypothetical earnings. The professionals in the industry had come forward to find out the results of the first survey, to be released in April 2022, and want to actively participate in further studies to deepen the initial results. 7 participants did not correctly indicate their postal address in order to be compensated, one participant wished to remain anonymous, and another expressly stated that he did not wish to receive his gratuity. More generally, remuneration was not a decisive factor in their participation.

1.3.3 Survey phase

The first part of the questionnaire consists of 11 general questions. The second part, consists of 18 questions, measures the perception of industry professionals of each other, in terms of trust, relationships, and reciprocity. The stated preference method proves particularly useful in our case, since there is no such data, so these subjective measures are valid (Aslam et al., 2017). We asked them to define their degree of trust on a scale of 0 to 10 in the different stakeholders in the value chain (organizations, competitors, customers), as well as their confidence in the ability of these different organizations to create responses to future challenges through collective action. Table 3 provides a summary of these responses. The third part of the questionnaire consists of 2 questions on the public good game: their contribution, and the contribution they expect from other players (table 2).

Table 1.2: Descriptive variables (N^a =80)

Variable	% of total
Male:	72.50
Age:	
18-44 years old.	30.00
45-54 years old.	38.75
55 and over	31.25
Position:	
Manager	85.00
Employee	11.25
Other	3.75
Education[b]:	
Before High school diploma	11.25
BTEC	27.50
Bachelor's Degree	23.75
Master's Degree and up	37.5
Type of firm:	
Private company	96.25
Cooperative, association or other	3.75
Firm sector:	
Production sector	57.50
Retail sector	26.25
Landscape sector	15.00
Other	1.25
Firm type details:	
Horticulturalists	28.75
Nurseries	23.75
Landscape companies	11.25
Florists	11.25
Wholesalers	8.75
Cut flowers	3.75
Landscape designers	2.50
Mixed producers	1.25
Cooperatives	1.25
Garden centers	1.25
Other	6.25
Firm size (FTE):	
0 to 5	16.25
6 to 20	45.00
21 to 50	22.50
51 to 100	8.75
101 and more	7.50
Individual amounts paid into the public good:	
0 €	22.50
5 €	18.75
10 €	58.75
Anticipated amounts for the other 3 players:	
0€ (0€ - 0€ - 0€)	17.50
5€ (5€- 0€ - 0€)	10.00
10€ (5€- 5€ - 0€ or 10€ - 0€ -0€)	10.00
15€ (5€ - 5€ - 5€ or 10€ - 5€ - 0€)	13.75
20€ (10€ - 5€ - 5€ or 10€ - 10€ - 0€)	6.25
25€ (10€ - 10€ - 5€)	8.75
30€ (10€ - 10€ - 10€)	33.75

[a] N is the number of subjects. [b] High school diploma for translation of French diploma (BAC), BTEC Higher National Diploma for French diploma (BAC +2), bachelor's degree for French diploma (BAC +3) and (BAC+4), and master's degree for French diploma (BAC +3).

1.3.4 Public good game

Each participant plays with three other players without communication. Each player has €10 (D), and can put €0, €5 or €10 into the public good. We have opted for a discrete

Table 1.3: Perception of professional from the industry (N^a =80)

	Number of relationships	Average confidence
Institutional organizations[b] :		
INRAE	19	6.6
ASTREDHOR	49	7.0
BHR	31	6.2
Chambre d'agriculture	50	6.5
FNPHP	57	7.8
VEGEPOLYS VALLEY	15	4.8
VALHOR	67	6.4
Plante et Cité	18	7.0
Direct actors:		
Suppliers		7.8
Customers		6.9
Competitors		6.0
Effectiveness of collective action:		
Creating innovations		7.6
Developing shared logistics		6.4
A common offering		7.1
Solving the problem of business takeover		6.5

[a] N is the number of subject
[b] INRAE is a public research institute for agriculture, food, and the environment. ASTREDHOR is an applied agricultural research organization. FNPHP is the national union of horticulture, and nursery producers, which became VERDIR in June 2022. VEGEPOLYS VALLEY is the French plant industry competitiveness cluster. VALHOR is the French trade association for horticulture, floristry, and landscaping. Plante et Cité is the technical center for green spaces, and landscaping.

choice for greater simplicity. The total amount of the pot is multiplied by two (k =2), and divided equally between the four players, regardless of the amount contributed. Each will receive a quarter of the public good, in addition to the amount kept. This gives us the winnings G_i for each player (i =1,2,..,4):

$$G_i = D - Y_i + \frac{1}{2}\sum_{i=1}^{4} Y_i = D - \frac{1}{2}Y_i + \frac{1}{2}\sum_{j \neq i} Y_j \tag{1.3}$$

And the overall gain for all players:

$$G = 4D + \sum_{i=1}^{4} Y_i \tag{1.4}$$

The social optimum is reached in (4) with 4 equal contributions to D (twice the profitability), but individual maximization leads to keeping the endowment, twice as profitable as the public good in (3). We then asked how much they thought the other three players would contribute to the public good.

1.4 Results analysis

1.4.1 General results

To measure trust, we used the stated preference method (Ali et al., 2021; Alpizar et al., 2008; Czajkowski et al., 2017; Vossler and Watson, 2013; Wuepper et al., 2019). On average, 48% of responses indicate a connection with organizations. They trust suppliers first, then customers, then organizations, and finally competitors. Trust exists vertically (supplier trust score 7.8/10, and customer trust score 6.9/10), but is less marked horizontally (competitors 6/10), and institutionally (organizations 6.4/10). They give priority to relationships when they directly affect the management of their company. Conversely, when there are no direct business issues, non-obligatory interactions are rarer, and trust tends to decline.

Perception results on the effectiveness of organizations in building collective actions remain consistent, as individuals have greater confidence in general issues such as innovation or supply strategies, than in more local issues such as logistics, or individual issues such as business takeovers, and transfers.

A high number of partnerships does not automatically lead to greater trust, since a high number of connections does not mean a high level of trust. As the survey was carried out after the health crisis, this result is all the more surprising. Indeed, growers had to cooperate by grouping together around the VALHOR interbranch and the FNPHP, to assert their rights to compensation following the destruction of unsold plants, the loss of sales suffered during the 2020 containment, and the recognition of horticultural products as basic necessities. During this period, orders from supermarket customers were simply cancelled or withdrawn. Nevertheless, the players are more confident in their relations with their customers than in their relations with their competitors. This result confirms

that cooperative ventures remain the result of one-off, project-based actions, but do not necessarily lead to reciprocity. People feel the need to cooperate in times of crisis, but as soon as the urgency wears off, everyone goes back to business as usual.

Individuals are naturally cooperative in their contributions, as only 22.5% of participants did not contribute. On average, players contributed €6.81 (68.1%, rather high) to the public good. The level of cooperation is high in agriculture in a public good game (Angeon et al., 2013; Bchir, 2011; Falk et al., 2019b). It increases very rapidly when individuals find themselves closer to problems (Carlsson et al., 2015; Reinhard et al., 2022). Groups of four were formed in order of arrival. Winnings ranged from €5 to €25 (Figure 1), with an average of €16.82. Finally, they estimated that the others would put €5.71 into the public good, i.e. 16.2% less than themselves, a significantly lower level (Student test, p-value = 8.62.10-05). The correlation between individual contribution, and anticipated contribution is both very high, and also higher than in the first experiment without real stakes (88% vs. 67.5%).

The results are sharper than in the first survey with hypothetical gains. 43.8% had put half their money into the public good, compared with 19.75% here. Subjects chose clearer strategies: to cooperate fully or not at all. The variance of contributions is higher with incentives (z =2.12, p <0.02). If they still expect others to contribute less than they do, they predict better, with 16.2% less instead of 27

These results rule out free rider behavior, as 59% of participants contributed 100%, while 34% anticipated a maximum public good. However, this result also confirms BTAE, with 30% of players anticipating a lower contribution from others. On the other hand, 62.5% of players anticipated the same contribution from other players as their own contribution, which corroborates the study by Schuch et al. (2021) on farmers in Cambodia, which shows that individuals try to guess other contributions to determine an appropriate

Figure 1.1: Contribution breakdown

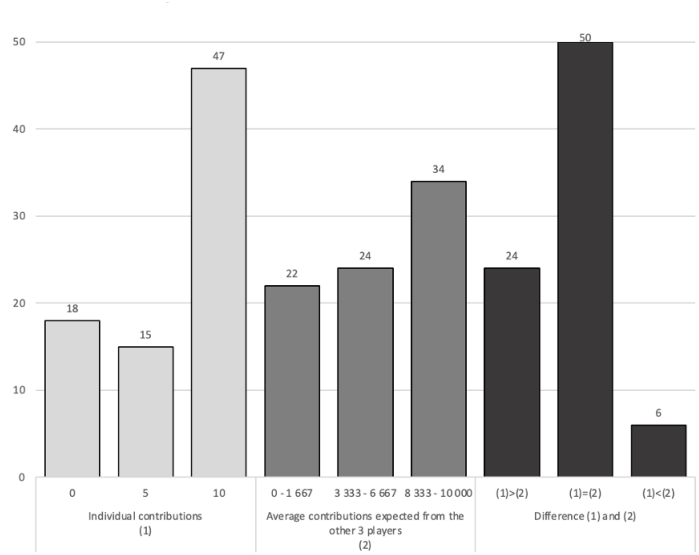
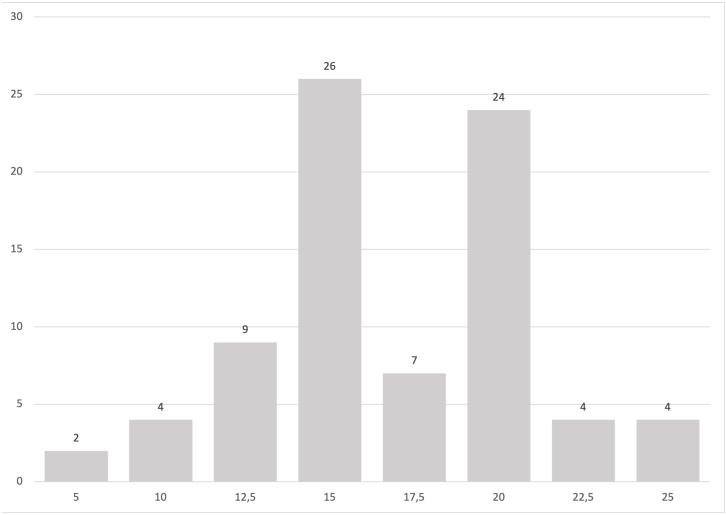


Figure 1.2: Payout breakdown by player



contribution that aligns private, and collective interests. Individuals bet on cooperation so that others will cooperate, but without being certain of reciprocity. They want to cooperate, but with skepticism, because they believe that others will do so less. This result clearly indicates that beliefs play a central role in determining contributions (Smith, 2013, 2015). For reciprocity to take hold, there needs to be an equilibrium in the gift/counter-gift loop. In this case, however, this loop has not fully engaged. There is altruism, but not enough expectation of reciprocity, which may explain why most of the time, actions

within the chain are short-term[11].

1.4.2 Econometric analysis

For the econometric analysis, as these are discrete variables, we used the ordered probit method. Our control variables are trust in partners, and trust in organizations to create collective actions.

Table 1.4: Variable explained: contributions made - Ordered Probit

	Individual contributionYi					
	With direct partners			With institutions		
Men(a)	-0.083		(0.341)	-0.082		(0.339)
18 to 44 years (a)	-0.500		(0.349)	-0.561		(0.363)
Manager (a)	0.042		(0.452)	-0.008		(0.438)
Before BTEC (a) (c)	-0.367		(0.360)	-0.252		(0.336)
Bachelor's Degree (a)	0.027		(0.417)	-0.209		(0.388)
Private firm (a)	-0.671		(0.847)	-1.143		(0.905)
Retail sector (a)	0.316		(0.437)	0.415		(0.424)
Production sector (a)	0.775	*	(0.397)	0.772	**	(0.393)
6 to 20 FTE (a)	0.594	*	(0.317)	0.479		(0.313)
Supplier confidence	-0.071		(0.147)			
Customer confidence	0.214	*	(0.116)			
Competitor confidence	0.160		(0.099)			
Organization confidence	0.004		(0.078)			
Innovation (b)				0.062		(0.070)
Buyouts (b)				-0.016		(0.064)
Logistics (b)				0.042		(0.079)
Improves offers (b)				-0.001		(0.079)
cut1	0.840		(1.534)	-0.919		(1.176)
cut2	1.483		(1.537)	-0.315		(1.172)
N	80			80		
lnL	-67.37			-70.42		

(a)the value is 1 if this is the situation described in the table, and 0 otherwise.
(b)degree of trust placed in organizations to create collective actions for innovations, for business takeovers, to pool logistics, and propose grouped offers.
(c)BTEC Higher National Diploma for translation of French diploma (BAC +2), bachelor's degree for translation of French diploma (BAC +3), and (BAC+4).
***, **, and *: significance at 1%, 5%, and 10%.
Standard deviations in brackets.

[11]For this second question, we presented the answers in both ascending, and descending order. There was no significant difference.

Table 1.5: Variable explained: anticipated contributions - Ordered Probit

	Anticipated Contribution Yi					
	With direct partners			With institutions		
Men (a)	-0.029		(0.305)	-0.113		(0.302)
18 to 44 years (a)	-0.325		(0.304)	-0.414		(0.315)
Manager (a)	0.055		(0.392)	0.032		(0.390)
Before BTEC (a) (c)	-0.413		(0.318)	-0.395		(0.303)
Bachelor's Degree (a) (c)	-0.315		(0.348)	-0.494		(0.337)
Private firm (a)	-1.397	*	(0.834)	-1.606	*	(0.833)
Retail sector (a)	-0.163		(0.398)	0.003		(0.392)
Production sector (a)	0.608	*	(0.364)	0.650	*	(0.364)
6 to 20 FTE (a)	0.216		(0.272)	0.068		(0.271)
Supplier confidence	0.001		(0.129)			
Customer confidence	0.211	**	(0.100)			
Competitor confidence	0.124		(0.087)			
Organization confidence	-0.043		(0.069)			
Innovation (b)				-0.025		(0.063)
Buyouts (b)				0.043		(0.057)
Logistics (b)				0.025		(0.070)
Improves offers (b)				0.011		(0.069)
cut1	-0.446		(1.378)	-2.293	**	(1.093)
cut2	-0.059		(1.378)	-1.931	*	(1.087)
cut3	0.072		(1.377)	-1.810	*	(1.086)
cut4	0.576		(1.377)	-1.340		(1.081)
cut5	0.874		(1.380)	-1.062		(1.081)
cut6	1.153		(1.384)	-0.803		(1.080)
N	80			80		
lnL	-129.9			-134.4		

(a)the value is 1 if this is the situation described in the table, and 0 otherwise.
(b)degree of trust placed in organizations to create collective actions for innovations, for business takeovers, to pool logistics, and propose grouped offers.
(c)BTEC Higher National Diploma for translation of French diploma (BAC +2), bachelor's degree for translation of French diploma (BAC +3), and (BAC+4).
***, **, and *: significance at 1%, 5%, and 10%.
Standard deviations in brackets.

Hypotheses H1 and H2 are not fully verified. While the degree of education seems to be a factor of cooperation in the sector (Blondel and Widehem, 2006), and the perception of cooperation in others (Defrancesco et al., 2007). There is no significant effect here, even if the sign for Before BTEC is negative for individual and expected contributions. For the latter, the p-value is 19%, indicating significance at 9.5% since the test is unilateral.

For individual contributions, this remains non-significant, since the probability of error is 15.4%. However, in the first version of our work on fictitious amounts, education had a positive effect. This remains a variable to be taken into account. The greater cooperative behavior of the more highly educated also seems logical, since education advocates cooperative rather than individualistic solutions (Le and Nguyen, 2021; Sunshine Hillygus, 2005). Note also that in the first equation of Table 4, smaller companies (between 6 and 20 FTEs) cooperate more. This is not the case for very small companies, which don't feel involved in collective initiatives. Conversely, larger companies are less involved, as the greater their market share, the less need there is for cooperation (Barr and Saraceno, 2009). Concerning confidence in collective action, hypotheses H1 and H2 are only confirmed for the «customers» item. The results in Table. 6 provide a detailed breakdown of behavior by organization.

Hypothesis H3 is not verified. Trust in institutional organizations is not correlated with individual contribution to the public good. Individuals who trust organizations appear to be in the production sector, and over 45 years of age. Level of education has no effect on trust in organizations. Three of the themes that could promote cooperation (innovation, business takeovers, and pooling of supply) are highly significant. The results are logical, given that innovation emerged for all three organizations: ASTREDHOR, FNPHP, and VALHOR. Innovation is a unifying theme that cannot be conceived individually, and therefore requires the cooperation of the various players in the sector. As far as business takeovers are concerned, the VALHOR interbranch seems to be the organization that can solve this problem. These results corroborate the interviews. The people who get involved in the organizations that promote collective action are often over 45 years of age, belong mostly to the baby-boomer generation, are very close to retirement, and are therefore concerned about business takeovers. On the other hand, concerns that have a direct impact on business, such as the pooling of supply chains or the bundling of a

Table 1.6: Variable explained: level of trust in the organizations they work with – Ordered Probit

	ASTREDHOR			**FNPHP**			**VALHOR**		
Men (a)	-0,263		(0,491)	0,044		(0,420)	-0,376		(0,350)
Age18 to 44 (a)	-1,744	***	(0,480)	-1,116	***	(0,432)	-0,8724	**	(0,378)
Manager (a)	-0,297		(0,611)	-0,501		(0,526)	-1,783	***	(0,533)
Before BTEC (a) (c)	1,110	**	(0,438)	-0,430		(0,356)	-0,329		(0,331)
Bachelor's Degree (a)	0,425		(0,490)	0,001		(0,413)	0,513		(0,368)
Private company (a)	1,633		(1,170)	-0,167		(1,043)	-1,161		(0,819)
Retail sector (a)	0,398		(1,024)	0,633		(0,635)	-0,291		(0,511)
Production sector (a)	-0,053		(0,981)	1,123	*	(0,599)	-0,625		(0,528)
Size 0 to 5	-0,230		(0,786)	-1,670	**	(0,697)	0,371		(0,611)
Size 6 to 20	-0,395		(0,587)	0,091		(0,562)	0,366		(0,489)
Size 21 to 50	-0,350		(0,597)	-0,344		(0,551)	-0,067		(0,524)
Innovation (b)	0,284	***	(0,084)	0,286	***	(0,084)	0,147	*	(0,077)
Buyouts (b)	0,039		(0,073)	0,054		(0,075)	0,196	***	(0,060)
Logistics (b)	-0,043		(0,089)	-0,097		(0,086)	0,079		(0,073)
Improves offers (b)	0,161	*	(0,096)	0,005		(0,085)	-0,179	**	(0,078)
Individu. Contrib	-0,012		(0,053)	0,002		(0,041)	0,010		(0,038)
cut1	0,914		(1,681)	-1,753		(1,496)	-4,146	***	(1,191)
cut2	1,364		(1,679)	-1,128		(1,441)	-3,242	***	(1,139)
cut3	1,664		(1,676)	-0,515		(1,423)	-2,450	**	(1,128)
cut4	3,074	*	(1,717)	-0,314		(1,425)	-1,691		(1,117)
cut5	3,693	**	(1,742)	0,508		(1,420)	-1,033		(1,109)
cut6	4,219	**	(1,750)	1,253		(1,409)	0,131		(1,109)
cut7	5,053	***	(1,771)	1,957		(1,408)	1,006		(1,153)
cut8	5,944	***	(1,796)	2,816	**	(1,427)			
N	49			57			66		
lnL	-79.03			-89.07			-104.5		

Number of observations as a function of the number of individuals declaring knowledge of the organisms.
(a) the value is 1 if this is the situation described in the table and 0 otherwise.
(b) degree of trust placed in organizations to create collective actions for innovations, for business takeovers, to pool logistics, and propose grouped offers.
(c) BTEC Higher National Diploma for translation of French diploma (BAC +2), Bachelor's Degree for translation of French diploma (BAC +3), and (BAC+4),
***, **, and, *: significance at 1%, 5%, and 10%. Standard deviations in brackets.

global offering, are not correlated with confidence in the organizations. The interviews revealed a certain skepticism about collective action, partly explained by past failures in these areas (Fleiß and Leopold-Wildburger, 2014).

Finally, the size of the company seems to have an effect on confidence in institutional organizations. The smallest companies (0 to 5 FTEs) are often made up of one or two people (33% of horticultural companies have 0 employees)[12], do everything on their own,

[12] https://www.deveniragriculteur.fr/fileadmin/user_upload/Auvergne-Rhone-Alpes/164_Eve-deveniragriculteur/OPPORTUNITES_FILIERES/Chiffres_cles_FNPHP_VD_BD_compressed.pdf

and don't have the time to participate. What's more, they feel they have no voice. Large companies (over 50 FTEs) are autonomous, and think they don't need cooperation. Cooperation is mainly envisaged by medium-sized companies, which are structuring themselves, and seeking differentiating strategies, and new markets.

1.5 Conclusion and discussion

Knack and Keefer (1997) report that better economic performance can be generated by creating more cooperation. Our dual approach to declarations of preference, and the mobilization of the public good game enables us to identify the typical profile of players active in the development of collective actions, as well as the obstacles and motivations of those who cooperate. The results show that horticulturalists cooperate naturally, putting 68% of their endowment into the public good, even if they think that others will only put in 57%. This rate did not completely validate our hypotheses H1 and H2. Level of education has no effect on individual contribution. It should be noted that our sample is made up of 89% of individuals with 2 or more years of higher education. This means that the majority of individuals in our sample have higher education, so there are no significant differences between different levels of qualification. On the other hand, the composition of the sample does help to explain the high rates of cooperation, corroborating the hypothesis that a better education helps to better grasp the issues at stake, and is therefore a factor in explaining cooperation. There is one limitation. As INSEE lists only 26% of farmers with higher education qualifications in 2019[13], further studies could validate our results.

With these high rates of cooperation, reciprocity can be initiated, but the players in the sector need to realize that the others will also be cooperative, so that reciprocity takes hold. This means overcoming the negative preconceptions of older players, based on their failed experiments, and the reluctance of younger players who want immediate results.

[13]https://www.insee.fr/fr/statistiques

While these obstacles have been raised, our experience has not been able to overcome them. One-shot games, unlike repeated games, don't allow us to measure the impact of past decisions. A repeated-game experiment could complete the analysis (chapter 2). Even so, average trust scores remain high for suppliers, customers, institutional organizations, and competitors, enabling collective actions to emerge, and be sustained. Key players are needed for cooperation and collective action to take place, and the participants interviewed would like to have this role. Although our hypothesis H3 is not validated, since trust in professional organizations does not increase with contributions, it does reveal a typical profile of a player active in collective action. This ideal profile would be a graduate horticulturist under 45 years of age, who would behave like an «older» person. He would have no negative preconceptions based on past experiences, while taking a long-term view, and not expecting immediate results.

This initial study has helped federate horticulturalists, and institutional organizations with our approach, which will be extended. The profession has taken ownership of our research, which is rare for a field experiment: there could be an impact of academic work on corporate behavior. There is a real interest on the part of industry professionals both in our study, in understanding the factors behind cooperation (their own obstacles and motivations), and in actively anticipating the search for solutions to improve economic performance. Our initial results were presented via their main professional relays: a conference at the Salon du Végétal in September 2022, and a summary in the Lien Horticole (approx. 5,000 readers) in December 2022 (Blondel and Noet, 2022a).

These studies contribute to the literature on collective action for improved economic performance. They enable us to identify a key profile type in cooperation, as well as the factors explaining the obstacles, and motivations to reciprocity in horticulture. These experiences can be transposed to other agricultural sectors, as well as to other sectors

of the economy. Finally, it also opens up the question of nudges, which can be used to remove obstacles to cooperation.

Appendices

Appendix B

What factors explain the low level of cooperation in horticulture?

Questionnaire sent online: Economic Research: Plan industry

As part of a university research project, we are inviting you to take part in a questionnaire on the plant industry. The questionnaire will be open from October 14 to November 5, 2022.

It should take you no more than 15 minutes and consists of three parts:
- Part 1: General questions
- Part 2: Questions about the industry
- Part 3: Questions involving financial amounts.

The winnings from part 3 will be paid out in Illicado vouchers. This is a coupon for purchases in many of the stores you visit most often. You'll know your winnings on October 30, and the coupon will be sent to you in the first half of November.

Results are and will remain anonymous and confidential. For best results, please answer the questions given as accurately and representatively as possible and take the time to think carefully about what you are being asked. The results will be sent to you on request, by entering your e-mail address at the end of the questionnaire. For any further information on the results, please contact me at: ngoc-thao.noet@etud.univ-angers.fr

Thank you in advance for your participation.

*Mandatory

Part 1: General questions

1.
You are: *
Only one possible answer.
- o Woman
- o Man

2.
Please indicate your age range *
Only one possible answer.
- o 18-44 years old
- o 45-54 years old
- o 55-64 years old
- o 65 years old and more

3.
You are: *
Only one possible answer.
- o Manager
- o Employee
- o Other

4.
What is your level of education? *
Only one possible answer.
- o No diploma
- o Before BTEC
- o Bachelor's degree
- o Master's degree
- o Ph.D.
- o Other (please specify):

5.
What type of company do you work for? *
Only one possible answer.

- Private company
- Association
- Cooperative
- Professional and technical organization
- Other (please specify):

6.
In which sector does your company mainly operate (Valhor ranking? *
Only one possible answer.

- If Production sector, specify:
  - Nurseries
  - Horticulturalists
  - Cut flowers
  - Mixed producers
  - Other (please specify):
- If retail sector, specify:
  - Garden centers
  - Agricultural Self-Service (LISA)
  - Florists
  - Wholesalers
  - Cooperatives
  - Other (please specify):
- If landscape, specify:
  - Landscape companies
  - Landscape designers
  - Other
- If others sector, please specify:
  - Other (please specify):

7.
What is the name of the company you work for? (not mandatory)

8.
Approximately how many people work in the company, all locations combined? *
Only one possible answer.

- 0 to 5
- 6 to 20
- 21 to 50
- 51 to 100
- 101 and more

9.
You sell to... *
Only one possible answer.

- Producers
- Wholesalers
- Florists
- Garden centers
- Large and medium-sized retailers
- Landscape companies

- Local authorities
- Agricultural Self-Service (LISA)
- Other (please specify):

10.
You buy to... *
Only one possible answer.

- Producers
- Wholesalers
- Florists
- Garden centers
- Large and medium-sized retailers
- Landscape companies
- Local authorities
- Agricultural Self-Service (LISA)
- Other (please specify):

Part 2: Questions about your industry

11.
On a scale of 0 to 10 (0 being none and 10 being all), how much confidence do you have in your suppliers? *
Only one possible answer.

0	1	2	3	4	5	6	7	8	9	10

12.
On a scale of 0 to 10 (0 being none and 10 being all), how much confidence do you have in your customers? *
Only one possible answer.

0	1	2	3	4	5	6	7	8	9	10

13.
On a scale of 0 to 10 (0 being none and 10 being all), how confident are you in your competitor? *
Only one possible answer.

0	1	2	3	4	5	6	7	8	9	10

14.
If you are familiar with INRAE, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

15.
If you are familiar with ASTREDHOR, on a scale of 0 to 10 (0 meaning none and 10 total), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

16.
If you know the BHR, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

17.
If you are familiar with the Chamber of Agriculture, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

18.
If you are familiar with the FNPHP, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

19.
If you are familiar with VEGEPOLYS VALLEY, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

20.
If you know Valhor, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

21.
If you are familiar with Plante et Cité, on a scale of 0 to 10 (0 meaning none and 10 meaning all), how satisfied are you? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

22.
Which organizations do you work with? *
Only one possible answer.

- ASTREDHOR
- BHR
- Chambre de l'agriculture
- FNPHP
- INRAE
- Plante et Cité
- Valhor
- VEGEPOLYS VALLEY
- Other (please specify):

23.
Do you have any comments on professional organizations?

24.
On a scale from 0 to 10 (0 being not at all and 10 being very much so), do you think collective action can encourage innovation? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

25.
On a scale of 0 to 10 (0 being not at all and 10 being very much so), do you think that professional organizations can encourage company takeovers? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

26.
On a scale of 0 to 10 (0 being not at all and 10 being very much so), do you think that a pooled system can solve your logistics problems? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

27.
On a scale of 0 to 10 (0 being not at all and 10 being very much so), do you think that a cooperative organization can address the following supply-side issues? *
Only one possible answer.

I don't know	I don't have any relationship	0	1	2	3	4	5	6	7	8	9	10

28.
To divide you into two groups, please indicate whether the last 2 digits of your telephone number (the 9th and 10th digits) are between: *
Only one possible answer.

- **00 and 49** *(group 1, answers to question 18 were proposed in ascending order)*
- **50 and 99** *(group 2, answers to question 18 were proposed in descending order)*

Part 3: Strategic games

We're going to offer you some strategic games.
You'll earn between €5 and €25.
Your winnings will be paid out in Illicado vouchers. It's a coupon for purchases in many of the stores you usually visit. You'll find out your winnings on October 30, and the voucher will be sent to you in the first half of November.
In this game, you'll be playing with three other players you don't know and can't communicate with. A benefactor gives each player €10, on condition that they participate. He explains the rules of the game.
« You'll each put whatever amount you want into the public good. I'll multiply the total amount by two, then divide it equally between the four of you, regardless of the amount you put in. So, you'll each receive a quarter of the public good, in addition to the amount you've kept. »

29.
How much do you put in the public good: *
Only one possible answer

- 0€
- 5€
- 10€

30.
How much do you think the other three players will contribute to the public good? *
(This question was proposed in ascending order for Group 1, and in descending order for Group 2)
Only one possible answer.

- 0€ (0€ - 0€ - 0€)
- 5€ (5€ - 0€ - 0€)
- 10€ (5€ - 5€ - 0€ or 10€ - 0€ -0€)
- 15€ (5€ - 5€ - 5€ or 10€ - 5€ - 0€)
- 20€ (10€ - 5€ - 5€ or 10€ - 10€ - 0€)
- 25€ (10€ - 10€ - 5€)
- 30€ (10€ - 10€ - 10€)

Chapter 2

Can in-group favoritism foster cooperation in the industry? A 5-day field experiment[1]

[1]This chapter is based on a working paper co-authored with Serge Blondel, and Marianne Lefebvre.

2.1 Introduction

Cooperation in supply chains is a key factor affecting the income of small and medium-sized farms, threatening their survival (Berti and Mulligan, 2016). This is particularly noticeable in the horticultural industry[2], which has a long, and complex supply chain, with a large number of actors mostly characterized by small and medium enterprises (Kuntosch et al., 2020), including plant producers, landscapers, and retailers. The French sector is no exception (FranceAgriMer, 2020). Strengthened cooperation between actors in the horticultural value chain, both horizontally, and vertically, is likely to improve competitiveness (Brito et al., 2014; Grega, 2012; Vasse and Wolff, 2022), particularly against European competitors.

Cooperation is defined as situations in which the activities, and/or resources of some independent firms are pooled, and common problems are solved (Elomri, 2015). Enhanced cooperation between landscapers, and producers could be a solution for producers to capture part of the added value, since they have limited market power compared to retailers. Cooperation can reduce production or transaction costs, increase market power, stimulate expertise dissemination, improve efficiency, and/or increase innovation capacities (Biró et al., 2016; Richardson, 1972, 1995), thus contributing to the competitiveness of horticulture (Grega, 2012). For example, cooperation within the horticultural industry made it possible to qualify products as essential during the 2020 lockdown, therefore allowing the reopening of garden centers, and horticultural nurseries. While economic actors are generally reluctant to take collective action (Hardin, 1971), there is evidence that the survival of a firm depends both on the aggressive pursuit of individual returns, but also on cooperation for the resolution of everyday problems of collective action (Ostrom, 2009). Furthermore, there is evidence that individuals cooperate, even when it is

[2]In this article, horticulture means ornamental horticulture.

individually costly (Fehr and Schmidt, 1999; Ledyard, 1995; Rand and Nowak, 2013).

One of the levers envisaged in order to foster cooperation is to first encourage cooperation at the horizontal level (Biró et al., 2016), i.e. between producers of the same sector of the industry (production, distribution or landscape). The sector identity is formed here by individuals with the same economic role, sharing social norms, and a common history. Previous evidence has shown that group identity is an effective way to promote cooperation within groups, since boundaries between the self, and others are blurred by the group identity (Elsenbroich and Payette, 2020; Ockenfels and Werner, 2014; Rabinovich and Morton, 2011; Tajfel et al., 1971).

However, cooperation requires time. Previous literature on how to encourage cooperation in the horticultural industry suggests that the actors cooperate (Ahmad et al., 2021; Musa et al., 2014; Richards et al., 2021), but in a very temporary, and selective way (Blondel and Noet, 2022b). Yet, long-lasting cooperation is necessary to have an impact on competitiveness (Axelrod, 1984; Axelrod and Dion, 1988; Elomri, 2015; Richards et al., 2021).

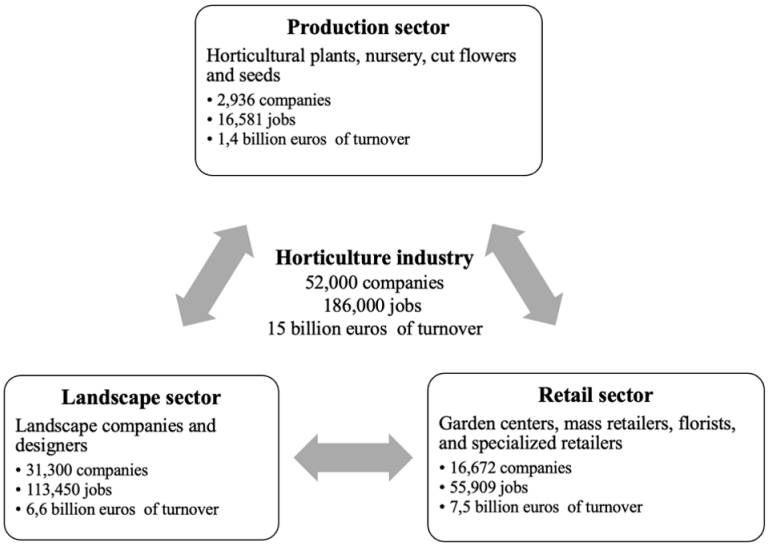
First, we investigate whether cooperation is fostered when individuals belong to the same sector, and whether cooperation tends to fade otherwise. Second, we focus on the effect of repetition on cooperation. We run a field experiment with producers, and landscapers, where we measure how cooperation evolves over 5 days, and whether group identity influences cooperation. We also account for the role of environmental preferences, and attitudes towards collective actions.

The article is structured as follows. Section 2 justifies the analysis of in-group, and out-group cooperation in the horticultural industry and presents the hypotheses to be tested. Section 3 describes the experimental design. Results are presented in section 4, and section 5 acts as a conclusion.

2.2 How to foster cooperation in the French horticultural industry?

2.2.1 Cooperation in horticulture

Figure 2.1: Horticultural Industry Overview



Source: FranceAgriMer (2023) statistics for year 2021

The French horticultural industry is fragmented, complex, with many agents. All of them are represented by an interbranch national organization named VALHOR[3], which is structured in unions speaking for the different sectors of the horticultural supply chain: producers, retailers, and landscapers. Overall, only 13% of French horticulturists belong to a professional organization, compared to 80% in the Netherlands and 60% in Belgium and Germany, its three main competitors (FranceAgriMer, 2023). This low representation of the professional organization limits the success of collective actions.

We provide here examples of collective actions that could benefit to the horticultural industry. Horticultural production is seasonal, living, perishable and fragile. Unlike

[3]Most European countries (except Estonia, Lithuania, and Luxembourg) have professional organizations recognized by the European Commission. However, only France and Hungary have a horticultural interbranch organization, bringing together the industry's professional organizations.
(Source : $https://agriculture.ec.europa.euproducer-and-interbranch-organisations$)

agri-food products, horticultural products are not processed, which means a homogenous product. Producers find themselves in direct competition on an undifferentiated market, so none of them has any market power. Marketing collective actions can enable producers to respond to a larger market, but only six cooperatives, and seven private groups operating in the ornamental horticulture, and nursery sectors were identified as being significantly involved. 57.9% of horticultural companies are producers who sell most of their production directly to the final consumer (making only 25.5% of the horticultural turnover). As a comparison, in the fruit and vegetable sector, 249 groups of producers are significantly involved in marketing, and 70% of production is carried out by mass-market retailers. The fragmentation of horticultural production is an obstacle to cooperation, making it more difficult to rationalize marketing operations.

Secondly, cooperation could improve logistics. With increasing fuel and labor costs, sharing transport activities through common logistics platforms could be of great value. Currently, in regions where no such platform exists, up to five producers can deliver the same garden center the same day, even though they produce in the same geographical area.

Lastly, cooperation could help comply with environmental regulations, and account for consumers' environmental awareness. For example, recycling plastic pots becomes a pressing need.[4]. A collective initiative was launched by the main retailers five years ago, but the charter written by the interbranch organization in 2023 has not been signed by all stakeholders yet. Another example is «the week of flowers for bees», initiated by VALHOR in partnership with the French observatory of bee research. It involves a week, in June each year, meant to raise citizens' awareness on the role of bee-forage plants, and to provide purchase opportunities of such plants. This collective action, involving producers,

[4]The horticultural industry as a whole consumes 770 million plastic pots, for a total weight of around 20,000 tones a year, for sowing, growing, transporting, and selling produce.

landscapers and retailers, can provide both private (sales during that week), and social (biodiversity conservation in the long run) benefits. The success of such an action relies on involving all actors: producers must produce bee-forage plants; distributors must communicate, and offer such plants on sale; landscapers must recommend them. Since the first edition in 2017, 5,000 out of 52,000 companies were involved. While biodiversity protection is in the spotlight, the animation is struggling to federate.

2.2.2 In-group favoritism to enhance cooperation

Group identity is a central concept in understanding phenomena in social sciences (Tajfel et al., 1971). Identity influences social preferences, and thus economic outcomes (Akerlof and Kranton, 2000; Brewer and Gardner, 1996). Previous research in psychology has shown that individuals have the ability to identify with a group very easily and quickly (Balliet et al., 2014; Buchan et al., 2011; Dorrough et al., 2015; Rabinovich and Morton, 2011). Individuals are accustomed to defining themselves in terms of their relationships with others. This «need to belong», which is part of human nature, creates the notion of group, hence the group identity (also referred to indifferently as social identity or group membership). Belonging to a group derives our sense of identity from that group (Chen and Li, 2009; Vaidyanatha and Charness, 2020).

Individuals also tend to compare their group with others, and favor their own (Bacharach, 1999; Charness et al., 2007; Chen and Li, 2009; Duijf, 2021; Tajfel et al., 1971). Within a group, individuals can agree to limit their individual gains in order to preserve a collective good (Brewer and Gardner, 1996; Zhang, 2019), or decide to work together to solve a task (Tan, 2021).

In-group favoritism has been observed in a wide range of situations, reviewed by Li (2020): social preferences (Goette et al., 2006, 2012a), gift exchange relationships (Vaidyanatha and Charness, 2020), trust (Falk and Zehnder, 2013; Gupta et al., 2018),

reciprocity (Chen and Li, 2009), cooperation (Goette et al., 2012b; Guala et al., 2013), coordination (Thom et al., 2022), punishment, or/and competition (Goette et al., 2012b). For example, in an experiment in which Swiss army officers were randomly assigned to platoons during a four-week training phase, Goette et al. (2006) found higher cooperation when interacting with members of their own platoon (69% in-group cooperation vs. only 50% out-group). In a door-to-door field experiment based on the prisoner's dilemma (PD) game with Japanese villagers, Mitani (2022) also found evidence of in-group favoritism in cooperation.

Experimental approaches have been favored to measure, and observe the impacts of group identity, and in-group favoritism, mainly due to data scarcity on identity, and the difficulty to isolate causal relationships between social identity, and economic choices using observational data. Experiments have focused both on naturally existing group identity (Dorrough et al., 2015; Tiwari et al., 2022), and artificial group identity, induced in the laboratory, through common experiences or common fate (Zhang, 2019). Interestingly, a minimal categorization of group identity is enough to generate in-group favoritism, and out-group hostility in an experimental setting (Charness et al., 2007; Chen and Li, 2009; Ockenfels and Werner, 2014). Our experimental approach builds on previous evidence with other subject pools, with the aim of analyzing whether in-group favoritism can trigger more cooperation in the horticultural industry.

2.3 Experimental design

In this study, we rely on an artefactual field experiment (Harrison and List, 2004) with professionals of the horticultural industry. We compare cooperation level in a PD game repeated over 5 days, where subjects are matched in-group (a landscaper with a landscaper or a producer with a producer), and out-group (a producer with a landscaper). The design

and hypotheses have been pre-registered[5]. The game has been designed in order to test two hypotheses: (H1) There is more cooperation in-group than out-group; (H2) Common views on attitudes towards collective actions, and environmental attitudes can influence cooperation in the game. The hypotheses were elaborated on the basis of a literature review, as well as discussions with staff of the interbranch organization, corroborated by a forecast survey (Appendix C) (DellaVigna et al., 2019).

2.3.1 Game

The prisoner dilemma

The PD game is a suitable framework for studying two-by-two negotiation relationships. In the PD, each player has an incentive to defect regardless of what strategy they believe the other player will adopt. In psychological research on social identity theory, the PD is known as the Hi-Lo game[6], and is used to detect group membership (Duijf, 2021). The PD game is also used to analyze decisions on the use of common resources or public goods (Carrozzo Magli and Manfredi, 2022; Diekert, 2012), and to model bargaining games through a two-to-two structure (Madani, 2013)[7]. PD game have been used to study in-group favoritism in cooperation by Dorrough et al. (2015); Tiwari et al. (2022); Mitani (2022).

The PD game is presented as follows to the participants: Each subject starts with €50. The player can keep it or give it to the other player. When he gives it, the sum is multiplied by two, and the other player receives €100. Therefore, if both players make the same decision, they both win €50 if they keep it, and €100 if they give it away. If

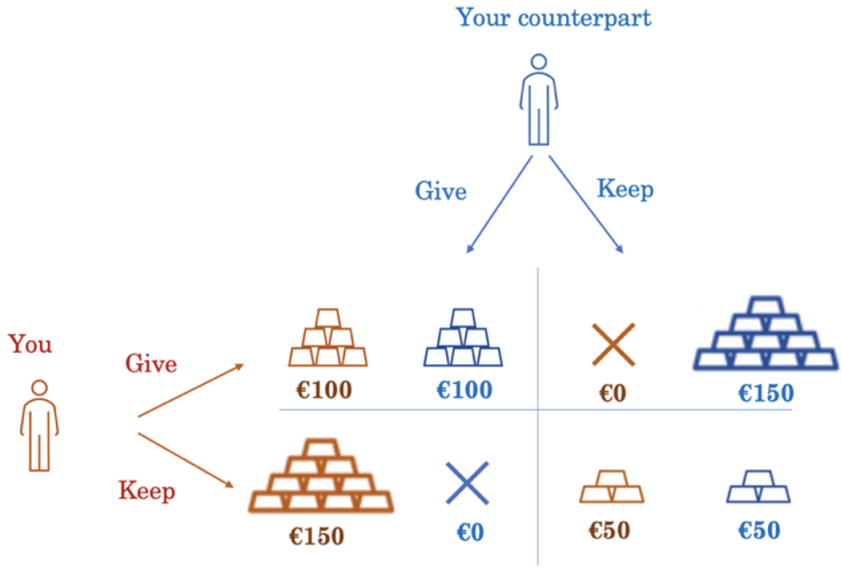
[5] `https://aspredicted.org/K7Z_KXB`

[6] In the Hi-Lo game, Hi means high as the only rational option when an individual tries to answer to the question what we should do, instead of what I should do. High corresponds to choosing the social optimum in a standard PD.

[7] To study cooperation in an economic experiment, other authors have relied on the public good game, in which each individual has to pay the cost for cooperation but the benefits resulting from cooperation are shared among all the players (Bohm, 1972; Chaudhuri, 2011; Ledyard, 1995; Nunn and Watkins, 1978).

one player is the only one to donate, he wins nothing, and the other has €150 (€50 kept and €100 received). At the time of the decision, the game was represented in a table summarizing all possible outcomes (figure 2.2).

Figure 2.2: PD Game



Contextualization

The PD game is played in an artefactual framework without referring to any specific opportunity to cooperate. However, professional participants are likely to bring their shared experience on the success, and failure of previous collective actions (Güth et al., 1998; Fleiß and Leopold-Wildburger, 2014), and their beliefs on the challenges faced by the sector. This is reinforced by the first part of the experiment which explicitly refers to the industry's context, in particular a collective action to foster bee-forage plants' production and sales.

A repeated game

Experimental evidence has shown that repetition increases cooperation through a mechanism of punishment and reward, known as shadow of the future (Axelrod, 1984; Axelrod

and Dion, 1988; Dal Bó, 2005; Dal Bó and Fréchette, 2018). However, most studies on group identity have not been designed with repeated games, and rather focus on one-shot interactions (Charness et al., 2007; Weng and Carlsson, 2015). Therefore, they cannot measure how the group identity effect evolves over time. One exception is Dorrough et al. (2015), who observed in a 10-round PD game that in-group favoritism occurs only after some rounds. They use a laboratory experiment where students from the same university or city (vs another university) played a repeated PD game in a one-hour time period.

Most of the experiments mobilizing repeated PD are run in laboratories with students, with a number of repetition going from 10 to 255 rounds, but the rounds are played one after another without any breaks (Andreoni, 1993; Baker and Rachlin, 2001; Dal Bó and Fréchette, 2019; Locey and Rachlin, 2012). The main novelty in our design relies on the repetition of the game for a duration of 5 days. As far as we know, it is the first experiment with professionals over a period of five consecutive working days. With professionals, we had to limit the number of repetitions to 5 to avoid attrition, but our novelty is to observe the impact of repetition at a daily pace. The repetition of the game each opening day from Monday to Friday with a partner-matching design mimics both the long run, and the discontinuity of real professional life interactions. In reality, producers, and landscapers manage several projects at the same time, wait for answers, and come back to decide what to do next, with the possibility to react (or not) to others' actions. With 3 to 21 hours between two decisions, decision making can be more reflective, and less impulsive.

Treatment allocation

To capture the in-group vs out-group effect, we have 3 treatments: P-P: producers are matched with producers; L-L: landscapers with landscapers; P-L: Producers with landscapers. We excluded retailers because of the distortion of market power on this category compared to the other sectors. They are clustered around a limited number of actors with

important market power, including both department stores specialized in gardening (with one big group representing half of specialized distribution), and flower shops, which are predominantly small, and medium-sized companies, but are generally affiliated to a brand name (Herzberg et al., 2022; Kopp and Sexton, 2021; Richards et al., 2021; Sexton, 2013). Being large companies, it would have been difficult to identify one decision maker to take part in the experiment. On the contrary, producers or landscapers are micro-enterprises where it is easier to identify the person in charge of taking strategic decisions regarding cooperation.

Our allocation in treatments is based on self-declaration, with producers, and landscapers declaring themselves according to the sector of their company. Once their type is self-declared, participants are randomly allocated to the in-group or out-group treatment. We assume that group identity naturally exists within a sector since they share similar objectives, experiences, and constraints. Furthermore, the way the sector is structured suggests the importance of production vs landscape group identities. Indeed, there are different unions for horticulturists, and nurserymen (Verdir) and landscapers (FFP), as well as different sectors within the Val'hor interbranch organization. We assume that professionals from the same sector share a common fate, since they operate in the same economic, and social context, and face the same difficulties, such as increasingly stringent environmental regulations, or a tightening market.

2.3.2 Survey administration

The experiment was self-administered online in order to reach a larger number of professionals of the horticultural industry at a national level, and to allow their participation over five consecutive days. Previous evidence has shown that social preferences elicited in the lab, and online are qualitatively very similar (Hergueux and Jacquemet, 2015).

The survey was structured in two parts (the full text of the survey is available in

Appendix C)[8]. Part 1 includes questions to characterize the respondents' profiles, and attitudes towards the environment, and towards collective action. Respondents also self-declared their type (landscapers or producers), and we double-checked this self-allocation on the basis of the name of their company visible in their email address. Four days later, they were invited to take part in part 2. The PD game was accessible every day from Monday to Friday from 6am to 11pm. Subjects knew whether they interacted with someone from their own sector or another but did not know the name of the person nor their company or city[9]. Each decision took no more than two minutes, and could be taken any time between 2 am and 11 pm. In the event of a player failing to respond for a round, we provided a robot that played randomly[10] with those players at midnight every day.

On the first day, prior to taking their decision, each subject indicated their guess on the other's decision (give/keep/don't know). For the next four days, each subject played with the same partner, and learned prior to their decision about the other player's previous decision, and thus about both their own, and the other's gain. Participants were incentivized in part 2. Four pairs of players were randomly selected to receive a purchase voucher of the value of their gains in the game, for one day also randomly selected[11].

The survey was disseminated to a list of contacts built by the authors, based on searches on websites of official organizations, trade shows, and companies with labels[12] in the horticultural industry. We completed our database with Master students in horticulture and landscape, who will enter the labor market in less than 12 months. These students have the advantage of representing a younger population, while already having

[8]The survey was programmed with LimeSurvey for part 1, and oTree for part 2 (Chen et al., 2016).

[9]An odd number of persons participated to the first part. We therefore paired one of the players with two players.

[10]It was programmed to cooperate with a 50% probability.

[11]Two had a day drawn when they hadn't played. The remaining 6 won €100 for 4, €150 for one, and nothing for the last.

[12]Official organizations such as UNEP, FFP, or members of the BHR, trade shows such as the international SIVAL show, the Salon du Végétal, Paysalia, and the labels are horticultural labels such as «Fleurs de France», and «Plante Bleue».

been confronted to the professional environment through internships, and work placements. We sent emails to 1256 producers and landscapers between late December 2022, and early January 2023, together with posts on social networks inviting any professional of the horticultural industry to take part in the survey.

2.4 Results

2.4.1 Sample description

In spite of the challenge that is recruiting professionals to take part in a field experiment (Torres-Guevara and Schlüter, 2016; Weigel et al., 2021), we managed to collect answers from 93 respondents who played the PD game at least one day out of the five (4.8% response rate). The game being repeated over 5 days but not all participants taking part every day, our analysis relies on an unbalanced panel of 330 choices (excluding the choices made by the robot)[13]. Participants played on average 3.63 days over 5. The number of participants each day is visible in Table 2. We have collected 37 complete responses (5 days of playing).

Table 1 describes the characteristics of the sample. Our sample is younger, and more educated than the population. The average total age is 37.0, which is younger than the population. While this is common with on-line surveys targeting agricultural producers, here it is also due to one third of the sample being students. The corollary is that the sample is more educated than the population: respondents have studied on average 3.8 years after secondary school, while only 40% in the population have received higher education (96% in the sample). The average company size is significantly higher in production compared to landscape, as observed in the population.

[13]The sample size is slightly lower than the pre-registered minimum sample size required to test our hypotheses with 80% power and $p<0.07$.

Table 2.1: Descriptive variables

	Landscapers *(n=39)*			Producers (n=54)		
	Sample		Population	Sample		Population
	Mean	St dev	Mean	Mean	St dev	Mean
Student	29%			36%		
Man	50%			67%		
Age (in years)	36.6	11.7	44.0	37.6	13.1	48.3
Company Size (in staff number)	70.4	351.4		105.4	435.5	
Education level (years if higher education)	4.1	1.4		3.6	1.3	

Note: Company size is 0 for students unless they provided the size of the company where they are doing their internship. Since students are master's students, their education level is 4 or 5 years of higher education.
Source for population statistics: FNPHP (2020); UNEP (2020)

Table 2.2: Cooperation rate per day

Day	**1**	**2**	**3**	**4**	**5**	**Total**
Cooperation rate	87%	78%	86%	85%	78%	83%
Number of decisions (In-Group; Out-Group)	79 (38;41)	64 (33;31)	69 (34;35)	60 (29;31)	58 (29;29)	330 (163;167)
Daily participation rate*	85%	69%	74%	65%	62%	85%

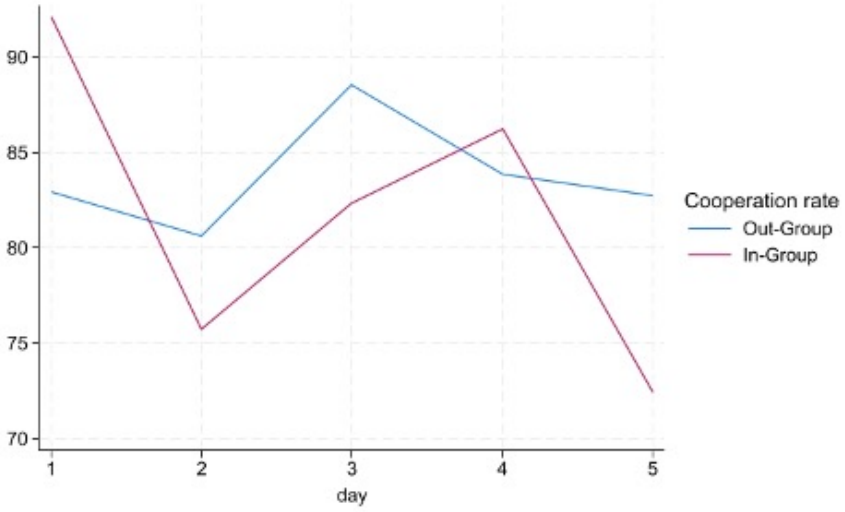
*Nb of decisions/93 participants

2.4.2 Testing hypotheses

To study the effect of in-group vs out-group pair compositions, we estimate the probability to cooperate by the mean of a probit model with random effects. Estimates presented in Table 4 correspond to the unbalanced panel with 330 decisions (n=79 in day 1), but the same analysis is performed on a balanced panel (n=37), and an unbalanced panel with those having played at least 3 days (n=319) as a robustness check (Appendix C). As is commonly done in the experimental literature on cooperation, we distinguish decisions taken the first day, when players only knew whether they were matched with someone from their sector or not, from decisions in days 2 to 4, and the last decision (with a potential end of the game effect). In days 2 to 5, participants learned, before taking their decision, whether the other had cooperated the day before (Güth et al., 1998). In columns 1 and

3, with the variable «Day», we also measure how cooperation evolves over time, and with the variable «Participation», whether more involved participants have different behaviors. We include treatment variables, and control for individual characteristics (gender, age, education in number of years after upper-secondary school, company type, and size), as well as attitudinal characteristics towards the environment, and collective actions.

Figure 2.3: Cooperation rate in % per day and treatment



To analyze whether environmental preferences, and preferences for collective actions explain cooperation in the game, we included attitudinal variables corresponding to answers to the questions presented in Table 3. Environmental concern is usually defined as an individual's insight that humans endanger the natural environment combined with the willingness to protect nature (Franzen and Vogl, 2013). To encompass both aspects, as well as different scales, we asked subjects whether they are sensitive to environmental issues, the loss of biodiversity, and the disappearance of pollinating insects. Respondents could indicate their sensitivity on a five points Likert-scale ranging from very sensitive to very insensitive. Attitudes towards collective actions were measured by a mean of nine items, focusing on levers likely to contribute to the success of collective actions. These items emerged during individual interviews with professionals in the industry conducted

prior to the experiment.

In our sample, respondents are highly concerned by environmental issues in general, and the loss of biodiversity and disappearance of pollinating insects in particular. Among the levers to successful cooperation, sharing common goals rank first, followed by the complementarities between members. We know from the literature that in roles' and tasks' allocation, complementarity is to be preferred to similarity, which is perceived as a source of competition (Potters and Suetens, 2009).

We reduce the number of hypotheses to be tested by reducing the dimensionality of the data (Arpinon and Espinosa, 2023). To do so, with a main component analysis, we aggregated the three variables on environmental attitudes into a single composite variable, and the 9 variables related to attitudes towards collective action into 4 composite variables. The selected composite variables are those with an egen value higher than 1. The four composite variables related to attitudes towards collective actions can be interpreted as follows: collective action will be successful if there is a large number of participants in order to share the financial contribution, and time dedicated to collective action (Prof1AttC); if there is a reduced number of participants with complementarities across members (Prof2AttC); if participants share common goals, and develop, and inter knowledge of the different stakeholders (Prof3AttC); it can benefit from external funding (Prof4AttC). There are no significant differences in the attitudes of students and professionals, nor between producers and landscapers.

The confirmatory analysis does not support the pre-registered hypothesis, and rejects the presence of in-group favoritism over the 5 days (column 1). However, we observe an impact on the first day: there is significantly more cooperation in in-group treatments than out-group (column 2), but this effect does not last over time (columns 3 and 4). Therefore H1's validation needs to be balanced: there is in-group favoritism, but only

on the first day of the game. Moreover, the end-of -game effect seems more pronounced in-group than out-group (as visible in Figure 3), this difference is insignificant. Overall, in this experiment cooperation is higher than usually observed (Andreoni and Miller, 1993; Axelrod, 1984; Axelrod and Dion, 1988), and remains high over time, with no significant effect of time (variable "Day"), and end of the game effect (Dal Bó, 2005). Results concerning H1 are confirmed by robustness checks run on the sub-sample of those who played for at least 3 days, but we find no evidence of in-group favoritism, even on the first day, in the balanced sample of those who played 5 days (Appendix C). The effect size is probably too small to be detected on the small sample size of the balanced panel (n=37). We find that gender, age, and being a student compared to being a professional significantly impact cooperation in some of the models, but with no robustness across the different models.

While pro-environmental attitudes only have a significant impact on the first day, attitudes towards collective action have more lasting impacts. In particular, those with higher scores for the Prof1AttC, and Prof4AttC composite variables, which can be interpreted as more opportunists with regard to the benefits of collective actions, have a significantly lower probability of cooperating. These results only partially confirm H2.

2.4.3 Further exploratory analysis

Furthermore, we explore additional unregistered hypotheses. We focus on the strategies used by players, in reaction to their beliefs on the other's decision (for the first day), and in reaction to the other's decision the previous day (from days 2 to 5).

Concerning beliefs declared prior to the first decision, the proportion of players believing the other will cooperate is higher in-group (31/45) than out-group (26/48) (z=1.79, Table 5). This can be interpreted as a sign of a priori in-group favoritism: respondents are more confident that cooperation will take place when they are matched in-group. How-

Table 2.3: Attitudes towards the environment and collective action – Principal Component Analysis (n=93)

Attitudes towards the environment	**Overall, to what extent are you sensitive to .....?** **Very sensitive (5)** **Rather sensitive (4)** **Neither sensitive nor insensitive (3)** **Rather insensitive (2)** **Very insensitive (1)**					
				Average score	Eigen Vector (Prof1Envt)	
	environmental issues (for example climate change, pollution or water scarcity, etc.)?			4.58	0.5698	
	the loss of biodiversity?			4.59	0.5852	
	the disappearance of pollinating insects?			4.60	0.5770	
Attitudes towards collective actions	**In your opinion, to what extent each of these factors can contribute to the success of collective action in the horticultural industry?** **Strongly agree (5)** **Agree (4)** **Neither agree nor disagree (3)** **Disagree (2)** **Strongly disagree (1)**					
		Average score	Eigen Vector (Prof1AttC)	Eigen Vector (Prof2AttC)	Eigen Vector (Prof3AttC)	Eigen Vector (Prof4AttC)
	Inter Knowledge of stakeholders	4.01	0.3247	0.2255	0.4502	0.0739
	Sharing a common, clearly defined goal	4.52	0.2604	-0.0406	0.4737	-0.3003
	The complementarity in the tasks and know-how of each	4.42	0.3391	0.4042	0.0596	-0.3877
	The fair sharing of time dedicated to collective action between participants	3.91	0.4713	0.3176	-0.0507	0.0617
	The financial contribution of each of the participants (contribution, joint investment, etc.)	3.26	0.3538	0.0537	-0.3482	0.2110
	The possibility of obtaining external funding	4.07	0.2909	-0.1474	0.1811	0.7359
	The ability to see the results of the action quickly	4.02	0.1264	0.3391	-0.5952	-0.0653
	A reduced number of participants	2.49	-0.2942	0.5512	0.0830	0.3996
	A large number of participants	4	0.4211	-0.4897	-0.2272	-0.0149

ever, there are no significant differences between the in-group, and out-group treatments on how people adapt their decision to their beliefs. In other words, individuals who play with another member of their own sector are more optimistic, but not more reciprocal. This is due to the fact that, overall, the cooperation rate is high, and believing the other will cooperate is nearly perfectly correlated with the decision to cooperate the first day. Only two did not reciprocate (one cooperated while thinking the other would not, and one did not cooperate, while thinking the other would).

We further analyze reciprocation through the choices made once knowing the other's decision the previous day. While cooperation is lower when the other did not cooperate the previous day, this effect is significantly stronger in-group than out-group (Tables 5 and 6). This suggests that professionals of the horticultural industry are more willing to punish their peers than strangers. These results confirm in-group favoritism, and are

Table 2.4: Decision to cooperate (panel probit) – unbalanced panel – Average marginal effects.

	(1)	(2)	(3)	(4)
	All days	First day	Days 2 to 4	Day 5
OutGroup	-0.0290	-0.224**	0.0278	0.0838
	(-0.44)	(-2.45)	(0.37)	(0.72)
Day	-0.0191		0.0348	
	(-1.49)		(1.46)	
Participation (Nb of days)	0.0229			
	(0.88)			
Man	-0.0188	-0.156*	0.0968	0.000123
	(-0.30)	(-1.87)	(1.15)	(0.00)
Age	-0.00471	-0.000476	-0.00964**	-0.00977
	(-1.16)	(-0.10)	(-2.12)	(-1.22)
Education	-0.0408*	-0.0329	-0.0387	-0.0383
	(-1.87)	(-1.07)	(-1.53)	(-0.83)
Student	-0.146	-0.102	-0.223*	-0.217
	(-1.28)	(-0.71)	(-1.73)	(-1.03)
Producer	-0.0378	0.00936	-0.0263	-0.140
	(-0.62)	(0.11)	(-0.36)	(-1.20)
Company Size	0.0000924	0.000273	0.0000327	0.0000567
	(0.80)	(1.20)	(0.26)	(0.20)
Prof1Envt	0.00984	0.0524**	0.0104	-0.0388
	(0.45)	(1.99)	(0.41)	(-0.79)
Prof1AttC	-0.0366**	-0.0190	-0.0319	-0.0347
	(-2.04)	(-0.78)	(-1.54)	(-0.83)
Prof2AttC	0.00229	-0.00293	0.0159	-0.0325
	(0.09)	(-0.08)	(0.52)	(-0.73)
Prof3AttC	0.00999	0.0512	-0.0133	-0.0403
	(0.40)	(1.33)	(-0.44)	(-0.70)
Prof4AttC	-0.0681**	-0.101*	-0.0634*	-0.0801
	(-2.12)	(-1.66)	(-1.67)	(-1.14)
N	330	79	193	58

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

consistent with the literature (Barreda-Tarrazona et al., 2017; Duffy and Ochs, 2009; Kloosterman, 2020; Mengel, 2014).

Table 2.5: Decision to cooperate and beliefs in day 1

		In-group			Out-group	
		Cooperate (G)	Do not cooperate (K)		Cooperate (G)	Do not cooperate (K)
Believe the other will cooperate	**31**	30	1	**26**	26	0
Believe the other will not cooperate	**3**	1	2	**4**	0	4
I don't know whether the other will cooperate	**4**	4	0	**11**	8	3

Table 2.6: Conditional strategies in days 2 to 5

	In-group			Out-group		
My decision Day d	Cooperate (G)	Do not cooperate (K)	% of cooperation	Cooperate (G)	Do not cooperate (K)	% of cooperation
Other's decision Day d-1						
Cooperate (G)	82	15	85%	79	17	82%
Do not cooperate (K)	17	11	61%	27	3	90%

Table 2.7: Decision to cooperate, conditional on the other's decision the previous day – Panel probit – Days 2 to 5

	Days 2 to 5
OutGroup	-0.0446
	(-0.68)
lag1NoCoopOther	-0.180**
	(-2.47)
lag1NoCoopOtherxOutGroup	0.188*
	(1.67)
N	330

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

2.5 Conclusion and discussion

In order to understand the bottlenecks to cooperation in the horticultural industry, we ran a field experiment with professionals based on a PD game repeated over five days. While horizontal, and vertical cooperation in the horticultural industry is limited, we observe a high rate of cooperation in the field experiment: 73.9% of players gave over the 5 days regardless of the other player's decisions. Furthermore, the proportion of cooperative decisions was stable over the 5 days, with no end-of-game effect. On the contrary, previous evidence has shown that the cooperation rate drops over time. People switch to free-riding when they observe selfish behavior in their group or towards the end of the game, when no more interactions are foreseen (Axelrod, 1984; Dal Bó, 2005; Gächter and Thoni, 2005; Guido et al., 2019; Keser and Van Winden, 2000). Here, respondents are willing to maintain cooperation, independently from the decision taken by the other in the previous round (which has no impact).

In this context, a burning question is how to initiate cooperation. Our results suggest that in-group favoritism can be used to trigger cooperation, but do not guarantee

cooperation will be sustained. Professionals from the horticultural industry know that cooperation is overall low, but it does not seem to have influenced their beliefs in the game. We find that professionals from both sectors share the same views on the key factors to successful collective action, and these attitudes can trigger more or less cooperation. Common views on how to achieve cooperation is instrumental to triggering more optimistic beliefs. This could help professionals move away from the idea that their peers from the horticultural industry do not cooperate or believe that they are always more committed to cooperation than the other sector.

Attitudes pro-environmental, and pro-collective actions in an ingroup context have a significant impact on the first day. In the context of flower for bee's week, this collective action can be considered as the first day's decisions, since individuals have the choice of participating or not in the event. The first stage of the game is essential to foster cooperation. To activate in-group favoritism, one needs to make sure that professionals can identify with their sector. Once a person considers themselves to belong to a group, they derive self-esteem from this group membership, and adopt behaviors consistent with the stereotypes associated with the group identity (Chen and Li, 2009). They compare their group to others, creating a bias in favor of the group to which they belong, even if their group identity can have a negative connotation, such as with inmate groups (Balafoutas et al., 2020). Group identity allows the other to be seen as a partner (Jiang and Wu, 2019), and makes individuals take decisions as members of a team, rather than individual profit-maximizing ones (Tajfel et al., 1971). Making the identity «horticultural industry» more salient, rather than sector identities (production vs landscape), could trigger more cooperation between landscapers, and producers, generate more benefits, and be more sustainable over the long run. It could be as nudging the professionals. However, these hypotheses remain to be tested. As far as attitudes pro-environmental, and pro-collective actions are concerned, we need to quickly identify favorable profiles to avoid free riders

who could sabotage the collective action.

We show here that it is possible to mimic day-to-day economic behavior with an original field experiment design. Our results shed light on the behavior of professionals of the horticultural industry, and contribute to a better understanding of cooperation, and the role of in-group favoritism in social preferences. One obvious limitation of our study is the high attrition rate between the first part, and second part of the experiment. We strongly encourage replication of this experiment in other countries, and among other professionals to shed light on the external validity of the results (Finger et al., 2023; Torres-Guevara and Schlüter, 2016).

Appendices

Appendix C

Can in-group favoritism foster cooperation?

Survey

Forecast survey (translated from French)

Cooperation in the horticultural industry: Experts' prediction survey

The aim of our research is to understand the factors that might encourage cooperation in the horticultural industry, particularly in the context of collective actions such as Flowers for Bees Week.
Different actors in the industry need to cooperate for such actions to work, especially horticulturists and landscapers. In this study, we analyze whether strengthening interactions between horticulturists, landscapers, or landscapers and horticulturists, is likely to foster cooperation.

We would like your feedback, as a professional involved in the horticultural industry, on the configurations in which horticulturists and landscapers are more likely to cooperate.

Our study is conducted by researchers working at the University of Angers, with no commercial or political aims. Completing the survey will take less than 10 minutes.

This study is anonymous. Neither your name nor that of your company will be asked. In accordance with the principles of open science, and in compliance with the General Data Protection Regulation, the data will be archived and made publicly available.

The results will be sent to you on request, by filling in your e-mail address at the end of the questionary. For further information on the results, please send a message to:
ngoc-thao.noet@etud.univ-angers.fr

We thank you in advance for your participation.

There are 20 questions in this questionary.

1. Our measure of cooperation

We use the tools of experimental economics, which allows us to observe decisions in a controlled setting, when it is not possible to observe all the configurations that interest us in real life.

To measure cooperation in different settings, we rely on a game often used in experimental economics, called the «prisoner's dilemma». The rules of this game are as follows:

- ⇒ Each person responding to the survey is associated with another person, whose identity does not know, and with whom he cannot communicate.
- ⇒ Each person receives an initial endowment of €50, which they can decide to keep or give, knowing that the sums given are multiplied by 2.

So, at the end of the game, there are three possible scenarios:

1) If both give the initial endowment, both have €100. This is the situation where the overall payout is maximum. This is the scenario where the players cooperate.
2) If both keep the initial endowment, both have €50. This is the situation where the overall payout is minimal.
3) If one gives away the initial endowment, but the other keeps it, the one who kept has €150 (maximum individual gain) and the one who gave away has €0 (minimum individual gain).

This game will run for 1 week. It will be repeated 5 times (once a day) with the same pairs of players. From the second day onwards, players are informed of the previous day's results before playing again.

The following figure summarizes the possible gains:

In order to analyze the context in which horticulturists and landscapers are most likely to cooperate, we will test three settings:

- Horticulturists play with horticulturists.
- Landscapers play with landscapers.
- Horticulturists play with landscapers (mixed pair)

At the end of the week, we'll randomly draw a pair of players in each of the three settings. The 2 players in the pair drawn will win the average amount earned over the 5 days.

2. Your opinion

We'd like your opinion, as a professional involved in the horticultural industry on the game settings in which horticulturists and landscapers are most likely to cooperate, i.e., to donate their initial endowment.

Your answers will be processed qualitatively, to validate our hypotheses. Don't hesitate to express your opinion, even if you don't know for sure!

As a reminder, the game is as follows:

In your opinion, in <u>the Horticulturist / Horticulturist pairs</u>, what proportion of players will give their initial endowment?

⚠Your answer must be between 0 and 100.

⚠Only whole numbers may be entered in this field.

Please enter your answer here:
% who give:

How do you think this proportion will change over the next few days (2 to 5)?

* Please select only one of the following:

- The proportion of players who give will increase.
- The proportion of players who give will decrease.
- The proportion of players who give will be the same every day.
- The proportion of players who give will fluctuate up or down depending on what happened the previous day.
- I don't know.

In your opinion, in the Landscapers / Landscapers pairs, what proportion of players will give their initial endowment?

⚠ Your answer must be between 0 and 100.

⚠ Only whole numbers may be entered in this field.

Please enter your answer here:
% who give:

How do you think this proportion will change over the next few days (2 to 5)?

* Please select only one of the following:

- The proportion of players who give will increase.
- The proportion of players who give will decrease.
- The proportion of players who give will be the same every day.
- The proportion of players who give will fluctuate up or down depending on what happened the previous day.
- I don't know.

In your opinion, in the Horticulturist / Landscapers pairs, what proportion of players will give their initial endowment? *

⚠ Your answer must be between 0 and 100.

⚠ Only whole numbers may be entered in this field.

Please enter your answer here:
% who give:

How do you think this proportion will change over the next few days (2 to 5)?

* Please select only one of the following:

- The proportion of players who give will increase.
- The proportion of players who give will decrease.
- The proportion of players who give will be the same every day.
- The proportion of players who give will fluctuate up or down depending on what happened the previous day.
- I don't know.

To what extent do you think players will take the other player's location into account before deciding whether to keep or give?

*Please select only one of the following:

- Players are more sensitive to the other player's location than to their type (Horticulturist or Landscaper).
- Players are more sensitive to the other player's type (Horticulturist or Landscaper) than to his location.
- Both factors (location and type) are equally important
- I don't know.

3. Your profile

You work in connection with the plant industry.
What is your area of expertise?

* Please select only one of the following:

- Teaching and research

- Industry leadership
- Technical and/or commercial support
- Other… please specify.

How many years have you been working in the plant industry?

What is the name of your employer?

Can you specify your company's postal code?

If you would like to be kept informed of the results of the project, once the survey of horticulturists and landscapers has been completed, please enter your e-mail address. This information will be deleted once the results have been sent.

Thank you for your participation.
Thank you for completing this questionnaire.

Forecast results.

We sent the questionnaire to 20 professionals connected with the industry but not directly active in it, such as university academics, consultants in animation organizations or research engineers. We received 18 responses, but only 7 were fully completed.

The forecaster sample is diverse in terms of seniority in the industry (from 2 to 36 years). Their forecasts are also diverse in terms of the expected level of cooperation: from 0 to 60% for the P/P pair, 0 to 75% for the L/L pair and 0 to 70% for the P/L pair.

Concerning the evolution of the cooperation rate, all forecasters agreed that the cooperation rate will increase over time and will fluctuate according to the other's response.

Survey (translated from French)

We are researchers working for the University of Angers. Our study is completely anonymous and is conducted without commercial or political purposes.

Expected answers

We expect answers from people in charge of strategic decisions in horticultural or landscaping companies.

Data management

This study is anonymous. Neither your name nor your company's name will be asked.
In accordance with the principles of open science, and in compliance with the General Data Protection Regulation, the anonymized data will be archived and made available for scientific use.

Duration

The survey lasts a maximum of 10 minutes. You can stop at any time and resume later, by clicking on the same link.
To return to the questions on the previous page, click on “previous” at the bottom left of each page but do not go back on the browser, otherwise your answers will not be recorded.

In addition to this short questionnaire, we offer you an online game with other horticulturists and landscapers. Your answers will allow us to make useful recommendations to your industry.
This game will take you a maximum of 2 minutes per day from Monday January 16, 2023, to Friday January 20, 2023.
On each of these days, you can play at any time of the day or night!

To thank you

For each complete answer, you will be entered into a draw that could make you win up to €150, depending on your answers in the game.

Contact

For any question:

There are 28 questions in this questionnaire.

1. Consent

Consent *
Please select only one of the following:
I confirm that I have read and understand the above information. I am at least 18 years old, and I give my consent to participate in this study.
I do not give my consent to participate in this study.

2. Your profil

You are: *

Please select only one of the following:

- man
- woman

Your year of birth:

* Please write your answer here:

You are: *

Please select only one of the following:

- Executive
- Employee
- Other

What is your education level? *

Please select only one of the following:

- No diploma
- BTEC and before
- Bachelor's degree
- Master's degree
- PhD
- Other

In which sector do you work? *

Please select only one of the following:

- Horticultural production
- Landscape sector
- Other
- Thank you for your participation. Our questionnaire is only for horticultural producers and landscape professionals.

Answer this question only if the following conditions are met: The answer was 'Other' to question '6 [Q006]' (In which sector do you work?)

In what type of structure do you work? *

Please select only one of the following:

- Private company
- Association
- Other

What is your job? *

Please select only one of the following:

- Nurseryman
- Horticulturist
- Cut flower grower
- Mixed category grower
- Other

What is your job? *

Please select only one of the following:

- Landscape contractor
- Landscape designer (or similar)

- Other

Did you participate in our survey (University of Angers - Cooperation Sector) in January 2022? *
Please select only one of the following:
- Yes
- No

Did you participate in our survey (University of Angers - Cooperation Sector) in October 2022? *
Please select only one of the following:
- Yes
- No

Approximately how many people (employees, non-employees, or FTEs) work in the company at all locations? *
Please write your answer here:

3. Your opinion on an action implemented by the industry.

Overall, how sensitive are you to environmental issues (e.g., climate change, pollution, water scarcity, etc.)?
Please answer these questions as if you were in a professional context.
Please select only one of the following:
- Totally sensitive
- Somewhat sensitive
- Neither sensitive nor insensitive
- Somewhat insensitive
- Totally insensitive

Overall, how sensitive are you to the loss of biodiversity? *
Please select only one of the following:
- Totally sensitive
- Somewhat sensitive
- Neither sensitive nor insensitive
- Somewhat insensitive
- Totally insensitive

Overall, how sensitive are you to the disappearance of pollinating insects?
Please select only one of the following:
- Totally sensitive
- Somewhat sensitive
- Neither sensitive nor insensitive
- Somewhat insensitive
- Totally insensitive

Are you familiar with Flower Week for Bees?
Please select only one of the following:
- Yes
- No

The "Flowers for Bees Week" is a citizen awareness week conducted by Val'hor in partnership with the French Observatory of Apidology. By allowing the public to discover the role of melliferous plants and to buy some, this collective action contributes to the fight against the disappearance of pollinating insects, and to the preservation of biodiversity. During a week in June, animations highlight the honey plants and their role for the biodiversity.

Answer this question only if the following conditions are met: The answer was 'No' to question '17 [Q106]' (Do you know about the week of flowers for bees?)

Have you ever participated in Flowers for Bees Week?

Choose the appropriate answer for each item:

	YES	NO
2022		
2021		
2020		
2019		
2018		
2017		

4. Your opinion on a collective action

Do you think that a collective action such as Flowers for Bees Week can improve the general public's recognition of the role of plants in the preservation of pollinating bees? *

Please select only one of the following:

- o Yes
- o No

Do you think that a collective action such as Flowers for Bees Week can help increase sales of honey plants? *

Please select only one of the following:

- o Yes
- o No

Are you planning to participate in Flowers for Bees Week 2023? *

Please select only one of the following:

- o Yes, probably.
- o Yes, maybe.
- o No
- o Don't know.

To what extent do you think each of these factors can contribute to successful collective action in the horticultural industry? *

Please select only one of the following:

Choose the appropriate response for each item:

	Definitely	Somewhat yes	Somewhat no	Not at all	Don't know
Inter-knowledge of the stakeholders					

	Definitely	Somewhat yes	Somewhat no	Not at all	Don't know
Sharing a common goal, clearly defined objective					
Complementarity in the tasks and know-how					
Equitable time allocation between the participants					
Financial contribution of each participant					
Getting external funding					
Seeing the effects of the action quickly					
Small number of participants					
Large number of participants					

If you wish to specify other factors of success of a collective action, you can use the space below.
Please write your answer here:

We will now invite you to an online game with other producers and landscapers in the next few days.
This game will take you a maximum of 2 minutes per day from Monday, January 16, 2023, to Friday, January 20, 2023.
Each day, you can play at any time of the day or night!
For each complete answer, that is to say 5 answers sent during these 5 days, you will be able to participate in a draw which could make you win up to €150, according to your answers in the game.

Please indicate here your email address to receive the instructions of the game.

This information will then be destroyed, and the data processed anonymously.

5. Your comment

Would you like to receive the results of this study by e-mail in 2023? *
Please select only one of the following:
- Yes
- No

Please specify your e-mail address.

Please write your answer here:

If you have any comments, please feel free to use the space below.

Please write your answer here:

Thank you for your participation.
Send your questionnaire.
Thank you for filling out this questionnaire.

The game with oTree: what participants see.

Memento for the strategic game over 5 days, from January 16 to 20

You **are 64 from the landscaping sector** and **68 from the horticultural sector**.

All games are played 5 times for 2, always with the same player.

You will be in one of the following three groups:
Group 1: 34 from the horticultural sector playing as a horticultural/horticultural pair
Group 2: 34 from the horticultural sector and 34 from the landscape sector playing as a horticultural/landscape pair
Group 3: 30 from the landscape sector playing as a landscape/landscape pair.

At the end of the game, 4 pairs of players out of 66 will be drawn, under the control of our financial manager: you therefore have a 6.06% probability of winning prizes. The decision of one of the 5 days will be drawn to determine the value of the prizes, which will range from €50 to €150, in Illicado vouchers.

You will play on January 16, 17, 18, 19 and 20 between 2 a.m. and 11 p.m. Each time, it will take a maximum of 2 minutes, by clicking on the following link https://abeille49.herokuapp.com/room/Abeille
For any information, contact by email vegetal@univ-angers.fr

Bienvenue (*Welcome*)

Veuillez saisir votre label de participant
(*Please enter your participant label*)

Suivant (*Next*)

Le jeu peut commencer
(*The game can begin*)

Suivant (*Next*)

2.

Voici le temps qu'il vous reste en minute avant ce soir 22h00 pour répondre : **473:10**
(*Strategic games*)

Quatrième Tour (*Fourth round*)

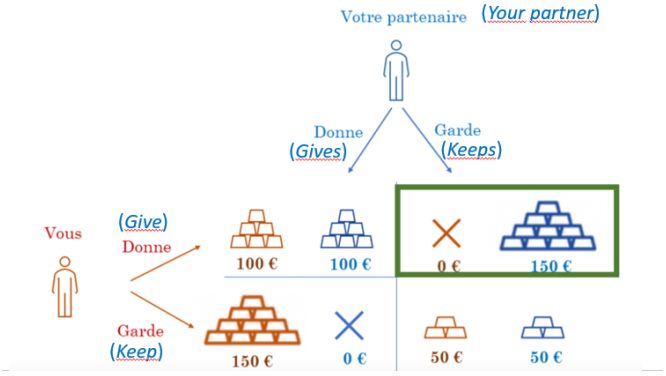
Vous rejouez pour ce quatrième jour le même jeu, avec ce même joueur d'un autre secteur
Vous aurez à nouveau 50€, sous condition d'y participer.
Les règles du jeu sont les mêmes.
Chacun garde ou donne à l'autre les 50€, sachant que les sommes données sont multipliées par 2. Donc, si vous gardez, vous avez 50€, et si vous donnez, l'autre personne a 100€.
Si les 2 donnent ce montant, les 2 ont chacun 100€.
Si les 2 gardent ce montant, les 2 ont chacun 50€.
Sinon, celui qui garde ce montant a 150€ et celui qui donne ce montant a 0€.

(*On the fourth day, you play the same game again with the same player from a different sector:*
You'll get another €50, provided if you participate. The rules of the game remains the same.
Each player keeps or gives the other the €50, knowing that the sums given are multiplied by 2. So if you keep, you get €50, and if you give, the other person gets €100.)
Si les 2 donnent ce montant, les 2 ont chacun 100€.

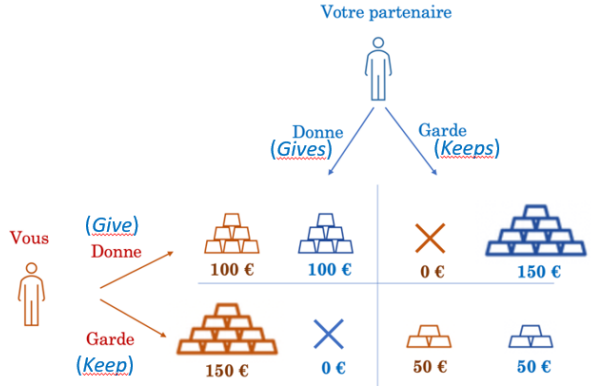
4.

Voici ce qui s'est passé hier : *(Voici ce qui s'est passé hier)*

Au tour 1 vous remportez : 0,00 € *(In round 1 you win €0)*



5.



Que faites-vous ? *(Que faites-vous?*

- Garder les 50€ *Garder les 50€*
- Donner les 50€ *Donner les 50€)*

Vous êtes au tour : 4 *(You are in round 4)*

Suivant

Additional econometric results

Table C.1: Panel with those having played at least 3 days (n=319)

	(1) Days 1 to 5	(2) Day 1	(3) Days 2 to 4	(4) Day 5
OutGroup	-0.0324	-0.236**	0.0369	0.0833
	(-0.46)	(-2.42)	(0.47)	(0.70)
Day	-0.0168		0.0345	
	(-1.24)		(1.43)	
Man	-0.00660	-0.155*	0.0872	0.00728
	(-0.10)	(-1.68)	(1.02)	(0.05)
Age	-0.00539	-0.000552	-0.0101**	-0.00955
	(-1.23)	(-0.11)	(-2.18)	(-1.16)
Education	-0.0388	-0.0351	-0.0384	-0.0360
	(-1.64)	(-1.06)	(-1.47)	(-0.75)
Student	-0.186	-0.103	-0.249*	-0.210
	(-1.55)	(-0.67)	(-1.87)	(-0.96)
Producer	-0.0390	0.0154	-0.0416	-0.148
	(-0.59)	(0.17)	(-0.54)	(-1.24)
Company Size	0.000101	0.000290	0.0000394	0.0000532
	(0.84)	(1.19)	(0.31)	(0.18)
Prof1Envt	0.00977	0.0544*	0.0124	-0.0421
	(0.41)	(1.93)	(0.48)	(-0.83)
Prof1AttC	-0.0293	-0.0227	-0.0191	-0.0344
	(-1.42)	(-0.85)	(-0.87)	(-0.80)
Prof2AttC	-0.000839	-0.00188	0.0150	-0.0323
	(-0.03)	(-0.05)	(0.53)	(-0.71)
Prof3AttC	0.00371	0.0559	-0.0222	-0.0375
	(0.13)	(1.35)	(-0.71)	(-0.62)
Prof4AttC	-0.0687**	-0.108	-0.0617*	-0.0815
	(-2.08)	(-1.64)	(-1.66)	(-1.15)
Wald chi2 LR chi2	14.34	13.62	16.06	10.10
N	319	73	189	57

t statistics in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table C.2: Panel with those having played the 5 days (n=37)

	(1) Days 1 to 5	(2) Day 1	(3) Days 2 to 4	(4) Day 5
OutGroup	0.0702	-0.0207	0.162	0.109
	(0.74)	(-0.28)	(1.56)	(0.72)
Day	-0.0368***		0.0137	
	(-2.71)		(0.62)	
Man	-0.0295		0.0891	-0.108
	(-0.32)		(0.81)	(-0.55)
Age	-0.00923*		-0.0114**	-0.0147
	(-1.75)		(-2.24)	(-1.36)
Education	-0.0130		0.0146	-0.0695
	(-0.43)		(0.45)	(-1.08)
Student	-0.297**		-0.197	-0.395
	(-2.33)		(-1.32)	(-1.46)
Producer	0.0309		0.0278	-0.0160
	(0.32)		(0.27)	(-0.08)
Company Size	-0.000744		-0.00108	-0.00235
	(-1.02)		(-0.94)	(-1.20)
Prof1Envt	0.0274		0.0305	0.0190
	(0.88)		(0.86)	(0.23)
Prof1AttC	-0.0153		-0.0234	-0.0195
	(-0.70)		(-0.94)	(-0.36)
Prof2AttC	0.0213		0.0253	-0.0159
	(0.81)		(0.74)	(-0.26)
Prof3AttC	-0.0238		-0.0409	-0.0754
	(-0.74)		(-1.04)	(-0.86)
Prof4AttC	-0.0544		-0.0515	-0.0802
	(-1.52)		(-1.36)	(-0.93)
Wald chi2 LR chi2	21.96	0.08	24.85	10.17
N	185	37	111	37

t statistics in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Chapter 3

Open innovation, risk, and value sharing: a field experiment[1]

[1]This chapter is based on a working paper, co-authored with Isabelle Leroux-Rigamonti, Serge Blondel, and François Pauly.

3.1 Introduction

Innovation as a key factor in improving performance, and gaining continued competitive advantage to ensure the survival of SMEs, is shared by academics, and practitioners (Adam and Alarifi, 2021; Rosenbusch et al., 2011). Based on the principle that collaboration has a positive impact on innovation, open innovation (thereafter OI) more specifically, makes it possible that valuable ideas can emerge, and be commercialized from inside or outside the firm. Firms can use external ideas as well as internal ideas, and internal, and external paths to market, as firms look to advance their technology (Chesbrough, 2003; Chesbrough et al., 2018; Dahlander and Gann, 2010). The idea behind it is that a single organization cannot innovate in isolation (Dahlander and Gann, 2010). It has to engage with different types of partners to acquire ideas, and resources from the external environment to stay abreast of competition. Researchers considered how firms obtained innovation outside the firm, whether from individuals, customers, suppliers, or universities : technology sourcing, and acquisition, strategic alliances with external suppliers of technology, or a collaborative R & D joint venture (West and Bogers, 2014).

Two main theoretical streams can be distinguished. The first stream is run by industrial organization economists: the incentives (i.e., investments), and contributions (i.e., spillovers) of cooperation in innovation for firms in the value chain. The second stream focuses on theoretical contributions, and aims at minimizing transaction costs and exploiting the complementary know-how of partner firms. In both cases, the impact of firm size and the degree of cooperation are considered determinants of the capacity to innovate.

Yet the French horticultural industry[2] is fragmented, with a wide range of actors. It covers horticulture, floristry, and landscaping, representing nearly 186,000 jobs, and a

[2]We focus on horticulture in the French definition, i.e., ornamental horticulture, as opposed to the English sense, which includes all garden crops (hortus), such as fruit and vegetables.

turnover of 15 billion euros. The supply chain is complex with strong international competition. The French trade balance for ornamental horticultural products shows that the deficit remains recurrent, and reached nearly 1,075 million euros in 2021 (FranceAgriMer, 2023). It is therefore necessary to gain competitiveness. Lastly, horticulture remains a sector where a large part of the knowledge is generated informally (Alaie, 2020), which can be problematic in contexts that may require sharing and spreading.

If the horticultural industry has had two serene years since the COVID-19 crisis, the market is becoming tougher, and difficulties are becoming more and more present. The cooperation between the actors in the sector makes it possible to increase the OI, and so competitiveness (Leroux et al., 2014). For example, the issue of water management has already been raised by the actors in the sector. Irrigation is a key element for the good development of crops. Climatic issues, and increasingly frequent droughts have forced public authorities to impose increasingly strict regulations (such as prefectural decrees temporarily restricting certain water uses[3]). In this context, innovation has allowed the use of a drip irrigation system, but this is still unsatisfactory, and needs to be made even more efficient. Other innovative techniques can be developed to help professionals in the sector. This is a common problem for both producers (horticulturists and nurserymen), and retailers such as garden centers, who need to water their stocks of potted plants. This calls for more open, and collaborative innovation.

Research and initiatives on how to foster cooperation in the sector have revealed resistance i.e., resentment after unsuccessful experiments (Blondel and Noet, 2022b). Elomri (2015) defined cooperation as a situation in which the activities, and/or resources of some independent firms are pooled, and common problems are solved. Alós-Ferrer and Garagnani (2020) clarify this definition, and explain cooperation as the act of contributing to a

[3]For example, the June 30, 2023, order on restrictive measures: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000047784127

common, and mutually beneficial goal. In addition, unlike the coordination that allows to work on the determination of this common objective, cooperation refers to the attitudes, behaviors, and results that are related to its implementation, and its realization (Castañer and Oliveira, 2020). More broadly, cooperation can be referred to as the actions generated within a network or by the ability to organize collectively around common projects, i.e., by the realization of collective actions (McCarthy et al., 2004). Collective action relates to the actions of individuals who seek to promote collective interests before their personal interests (Van Zomeren and Iyer, 2009).

While most of the time, studies in the OI literature are run at the firm level, and only a few exceptions are at the project level (Bahemia and Roehrich, 2023; Du et al., 2014). We define OI here as collective action in which individuals cooperate through projects that aim to create innovation. However, innovation is by nature risky, since tangible or intangible results are always uncertain (Gomber et al., 2018), and raise the question of how to share this unsettled outcome in a common project. Moreover, OI, as its name suggests, sets out the idea of openness, which adds a further degree of risk (Dahlander and Gann, 2010; Pisano and Verganti, 2008).

To the best of our knowledge, although there is a broad consensus in the literature on OI, there is no study on individuals' preferences toward taking risks, and sharing outcomes related to innovation creation. Our study aims to explain the key factors revealing individuals' preferences in adopting OI, i.e., in the risk context of innovative projects, considering the uncertain sharing of value. In line with the literature on the projects, and the costs of innovation, but unlike most previous works analyzing the economics, and licensing, we focus on improving cost reduction through risk-taking, and profit-sharing. Our original three-phase design contributes to this gap. Through an artefactual field experiment, we measure behaviors towards risk, time, and loss aversion with Holt and

Laury's mechanism, and the degree of cooperation of professionals in the redistribution of value with the reviewed public good (PG) games.

We believe that we can contribute to providing concrete answers for the levers allowing the realization of successful collective actions. The article is structured as follows. Section 2 further explains the context of the horticulture industry, the challenges of OI, and presents the hypotheses to be tested in the experiment. Section 3 describes the experiment design. Results are presented in section 4, and section 5 provides the conclusion.

3.2 Open innovation, the challenge for the horticultural sector

3.2.1 Horticultural production, technical and complex

The French horticulture, floristry, and landscaping industry counts 52,000 specialized companies, 175,000 jobs, and 15 billion euros in turnover. Horticultural production alone represents 7.8% of agricultural employment. It is one of the most labor-intensive sectors in agriculture. Moreover, France has the particularity of being one of the European Union countries with a high per capita consumption of ornamental plants, with a large population. It has insufficient production to satisfy its domestic market, and is competing in its market. The trade balance is structurally in deficit, and has increased by an average of 23% every year since 2016, accelerating to 26% in 2020 (FranceAgriMer, 2023). The Netherlands is by far the market leader and the main supplier country (61% of total value), and the main customer (28% of total exported value) of France (FranceAgriMer, 2022b).

The report on the competitiveness of the sector (FranceAgriMer, 2020) shows that the Netherlands' lead is mainly explained by R & D indicators, as well as production capacity, where it is well ahead of other countries such as Germany or Spain. Their strengths in conquering the markets are explained by their capacity to innovate, the creation of

quality labels, a mastery of logistics, and especially, a commercial dynamic with a price positioning. Two factors were identified as key elements in improving competitiveness. On the one hand, horizontal cooperation (between production actors such as commercial and logistic groups), and vertical cooperation (between producers, retailers, and the landscape sector, such as the actions developed by the VALHOR interbranch organization), and on the other hand, the development of R & D to foster innovation (Bhat, 2017). This finding makes OI projects an obvious answer to enhancing the competitiveness of the horticultural industry. The ability to generate horizontal and vertical cooperation across the supply chain, enables a better sharing of value within the industry (Biró et al., 2016).

3.2.2 Open innovation as a key to competitiveness

Innovation is one of the most important factors in improving the competitiveness of SMEs (Piperopoulos and Scase, 2009). Jovanovic (1982) argues that size doesn't matter; it's efficiency that determines a firm's growth and survival. Firm's growth is defined as a learning process in which companies that can adopt, and create technologies and knowledge, grow, and survive. As a result, companies that fail to innovate decline and disappear. Innovation can be seen as a process of continuous learning, and research that allows new ideas to be successfully explored on the market, thus improving the performance of firms (Rosenbusch et al., 2011).

In the traditional model, innovation is based on the paradigm of closed innovation. Firms rely mainly on internal knowledge, and skills to develop new innovations. Firms therefore seek to protect internal intellectual property, and avoid or strongly limit interactions and exchanges of internal resources, and knowledge with agents outside the organization (Almeida, 2021). However, opening the innovation process to external parties can be a key element in improving innovative structures (Chesbrough, 2003; Gassmann

et al., 2010; Laursen and Salter, 2006)[4]. For horticulturists, who are subject to both very strict social, and environmental regulations, and strong competition in their markets, innovation enables them to shift competition from price to quality (Jolly et al., 2023).

However, because the research on OI emerged from the high-tech sector (Chesbrough, 2003; Chesbrough and Crowther, 2006), and large multinational firms only a few studies have empirically examined, and supported this proposition with large samples of companies from various industries, and considering the case of SMEs. OI is more important for SMEs than it is for large organizations (Spithoven et al., 2013), but studies on OI focus more on large firms than SMEs whose size is seen as a limitation on their ability to obtain critical resources (technological, human, and financial) to support innovation activity (Gassmann et al., 2010; Torchia and Calabrò, 2019).

Research on OI in SMEs is discussed in terms of product, process, marketing and organization (Torchia and Calabrò, 2019). However Torchia and Calabrò (2019) explain that scholars of OI literature do not always share or use a common terminology, because methods for integrating external actors into the innovation process were in use long before the concept of OI was introduced into innovation literature. However, conceptualizing OI provides existing approaches with scientific support for new perspectives on existing practices. OI can also be approached from another perspective, that of the strategic component. It is then considered in terms of knowledge management, network management, and business model management. Innovation can also be approached from a purely technical perspective, as in the research of tools, and methodologies (evaluation, performance, and practices).

All these perspectives intertwine and merge, as illustrated in the paper by Lichten-

[4]OI has also a dark side (Purdy et al., 2023) and is the subject of critical papers, such as the study by Audretsch and Belitski (2023), which points to problems of information asymmetry between contributors, internal investment to maintain and develop absorptive capacity, and the overestimation of managers' abilities to manage projects in the context of open innovation.

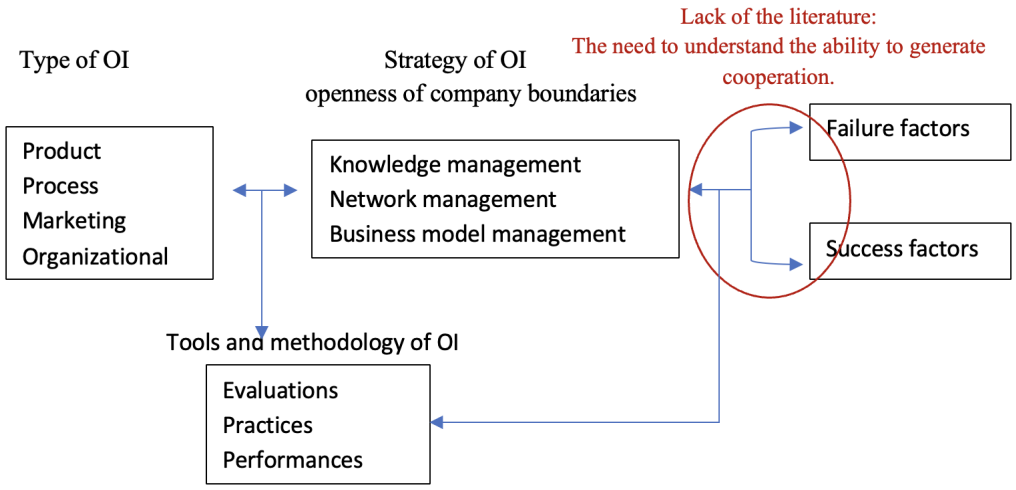
thaler and Lichtenthaler (2009). Indeed, they demonstrate that OI needs to be explored from an integrative perspective, considering the type of innovation, the strategy, as well as the method deployed to achieve it. Their research therefore combines knowledge management, and absorptive capacity and considers the exploration, retention, and exploitation of knowledge inside, and outside a firm's boundaries. On a knowledge management basis, Lichtenthaler and Lichtenthaler (2009) explain the heterogeneity of interfaces in both knowledge, and alliance strategies, organizational boundaries, and innovation performance. This is in line with Piller and West (2014) idea of the OI paradigm. Therein, OI is interpreted as a company-centric paradigm, aimed primarily at leveraging external knowledge to improve internal innovation, and hence economic performance. The literature therefore discusses OI by type of approach (product, process, marketing, and organizational), by strategy (knowledge management, network management, and business model management), or by tools, and methodology (evaluations, practices, and performances).

Table 3.1: OI in literature

	Exemplary references	**Topic**
Type of approach		
Product, process, marketing	Scuotto et al. (2017)	Innovation processes improve processes by generating new products and/or services.
Organizational	Van De Vrande et al. (2009)	Implementing OI of SMEs
Strategy to approach		
Knowledge management	Majchrzak et al. (2004)	Understanding the knowledge reuse process to create radical innovation .
Network management	Zeng et al. (2010)	Networks on innovation performance.
Business model management	Müller et al. (2018)	Impact of Industry 4.0 on business model innovation.
Tools and methodology		
Evaluations	Mastrocinque et al. (2022)	Input variables to evaluate OI
Practices	Van De Vrande et al. (2009)	OI practices.
Performances	Rosenbusch et al. (2011)	Effect of innovation on performance.

Considering OI raises both the question of openness in innovation (Dahlander and Gann, 2010; Mastrocinque et al., 2022; Pisano and Verganti, 2008) and the concept's integrative perspective. Dahlander and Gann (2010) define openness in innovation as the permeability of corporate boundaries, where ideas, resources, and people flow in and out of organizations («inside-out» and «outside-in»). As the concept of OI must integrate an integrative perspective of approaches, understanding OI also means understanding other

Figure 3.1: Integrative perspective of the OI concept in the literature



Source: literature review above

matters, such as collective creation (i.e., interactive co-creation (Piller and West, 2014), and appropriation, and sharing of value in its process (Dahlander and Gann, 2010; Félix, 2022; Holgersson et al., 2022; Madanaguli et al., 2023; Pisano and Verganti, 2008; Shaikh and Randhawa, 2022). Capturing the ability to generate cooperation is therefore a key element in elucidating the factors behind OI's failure or success.

3.2.3 Open innovation: value creation and risk

Fostering cooperation when opening up boundaries can be a risky move. First, the openness of OI can be an intra-organizational risk factor. Shaikh and Randhawa (2022) argue that a new business model management can introduce a risk of managerial misalignment of interests, and motivations within the company, with OI interpreted as a distributed innovation process involving a wide range of stakeholders. According to West and Bogers (2014), OI takes place through three processes: the «outside-in» process of acquiring, and integrating external knowledge, the «inside-out» process of selling intellectual property, and generating new technologies on the market, and the «coupled» process of complementing incoming, and outgoing OI through alliances, and partnerships.

Second, OI is by nature uncertain. Dahlander and Gann (2010) and West (2020) defined OI as an uncertain, collective, and cumulative R & D process involving the exchange of knowledge between multiple internal, and external stakeholders through pecuniary, and non-pecuniary mechanisms, which implies a problem of value sharing linked to the uncertainty of OI results.

Last, the very question of risk is therefore inherent to innovation. It is itself risky, with uncertain processes, and outcomes (Gomber et al., 2018). While it is often mobilized to minimize companies' commercial risks (Fu et al., 2014), OI can create risks of unfavorable outcomes or failures: knowledge leakage, and hold-up phenomena, loss of competitive advantage (Chaudhary et al., 2022; Linåker and Regnell, 2020), reputational problems (Cao and Song, 2016), refusal of a contributor to participate in a project or technical difficulties. It can also generate unexpected results, such as a lack of visibility, and ownership of contributions, an inability to achieve project goals or intellectual property leakage. Some forms of OI, such as networks, and communities, industry-university collaboration, contracts, and patents, exhibit an inverted-U-shaped relationship with financial performance. Individuals' preferences in terms of risk aversion, and hence loss aversion, may determine their behavior in OI approaches, and the expected gain from cooperation, whether horizontal or vertical. OI practices are therefore risky, and the success or failure factors of the project depend to a large extent on the ability to generate cooperation among stakeholders regarding risk-taking.

3.2.4 Research issues

The nature of risk in OI is complex since different types of risk are intertwined, and have a direct impact on all the different stages of innovation. However, risk assessment, and mitigation are key factors in the understanding of OI processes. If many studies address risk in OI, there is little specific work on risk assessment, and mitigation models.

Moreover, while OI is the sphere of the collective, its micro-foundation is grounded in an individual's actions, experiences and intentional preferences, little is known about how individuals behave when faced with the choices, and actions that determine overall organizational results (Aleksić et al., 2022; Bogers et al., 2018; Santoro et al., 2020).

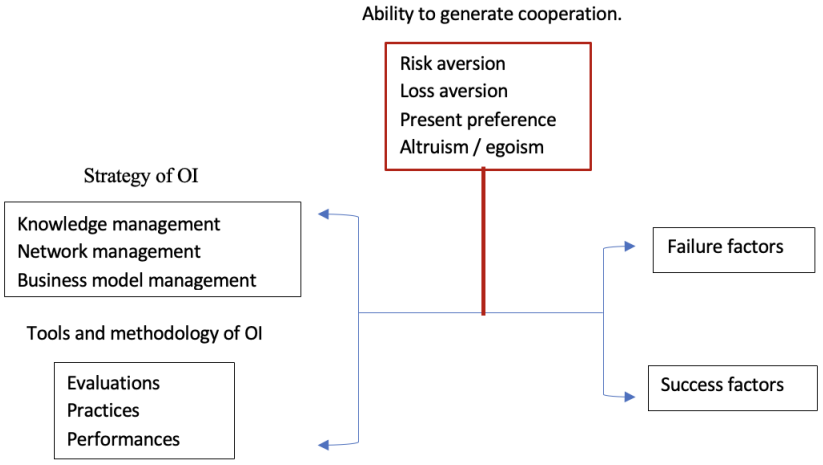
Social preferences such as trust, altruism, or reciprocity can be a determining factor in the ability to generate cooperation, and thus success or failure of OI projects. For example, in a context of mistrust, certain problems can arise, such as the withholding of information, thus affecting the company's overall performance. According to Černe et al. (2014) employees hide knowledge to protect themselves. Connelly et al. (2019) identified distrust as an important predictor of knowledge hiding, even if it is not an effect explained by a performance goal but by the orientation of the performance feedback (individual- or group-focused feedback) (Zhu et al., 2019). Nevertheless, they must acquire, assimilate, transform, and exploit knowledge to sustain a competitive advantage (Zahra and George, 2002).

Individuals' propensity to generate innovations, and face market risk can be defined by knowledge sharing, avoiding knowledge hiding, and helping behavior, and knowledge flow involvement. As the concept of OI has an integrative perspective, a focus on knowledge management does not in any way exclude consideration of other dimensions (Lichtenthaler and Lichtenthaler, 2009; Piller and West, 2014). A knowledge management perspective therefore provides a significant response to the concept of OI. In our study, we define the openness of innovation by taking the openness of the company's knowledge as a starting point.

Our Model:

OI has an individual cost. We can note it C_i for each firm ($i = 1, 2, .., N$). Here, we develop a simple model where the OI is a success if the global investment, $C = \sum_{i=1}^{N} C_i$,

Figure 3.2: The ability to generate cooperation as an explanatory factor for success or failure in OI processes



Source: literature review above

reaches a feasibility threshold A, i.e., $C \geq A$. In this case, each firm has a gain $B_i = (1+\beta)\frac{C}{N}$, with $\beta > 0$. $1+\beta$ is the multiplier of a PG game with threshold (Isaac et al., 1989). As all innovation, OI is risky. We assume here that the probability of success is equal to p: $Pr[C \geq A] = p$. For simplicity and consistency with the reality, we assume a null gain if the OI fails.

All in all, the net value of the profit is:

$$\pi_i = p(1+\beta)\frac{C}{N} - C_i \tag{3.1}$$

However, 4 dimensions of preferences must be taken into account. First, the possible success $(1+\beta)\frac{C}{N}$ is valuated only T years after the investment, so the actual value is $(1+\beta)\frac{C}{N}$ multiplied by the discount factor of the firm i, $\frac{1}{(1+d_i)^T}$. The more impatient the decision-maker, the higher d_i is.

Second, the more cooperative firms are, the more they cooperate in the OI game, and the greater the probability of success p.

Third, we assume a power utility function $u(y) = y^{\alpha_i}$ with α_i>0. The risk seeking

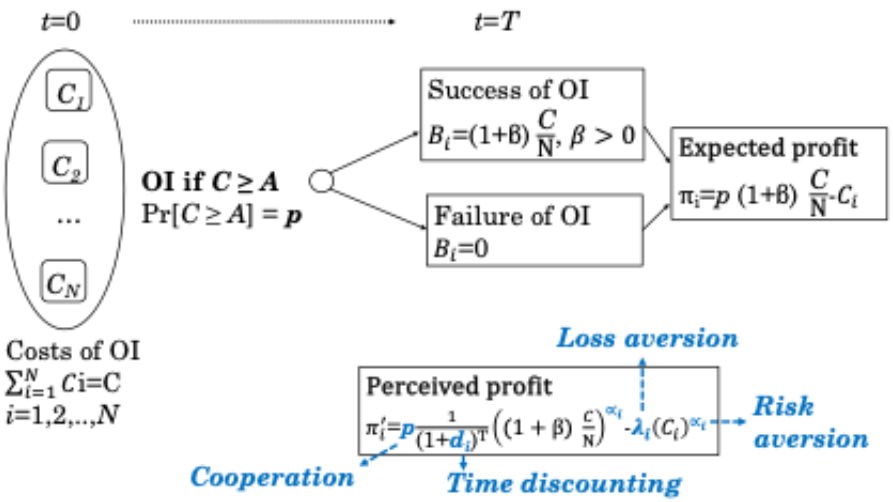
increases with α_i : risk aversion if it is less than 1, risk neutral for 1, and risk-seeking otherwise. $(1+\beta)\frac{C}{N}$ and C_i are then transformed by this power-function.

Lastly, we take into account the loss aversion (Kahneman and Tversky, 1979), the fact that the losses loom larger than the gain: here, the utility of the loss C_i is multiplied by a loss aversion parameter λ_i, greater than 1.

All in all, the perceived profit is transformed as follows :

$$\pi_i' = p\frac{1}{(1+d_i)^T}\left((1+\beta)\frac{C}{N}\right)^{\alpha_i} - \lambda_i(C_i)^{\alpha_i} \tag{3.2}$$

Figure 3.3: Individuals' behavior when faced with innovation and value sharing



π_i' increases with :

1. the egoism of each firm $i(i = 1, 2, \ldots, N)$, or the willingness to take part in collective action, which increases the probability of success p;
2. the level of risk-seeking α_i;
3. the patience, when d_i is smaller;
4. the non-sensitivity to loss aversion, i.e., a smaller λ_i.

This study aims to provide insight into the behavior of individuals confronted with

uncertainty, and risk factors in the context of OI projects.

First, we use measurement items from (Chow and Chan, 2008) for knowledge sharing, and modify them to fit our context of knowledge sharing. Those measures had been validated in prior studies (Bavik et al., 2018). We are interested here in the behavior of individuals facing the value sharing of projects in the OI framework, and contribute to the «human side» of OI literature.

Second, we seek to assess how individuals behave when faced with the risk, and uncertainty of IO. In the literature, studies such as Akhundjanov et al. (2020) analyze the maximization of the level of innovation regarding the level of individual profit. The innovation process is therefore only justified by the quest for profit. They use actual producers in economic experiments. Contrary to our study, they assume that the innovation already exists, and the innovator must only decide how to license the innovation. They do not consider the uncertainty in the research process, which is our main point. Goel (1999) takes well into account the uncertain aspect of innovation. On the other hand, the starting hypothesis stipulates a bounded contract between the two agents.

Referring to Lichtenthaler (2011) who identifies OI as systematically performing knowledge exploration, retention, and exploitation inside, and outside an organization's boundaries throughout the innovation process, we suggest defining OI in horticulture as the realization of a common project through a technological change that maintains or increases labor productivity while optimizing the use of natural capital (water, fertility, biomass...) through interactions between the different actors of the value chain (exchange of information, know-how, knowledge...), inside-out, and outside-in the boundaries of the firm. Following Aleksić et al. (2022) and Santoro et al. (2020), the objective of this research is to understand the behaviors of the actors (who are entrepreneurs or decision makers) in the plant sector[5] regarding OI. We explore how choices about risk, and value

[5]The plant sector is very diversified, but nevertheless has the particularity of being composed essentially

sharing influence the willingness to help others, the sharing and hiding of knowledge, and therefore the OI of firms. To do this, we use an original design based on game theory. Through a field experiment, after playing three PG games, professionals are challenged by Holt and Laury's mechanisms.

Our study focuses on three axes, risk, and loss aversion, time preferences, and value sharing. The first one is the risk and uncertainty of innovation. Innovation strategies are based on the long-term principle, and naturally incorporate risk, and loss preferences. While other measures exist for estimating the risk parameters of utility functions, we use Holt and Laury's measures for this study. On the one hand, they are widely used, and on the other, because Brañas-Garza et al. (2021) trimmed version, hereafter (HLSV)[6], makes them easier to understand, our survey being online and professionals not being used to this type of exercise, a short version seems the most appropriate for obtaining results.

Because innovation is always uncertain, expected performance is also uncertain (Bowen et al., 2010; Sultan and Winer, 1993). In line with risk and loss measures (Fidanoski and Johnson, 2023), we slightly modify the HLSV mechanism to measure present preference.

Finally, still, to foster cooperation and open up boundaries, we seek to capture behaviors' when faced with value sharing of the intangible. First, individual interests can sometimes contradict the interests of the group (Olson, 1965). Different groups in a community may simply disagree about how to share the private benefits associated with collective action or place less value on the benefits accruing to members of other groups (Vigdor, 2004). Second, the individuals in a group have usually different positions, have a different valuation of the prize at stake, and may expect larger gains than other group members (Nitzan and Ueda, 2014). And lastly, because the uncertainties of a projects do

of SMEs. For example, in landscape sector, 13% of the companies have more than 6 employees (out of a total of 30,050 companies). In floristry sector, only 3.5% of companies have 6 or more employees (out of a total of 14,096 companies).

[6]HLSV : Holt and Laury's Short Version

not allow us to know the value of the results, conceptualizing a sharing of an uncertain result remains difficult. The question is therefore how to adhere to a common project without being constrained to do so. How can we solve the free-riders problem to promote group interests over and above individual interests? What is the cost of getting involved? What do they expect from it? In horticulture, there have been many attempts, but very few successes. At some point during the project's life, individual interests contradict group interests, and collective action fails to last.

From π_i', our hypotheses are the following:

- H1: is that the sharing of knowledge, ideas, and know-how is more important in vertical cooperation, i.e., supplier-customer relationships, than in horizontal cooperation, i.e., between competitors (impact on p).
- H2: the more risk averse individuals are (lower α) the lower the degree of innovation.
- H3: the more loss averse individuals are (higher λ), the lower the degree of innovation.
- H4: the more individuals prefer the present (higher d), the lower the degree of innovation.
- H5: in the context of value redistribution, the degree of cooperation is greater than (Game 1) when the group converts free riders (Game 2) or when it excludes them (Game 3).

Dohmen et al. (2011) found that risk attitudes are strongly but not perfectly correlated across contexts. And asking questions about specific context (like OI) can add value. In this study, we aim to analyze, and understand why they get involved, and why they don't.

One of the most widely used standards for studying questions concerning the sharing and use of common resources is the PG game (Dufwenberg and Kirchsteiger, 2004;

Geanakoplos et al., 1989; Rabin, 1993). The emergence of cooperation is highlighted by the mechanism of voluntary contribution to the provision of PG. This game features the conflict between collective, and individual interests, and measures the degree of cooperation.

Formally, $N(N \geq 2)$ players take part. Each has an endowment D which he can divide between a collective investment $Y_i(i = 1, 2, .., N)$, and private investment $D - Y_i$. There is thus a PG $\sum_{i=1}^{N} Y_i$ which is multiplied by a factor $k(1 < k < N)$, then divided into N equal shares, whatever the stakes, between the N players. This gives us the individual winnings G_i for each player $i(i = 1, 2, .., N)$:

$$G_i = (D - Y_i) + \frac{k}{N} \sum_{i=1}^{N} Y_i \tag{3.3}$$

and the overall gain $G = \sum_{i=1}^{N} G_i$ for all players:

$$G = ND + (k - 1) \sum_{i=1}^{N} Y_i \tag{3.4}$$

The search for individual gain leads to putting nothing into the common pot, with each person collecting only D, the initial stake. Conversely, the social optimum is obtained when all endowments are paid into the common pot in full, which maximizes G, with everyone then earning $k.D$. Individual maximization leads to non-contribution, since each contribution will only benefit from a share of the whole (Hardin, 1968). Free rider behavior is the dominant strategy, and leads to the only equilibrium. If individuals behave selfishly, they try to benefit from the PG by avoiding, as far as possible, contributing to its financing. This is a social dilemma, since the group would be better off if everyone contributed their full share to the PG. From 0 to D put into the common pot, the amount invested measures the degree of cooperation, from nil to total.

3.3 Experimental design

This study presents an artifactual field experiment (Harrison and List, 2004), with real professionals (Viceisza, 2016) in the horticultural industry. First, we use the HLSV to measure time preference, risk, and loss aversion. We also use the PG game to elicit cooperation, within a benefit-sharing framework. Secondly, we check whether OI can be a cohesive factor for the supply chain. To do this, we then compare the degree of acceptance of OI, and the degree of risk aversion, time preference, and degree of cooperation of groups where actors are matched in-group (landscaper with landscaper, distributors with distributors, producer with producer), and out-group (producer, retailers, and landscaper). The design and hypotheses were pre-registered. The games were designed to test our five hypotheses.

3.3.1 Game and experiment design

Public good game

The PG game is used to analyze decisions on the use of common resources or common goods (Andreoni, 1990; Fischbacher and Gächter, 2010; Ledyard, 1995; Ostrom, 2000), and to model bargaining games through a $N \geq 2$. structure. Unlike Esteban and Ray (2001), who refer to public, and private[7], our design differs slightly. We mobilize three versions of the PG game to measure the degree of cooperation in these different situations. In our versions, the individual payoff is affected by group members. Being partially or fully excluded from the group allows us to understand the extent to which group members are willing to share the common payoff.

Game 1 is the standard version of the PG game, with $N = 4$. The participants are

[7]Esteban and Ray (2001) characterize the public price as the gain of a group member that would not be affected by the number of members, but that non-members can be partially or totally excluded, while the private price is fully distributed, but only among the group members.

randomly assigned to groups of four persons. Each participant is endowed with 10€, which they can either keep or contribute to a «project», the PG. The amount in the PG $\sum_{i=1}^{N} Y_i$ is multiplied by 2, then divided into 4 equal shares, whatever the stakes, between the 4 players. This standard version has the advantage of having a first result for the degree of cooperation that is comparable with most results in the literature (i.e., between 40% and 60% of their endowment).

We're changing the design for Game 2. The amount in the PG $\sum_{i=1}^{4} Y_i$ is always multiplied by 2, then divided into equal shares, regardless of the amounts of $10 - Y_i$ if only all players put in the PG (5€ or 10€). If only one player does not put anything, the money in the PG will be lost for all players. In case a player puts 0€, he condemns everyone. The idea behind it is to convert undecided individuals and make sure there's a real willingness to join the collective. Indeed, people are in the collective interest up to a certain threshold. And at some point, individual interest will take precedence. People will adhere to the common project, but as soon as they consider that the project can be detrimental to their interests, they won't go, and they will not bother with the others. If they are truly interested in the collective, they'll stay.

PG game's latest design in Game 3 takes free-rider behavior into account. The PG $\sum_{i=1}^{4} Y_i$ that is multiplied by 2, then divided into equal shares but only among the players who did put in (5€ or 10€). Here, we expected individuals who had put in €0 in Game 2 to return to the PG. This last version joins the definition of the private price of Esteban and Ray (2001).

Trimmed Holt and Laury's mechanism

HLSV is proposed in 3 versions, each with a series of 5 questions, i.e., half of the original version. All the sums are in €. Instead of 10 choices, this short version by Brañas-Garza et al. (2021) has 5 choices: 9 and 1 (extreme cases), and 4, 5, and 6 for the middle points,

which represent the switch of options based on the previous studies (in the game 6, the scale is based on the numbers 19, 16, 15, 14 and 11). Each question corresponds to a choice between 2 options A and B. The questions are presented to participants as shown in Table 1. As they answer, individuals switch between averse and love. Game 4 reveals risk lover and risk averse, Game 5 detects loss averse, and Game 6 identifies time preferences behavior.

Each game will not be presented one after the other. Each player will be compensated by his winnings from one game chosen from the six games. He will win the amount in vouchers to buy current products (Voslinsky and Azar, 2021). For a sample $N = 144$, and an average gain estimated at $G = 8{,}5€$, our estimated budget is 1 250€. Compensations for participants will be sent mid-October 2023.

Table 3.2: Game 4 Loss: option A and option B on 50/50 chance

Loss						
Option A					**Option B**	
1/2 to win	10 €	&	1/2 to lose	9 €	neither win nor lose	0 €
1/2 to win	10 €	&	1/2 to lose	6 €	neither win nor lose	0 €
1/2 to win	10 €	&	1/2 to lose	5 €	neither win nor lose	0 €
1/2 to win	10 €	&	1/2 to lose	4 €	neither win nor lose	0 €
1/2 to win	10 €	&	1/2 to lose	1 €	neither win nor lose	0 €

Holt & Laury's (2002) mechanism
Trimmed Brañas-Garza et al. (2021) version

This model provides the answer to loss aversion (Kahneman et al., 1991; Knetsch and Sinden, 1984). As Thaler's example of the wine bottle illustrates (Thaler, 2016) when an individual possesses something, the weight attributed to that possession is always greater than the actual value of the actual object. What we're looking at here is the extent to which professionals are sensitive to loss. In this game, behavior is determined by option A. The extremes are €9 and €1. We expect individuals to change their behavior between choices €6, €5, and €4. If individuals choose option B all the time, they are considered totally loss averse. If they choose option A all the time, they are not sensitive to loss.

Table 3.3: Game 5 Risk: option A and option B on ten chances

Risk									
Option A					**Option B**				
1/10	5 €	&	9/10	4 €	1/10	9 €	&	9/10	0,20 €
4/10	5 €	&	6/10	4 €	4/10	9 €	&	6/10	0,20 €
5/10	5 €	&	5/10	4 €	5/10	9 €	&	5/10	0,20 €
6/10	5 €	&	4/10	4 €	6/10	9 €	&	4/10	0,20 €
9/10	5 €	&	1/10	4 €	9/10	9 €	&	1/10	0,20 €

Holt & Laury's (2002) mechanism
Trimmed Brañas-Garza et al. (2021) version

Similarly, if individuals choose only option A, they are totally risk averse. If they choose 2 A and 3 B, they are neutral. We don't know whether they are risk-averse or risk-lovers. If they choose at least 4 B, they are risk-lovers.

If we consider a power utility function: $u(y) = (y - 0.2)^{\alpha_i}$ with $\alpha_i > 0$ and note q the probability of the high stake $(1/10, 4/10, 5/10, 6/10, 9/10)$, the indifference between A and B, under expected utility is given by $p4.8^{\alpha} + (1-p)3.8^{\alpha} = p9.8^{\alpha}$[8].

We obtain the following thresholds for α:

- AAAAA for the maximum risk aversion, $\alpha < 0.14$;
- AAAAB for $0.14 \leq \alpha < 0.64$;
- AAABB for $0.64 \leq \alpha < 0.84$;
- AABBB for $0.84 \leq \alpha < 1.08$ (around risk neutral, slightly risk averse or risk loving);
- ABBBB for $1.08 \leq \alpha < 2.61$;
- BBBBB for the maximum risk loving $\alpha \geq 2.61$.

In this time model, if individuals choose only A, they are very patient, and if they choose only B, they are very impatient. The degree of patience increases with the number of B choices. An agent choosing always B has a discount rate of less than 64.2%[9], and another one who always chooses A has a discount rate greater than 2815%! It seems very

[8] We consider the variation relative to the minimum gain, 0.2

[9] The discount rate a is here given by $1 + a = (\frac{11}{10})^{\frac{52}{10}}$

Table 3.4: Game 6 Time: option A right away, option B from 1 to 10 weeks

Time			
Option A		**Option B**	
in ten weeks	19 €	now	10 €
in ten weeks	16 €	now	10 €
in ten weeks	15 €	now	10 €
in ten weeks	14 €	now	10 €
in ten weeks	11 €	now	10 €

Holt & Laury's (2002) mechanism
Trimmed Brañas-Garza et al. (2021) version

high, but this is standard in the experiments on time preferences (Frederick et al., 2002).

More precisely, the discount rate d has the following thresholds:

- AAAAA for a «low» discount rate, $d < 0.642$;
- AAAAB for $0.642 \leq d < 4.75$;
- AAABB for $4.75 \leq d < 8.23$;
- AABBB for $8.23 \leq d < 11.52$ (neither patient nor impatient);
- ABBBB for $11.52 \leq d < 28.15$;
- BBBBB for the maximum of impatience $d \geq 28.15$.

OI Context design

Slightly modified from Chow and Chan (2008) study, this part focuses on the attitudes, and subjective norms towards knowledge sharing with three axes: the social network, the social trust, and the shared objectives. On each axis, 5 relationships are tested: with colleagues or employees, with suppliers, with customers, with other companies in the same sector, and with institutional organizations. We used the 5-point Likert scale (Likert, 1932) for stated preferences for each axis (from strongly agree to strongly disagree). So as not to restrict individuals, we also asked 2 open-ended questions on innovation, and OI. These 2 questions allow individuals to freely add their beliefs, and representations of these 2 concepts to the questionnaire. This final section therefore comprises a total of 12

questions.

Survey administration

We used an online questionnaire run via LimeSurvey[10]. Our protocol has been pre-recorded on AsPredicted[11]. A total of 979 e-mails were sent to growers, independent garden centers, and landscapers at the beginning of July. Considering the production, and sales constraints of the industry's actors, and the fact that recruiting participants from the professional world is complex (Torres-Guevara and Schlüter, 2016; Weigel et al., 2021), the right time to run the questionnaire is limited. We had to start the questionnaire at the beginning of July, when the season was easing off. However, this meant that we had to wait until the summer vacation to contact participants again. We therefore had to repeat the campaign a week before September. Although the survey remained open for two, and a half months, it was only truly active for one month. This list of contacts was compiled by the authors, based on a search of the websites of official organizations, trade fairs, and companies with labels in the horticultural sector.

The survey, including stated preferences for innovation, and open innovation, was pre-tested with professionals belonging to the institutional organizations of the sector. A link to the survey was provided to participants by email.

After some general demographic questions, we immediately asked them to play the three versions of the PG game. They were then confronted with three versions of the THL, and it was only at the end of the questionnaire that we measured their stated preference for OI using the 5-point Likert scale following Dohmen et al. (2011). The stated preferences were elicited on their perception in general, and then through their relationship with their colleagues or employees, their suppliers, their customers, other

[10] https://limesurvey.univ-angers.fr/index.php/129219?lang=fr
[11] https://aspredicted.org/G3P_99V

companies in their sector, and then with institutional bodies (e.g., interbranch, unions, ASTREDHOR stations or other organizations...).

To ensure incentive compatibility, subjects were informed that after the experiment a random device would determine one of the six games. For the three PG game versions, they would be paid according to their choice. For the THL, the random device would choose one of the options, and then a lottery would be run.

3.3.2 Treatment allocation

To identify the ability to cooperate, we used 2 treatments: a control group, and a group where they were paired with an individual from another sector.

Our allocation in treatments is based on self-declaration, with professionals declaring themselves according to the sector of their company. Once their type is self-declared, we randomly assign them according to the last two digits of their mobile phone number. From 0 to 49, participants play with 4 individuals from their sector, from 50 to 99, they play with 2 individuals from their sector, and 2 individuals from another sector. We therefore have 3 groups in total, a PP-RR-LL group, a PR group, and a PL group.

3.4 Results

3.4.1 Sample description

Despite the challenge of recruiting professionals to take part in a field experiment (Torres-Guevara and Schlüter, 2016; Weigel et al., 2021), we managed to collect answers from 88 respondents who had played the games, and 70 who completed the questionnaire fully (9.0% and 7.2% response rate). Excluding individuals who do not give their consent, and individuals who are in a sector other than the target sectors (production, retail, and landscape) of the survey, 179 individuals opened the survey, and filled in the demographic

data, which means a drop-out rate of 50.8% for the strategic games, and 10% more when answering the questions on OI. A self-selection is made, which suggests that the answers concerning games, and OI are viable, and consistent. This also points to the difficulty of field experiments with designs based on strategic games, with which professionals are very unfamiliar. This drop-out rate (i.e., $N = 18$) is not explained by intrinsic absorptive capacity data (such as level of education, age, etc.), since the 2 samples are relatively similar (Table 2).

Table 3.5: Descriptive variables (in %)

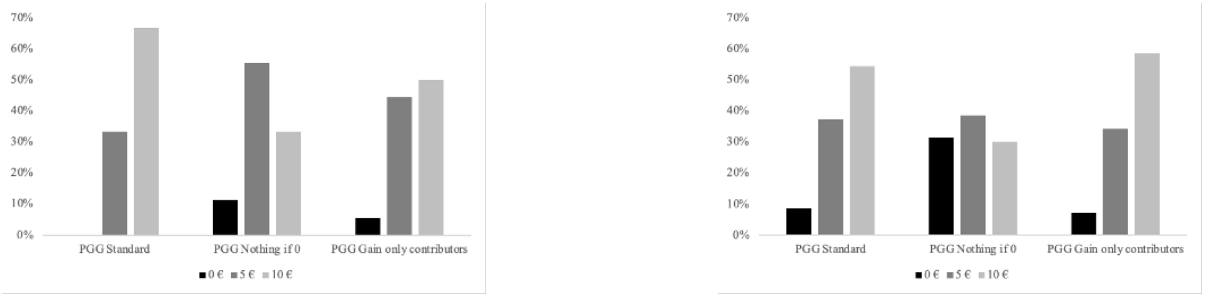
%	N =18	N =70
Gender: Men	66,7	75,7
Generation group (age) :		
18-44	55,6	44,3
45-54	22,2	24,3
55 and up	22,2	31,4
Education :		
Before Bachelor's Degree	33,3	30,0
Master's Degree	61,1	70,0
Ph.D's Degree	5,6	
Sector		
Production	38,9	60,0
Retailing	22,2	10,0
Landscaping	38,9	30,0
Activity :		
Business owner	66,7	77,1
Employee	33,3	22,9
Company type :		
Private company	94,4	95,7
Association	5,6	1,4
Other	0,0	2,9
Company Size		
Micro enterprise ≤ 5	27,8	27,1
Small enterprise $6 \leq 50$	55,6	61,4
Other ≥ 51	16,7	11,4
Taking part in our survey in October 2022	44,4	52,9
Taking part in our survey in January 2023	16,7	45,7

$N = 18$ is the number of individuals who have given up between games and preferences for innovation.

Our original design of the PG game in 3 consecutive versions highlights the change in behavior in a value-sharing context when faced with the existence of free rider behavior in the collective. Behavior is similar between individuals who just played the games

Figure 3.4: Evolution of the cooperation rate on the 3 PG games

(a) $N = 18$ (b) $N = 70$



($N = 18$), and those who completed the surveys to the end ($N = 70$). The results show that individuals who invest in the standard version (Game 1) stop investing as soon as they have to bet on each other's behavior (Game 2). Cooperation returns when the winnings of those who invest are shared between them, thus excluding free rider behavior (Game 3)[12]. The endowment rate for Game 1 and Game 3 is higher than predicted in the literature (between 40% and 60% (Ledyard, 1995)), but matches that observed in the field (Bchir, 2011). For $N = 18$, the rates are 83% and 72%, and for $N = 70$, the rates are 73% and 76% for Game 1 and Game 3. For set 2, this rate drops to 61% for $N = 18$ and 49% for $N = 70$. H4 is not totally validated. The rate of cooperation drops when we try to convert free-riders (Game 2) but the rate rises again when free riders are excluded (Game 3)[13].

Table 3.6: Distribution of the loss aversion level

Decision	**Loss aversion category**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**
			N=18			***N=70***	
BBBBB	Level 5 loss aversion (high)	1	5,6	5,6	2	2,9	2,9
BBBBA	Level 4 loss aversion	0	0,0	5,6	2	2,9	5,7
BBBAA	Level 3 loss aversion	2	11,1	16,7	2	2,9	8,6
BBAAA	Level 2 loss aversion	4	22,2	38,9	24	34,3	42,9
BAAAA	Level 1 loss aversion	3	16,7	55,6	14	20,0	62,9
AAAAA	Level 0 loss aversion (low)	7	38,9	94,4	21	30,0	92,9
	Inconsistency	1	5,6	100,0	5	7,1	100,0

Inconsistent choices: AAAAB; ABAAA; ABBBB; BBABB

[12]This change is similar when we focus on sectors one by one, and in cases where players play in-group, and out-group. As the sample for each group is too small, the results are given in the appendices

[13]This change is similar when we focus on sectors one by one, and in cases where players play in-group, and out-group. As the sample for each group is too small, the results are given in the appendix D.

Here again, the 2 samples behave in the same way. The descriptive data for the two extremes show that individuals are very slightly loss averse.

Table 3.7: Distribution of the risk aversion parameter α

Decision	**Risk aversion**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**
			$N = 18$			$N = 70$	
AAAAA	α<0.14	7	38,9	38,9	22	31,4	31,4
AAAAB	0.14≤ α<0.64	4	22,2	61,1	10	14,3	45,7
AAABB	0.64≤ α<0.84	2	11,1	72,2	15	21,4	67,1
AABBB	0.84≤ α<1.08	2	11,1	83,3	9	12,9	80,0
ABBBB	1.08≤ α<2.61	0	0,0	83,3	3	4,3	84,3
BBBBB	$\alpha \geq$2.61.	2	11,1	94,4	3	4,3	88,6
	Inconsistency	1	5,6	100,0	8	11,4	100,0

Inconsistent choices: AABAB; ABAAB; ABBAB; BAAAA; BBAAA

On the other hand, individuals are very risk averse. Over 67% of individuals are risk averse, with more than 30% highly risk averse.

Table 3.8: Distribution of the discount rate d

Decision	**Present preference category**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**	**Number of subjects**	**Frequency (%)**	**Cumulative frequency (%)**
			N=18			*N =70*	
AAAAA	d<0.642	6	33,3	33,3	23	32,9	32,9
AAAAB	0.642≤ *d*<4.75	7	38,9	72,2	23	32,9	65,7
AAABB	4.75≤ *d*<8.23	1	5,6	77,8	9	12,9	78,6
AABBB	8.23≤ *d*<11.52	0	0,0	77,8	3	4,3	82,9
ABBBB	11.52≤ *d*<28.15	0	0,0	77,8	2	2,9	85,7
BBBBB	*d* ≥28.15	3	16,7	94,4	7	10,0	95,7
	Inconsistency	1	5,6	100,0	3	4,3	100,0

Inconsistent choices: ABABA; BBBBA

Individuals tend to be patient. Over 65% of individuals chose at least 4 A, and chose to win without waiting only for the extreme option, i.e., with a very slight difference in payoffs (€11 vs. €10). Waiting in projects is a possible scenario, but only if the outcome is worth the time.

Table 3.9: Stated preferences. Open Innovation (in %)

% agree	**Good relationship**	**Regular discussions**	**Share the same goal**	**Knowledge sharing**	**Should share**	**Reciprocity**
Colleagues or employees	97,1	97,1	88,5	92,8	87,1	85,7
Suppliers	95,7	92,8	67,1	91,4	52,8	80,0
Customers	100,0	95,7	67,1	97,1	65,7	70,0
Other companies in your sector	87,1	72,8	60,0	81,4	54,3	52,8
Institutional organizations	81,4	61,4	52,8	97,1	61,4	62,8

Over 90% of participants see innovation as a key factor in sustaining competitiveness, and OI as a key component. However, while the various exchanges remain very strong

within the firm, they are less so outside the firm, as with organizations, or even worse, as with other companies in the same sector, and on certain items such as sharing the same goal or beliefs or behavior towards others. It shows that they don't trust each other in the same sector, or at least not enough to create a common project.

3.4.2 Testing hypothesis

Table 3.8 shows a correlation between the degree of loss, and the degree of preference for innovation. H3 is confirmed. On the other hand, the econometric results show no correlation between risk aversion, and present preference, and preferences for innovation, and OI. H2 and H4 are not confirmed. This is not surprising. Remind that our perceived profit π_i' depends on risk aversion, loss aversion, and patience. However, loss aversion can lead to an apparent risk aversion or impatience. If the loss aversion parameter λ is high, the decision-maker will overweight the costs (losses), and will «appear» impatient. In the same way, the risk can be rejected simply because the losses are too salient in comparisons with gains.

In the context of cooperation, we can note that there is a very strong correlation between loss aversion, and present preference in cooperation. There is no more loss aversion in Game 3, where only those individuals who contribute benefit from the gains. The degree of loss aversion is correlated with the degree of cooperation, but loss aversion can be de-correlated with cooperation in certain collective action contexts. In the case of this study, we can argue that in the context of Game 3, the rate of cooperation no longer depends on individuals' loss aversion. We can assume that, in certain contexts, they can invest in OI projects without their loss aversion influencing their behavior. This suggests that uncertainty in collective projects is a function of trust in others, rather than intrinsic individual risk-averse, loss-averse, or present-preferential behavior.

The factor that can influence the adoption of OI is fairness in the sharing of gains

Table 3.10: Degree of loss, risk aversion and time preference to innovation and OI Ordered probit

	Innovation	Open innovation
Man	-0,233	-0,153
	(0,441)	(0,442)
Less45	-0,244	-0,7685*
	(0,416)	(0,433)
Manager	-0,172	-0,302
	(0,453)	(0,477)
Education	0,043	-0,165
	(0,230)	(0,253)
Production Sector	0,737	0,712
	(0,552)	(0,621)
Landscape Sector	-0,226	0,921
	(0,477)	(0,645)
Small Company	-0,9115*	-0,306
	(0,493)	(0,457)
Game4 Loss Averse(a)	-0,2685*	-0,2676*
	(0,138)	(0,154)
Game5 Risk Averse(a)	-0,030	-0,090
	(0,165)	(0,157)
Game6 Time Preference(a)	-0,112	-0,084
	(0,114)	(0,117)
cut1	-3,701***	-3,446***
	(1,134)	(1,189)
cut2	-3,028***	-3,143***
	(1,055)	(1,157)
cut3	-1,974*	-1,384
	(1,107)	(1,102)
n	54	54
lnL	-37.03	-38.43

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (a) the number of B from 0 to 5

between contributors. The results show a strong tendency to reject free rider behavior.

3.4.3 Further exploratory analysis

Furthermore, we explore additional unregistered hypotheses. We focus on firms' degree of openness, and preferences for innovation practices. The correlation between the degree of inbound-out, and outbound-in exchange with the willingness to practice innovation, and OI. This corroborates the degree of cooperation, and innovation, and OI.

Table 3.11: Different decision to cooperate (Ordered probit) - under uncertainty (risk, loss and time)

	PG game Standard	PG game If 0	PG game contrib & Gain
	(1)	(2)	(3)
Man	-1,320***	-0,5793*	-0,7518*
	(0,371)	(0,336)	(0,390)
Less than 45 years old	-0,369	0,153	-1,029***
	(0,409)	(0,338)	(0,395)
Manager	-3,273***	-5,245***	-2,620***
	(0,923)	(1,302)	(0,851)
Employee	-3,067***	-5,420***	-2,701***
	(0,867)	(1,429)	(0,800)
Education	-0,085	-0,070	0,326
	(0,258)	(0,221)	(0,247)
Production Sector	0,413	0,9111**	0,618
	(0,466)	(0,420)	(0,447)
Landscape Sector	0,398	0,470	0,376
	(0,577)	(0,451)	(0,537)
Small Company	0,6591*	0,7101**	0,9043**
	(0,338)	(0,349)	(0,359)
Game4 Loss Averse	-0,2646**	-0,2638**	-0,138
	(0,122)	(0,106)	(0,138)
Game5 Risk Averse	-0,038	0,028	0,000
	(0,129)	(0,103)	(0,131)
Game6 Time Preference	-0,2244**	-0,2106***	-0,2015**
	(0,090)	(0,081)	(0,081)
cut1	-6,168***	-5,872***	-4,547***
	(1,062)	(1,183)	(0,893)
cut2	-4,565***	-4,513***	-2,821***
	(1,053)	(1,164)	(0,959)
n	71	71	71
lnL	-50.45	-65.72	-49.14

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.5 Conclusion and discussion

To understand the obstacles to innovation practice in the horticultural industry, we ran a field experiment with professionals based on the PG game, and the H&L mechanism. Our first result confirms that social preferences are a key component in OI practices. The ability to generate cooperation is indeed a factor in the success or failure of OI processes. Cooperation in the context of OI is not explained by risk aversion but by loss aversion. In a specific configuration, our result shows that cooperation is no longer subject to loss aversion (Game 3). Waiting time is a function of the payoff amount. The use of game theory tools in experiments provides new insights into the understanding of OI.

The different versions of the PG game show a high rate of cooperation: over 73%

Table 3.12: Degree of cooperation and openness to innovation and open innovation - ordered probit

	Innovation	Open innovation
Man	0,640	0,684*
	(0,412)	(0,410)
Less45	0,292	-0,015
	(0,339)	(0,313)
Manager	0,577	0,123
	(0,410)	(0,383)
Education	0,390*	0,332*
	(0,223)	(0,197)
Production Sector	0,7448*	1,008**
	(0,424)	(0,472)
Landscape Sector	-0,158	0,702
	(0,434)	(0,519)
Small Company	-0,7266**	-0,058
	(0,356)	(0,377)
PG game Standard	0,110**	0,189***
	(0,044)	(0,041)
Relationship	0,031**	0,083***
	(0,014)	(0,018)
cut1	2,500	7,911***
	(1,612)	(1,638)
cut2	3,344**	8,973***
	(1,591)	(1,838)
cut3	4,510***	10,65***
	(1,705)	(1,958)
n	70	70
lnL	-50.02	-50.14

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

contribution for games 1 and 3. Game 2 is revealing, as the contribution rate drops to 49% (with $N = 70$). Our first result is an aversion to free rider behavior. As soon as there is any doubt, cooperation drops drastically. In innovation processes, there is the intentional nature of the process, which can be explained by the determinants, and the choice of partners, and collaboration modalities (Labrouche and Levy, 2022). Alesina and La Ferrara (2000), and Bandiera et al. (2005) argue that individuals might simply dislike working with others outside their group. Our study shows that it's more a question of trusting other people's behavior in long-term projects than of disliking working with

them. It's also more about loss aversion than risk aversion. People don't like to lose what they possess. This is (Kahneman et al., 1991) endowment effect.

The second result of our study points to a very strong correlation between time preference, and the different configurations of the PG game. The more individuals detect free-riding behavior in others, the more they prefer the present. However, innovation strategies are based on the principle of the long term, which presupposes long-term trust, and cooperation. This explains why OI projects cannot function properly, since the very philosophy of OI is to open up to the outside world, in a community that may be anonymous. The role of the trusted third party in OI projects is very important for the horticultural industry, as it helps to recreate links between individuals. However, when we look at the answers to the stated preferences in Table 5, we see that industry professionals do not share as many relationships with organizations as they should. This raises the question of how to position the role of organizations in the value chain, and their ability to help companies fluidity relations along the supply chain.

Our third result shows that OI practices are not correlated with intrinsic individual behavior such as risk aversion or present preference. This suggests that increasing trust between players in the value chain can lead to an increase in collective projects, including OI projects. Lack of trust can lead to individual interests taking over from collective interests, and the collective project coming to a standstill as a result. The learning and experience effect is therefore not triggered.

One obvious limitation of our study is the number of participants. Of the 179 participants who started the questionnaire, only 88 played the strategic games, and 70 filled out the entire survey. We strongly encourage replication of this experiment in other industries, and other professionals to shed light on the external validity of the results (Finger et al., 2023; Torres-Guevara and Schlüter, 2016).

As with the PG games, we would like to point out several limitations. Firstly, we asked the questions always in the same order for the amounts (0€, 5€, and 10€), and for the 3 versions (standard, everyone loses if 0 contribution, and finally, winnings are only shared between contributors). Our results can be interpreted with the transition from Game 1 to Game 2, and from Game 2 to Game 3, but we can't interpret the results of Game 1 with Game 3. It would be interesting for future research to study whether the absence of a free rider enables hesitant individuals to become cooperators.

Industry professionals see themselves as potential competitors, not as colleagues with whom they can collaborate. As soon as they have to anticipate each other's behavior, they stop cooperating. In a free rider configuration, horticultural industry professionals put themselves in a position of strategic under-investment, i.e., they deliberately decide to stop cooperating. In our experiment, the results of the PG games of the different sectors fluctuate in similar ways. The results between players who play with his sector, and players who play with another sector also fluctuate in similar ways between Game 1 and Game 2, and Game 2 and Game 3. These results suggest that the mechanisms of horizontal, and vertical cooperation work in the same way. However, we recognize that our sample is limited for such a conclusion. It would therefore be interesting to replicate this experiment on a larger sample for a more in-depth analysis.

With this original field experiment, we show that it is possible to increase the rate of cooperation in collective actions, and overcome loss aversion with the same sample of individuals. Our results shed light on the behavior of professionals in the horticultural industry, and contribute to a better understanding of individuals' behavior when faced with OI through cooperation, loss and risk aversion, and preferences for the present. In terms of public policy, collective action should aim to deliver equitable benefits to all contributors, not just anonymous ones.

The limitations discussed above make us strongly invite replication of this experiment in other industries, other countries, and among other professionals to shed light on the external validity of the results Finger et al. (2023); Torres-Guevara and Schlüter (2016); Perez et al. (2021).

Appendices

Appendix D

Open innovation, risk, and value sharing: a field experiment.

Survey online

Survey online (this survey is translated from French)

This questionnaire on LimeSurvey[1] was run in French. It is translated into English here for the appendix.

Open Innovation:
A survey of the plant sector

We are scholars at the University of Angers. Our study is conducted without commercial or political motives.

Data management

This study is anonymous.

In accordance with the principles of open science, and in compliance with the General Data Protection Regulation, anonymized data will be archived and made accessible for scientific use.

Duration

The survey lasts a maximum of 15 minutes. You can stop at any time and resume later, by clicking on the same link.

To return to the questions on the previous page, click on «previous» at the bottom left of each page, but do not go back on the browser, otherwise your answers will not be saved.

The survey consists of 3 parts:

- a first part on general questions,
- a second part where we invite you to play 6 strategic games.
- a third part on your perception of innovation.

Your answers will enable us to make useful recommendations to your sector.

To thank you

For each complete answer, we'll draw one of the six games. Your winnings will depend on your answers in this game.

Contact

For any questions: ngoc-thao.noet@etud.univ-angers.fr

There are 39 questions in this questionary.

Consent

Please select only one of the following:

I confirm that I have read and understood the above information. I am at least 18 years old and give my consent to participate in this study.

[1] https://limesurvey.univ-angers.fr/index.php/129219?lang=fr

I do not give my consent to participate in this study.

Your profile

You are:
Please select only one of the following:

- male
- female

Your year of birth:
Please write your answer here:

You are:
Please select only one of the following:

- Executive
- Employee
- Other

What is your education level?
Please select only one of the following:

- No diploma
- 9th Grade
- Vocational certificate obtained 2 years after the 9th grade
- High-School Diploma/Degree
- 12th Grade / associate degree
- Bachelor's degree
- Master's degree
- One-year degree before postgraduate studies
- PhD
- Other

In which sector do you work?
Please select only one of the following:

- Horticultural production
- Retail
- Landscape
- Other

If «Other»: Thank you for your participation. Our questionary concerns only horticultural producers, retailers in the plant sector and landscape professionals.

In what type of structure do you work?
Please select only one of the following:

- Private company
- Association
- Other

What is your job?
Answer this question only if the following conditions are met:

Please select only one of the following:

- Nurseryman
- Horticulturist
- Cut flower grower.
- Mixed category grower
- Other

What is your job?

Answer this question only if the following conditions are met:

Please select only one of the following:

- Landscape contractor
- Landscape designer (or similar)
- Other

What is your job?

Please select only one of the following:

- Florist
- Wholesaler
- Garden center
- Agricultural self-service
- Other

How many people roughly (salaried, non-salaried or FTE (full-time equivalent)) work in your company?

Please enter your answer here:

What is your company's postal code?

Please enter your answer here:

Did you take part in our survey in October 2022?

Please select only one of the following:

- Yes
- No

Did you take part in our survey in January or in February 2023?

Please select only one of the following:

- Yes
- No

Your game group

We now invite you to play six games.

Each game is played independently.

You can win up to €25.

To be able to assign you to a playgroup, please enter the last 2 digits of your cell phone number.

Please select only one of the following:

- between 00 and 49
- between 50 and 74
- between 75 and 99

Strategy games PG Game

Same sector

The following three games (in the three cases format) are played with 4 players.

You'll play with three other people **from your sector** (distribution, horticulture, **or** landscape).

For each game, we'll give you €10 to get started.

Each game is played independently.

You have €10 to start each game.

You each put whatever amount you like into the common pot (0€, 5€, or 10€).

The total amount deposited by all players will be multiplied by 2.

This amount will be divided equally between the four of you, regardless of how much each of you has contributed.

So, you'll each receive a quarter of the common pot, in addition to the amount you've kept.

Choose the appropriate answer for each item:

	€0	€5	€10
Case 1: You will have the amount you keep and your share of the public good. How much do you give into the public good?			
Case 2: If only one player puts in €0, the amount in the public good will be lost for all players and you will win the amount you have retained. How much do you give into the public good?			
Case 3: The total amount deposited by the players will be divided equally *only among the players who contributed to the public good*, regardless of the amount each of you contributed. How much do you give into the public good?			

Sector P/L

The following three games (in the three cases format) are played with 4 players.
So, you'll be playing with 3 other **horticultural production** and **landscape players**.
You'll be **2 horticultural production players** and **2 landscape players**.
For each game, we'll give you €10 to get started.
Each game is played independently.
You have €10 to start each game.
You each put whatever amount you like into the common pot (0€, 5€, or 10€).
The total amount deposited by all players will be multiplied by 2.
This amount will be divided equally between the four of you, regardless of how much each of you has contributed.
So, you'll each receive a quarter of the public good, in addition to the amount you've kept.

Choose the appropriate answer for each item:

	€0	€5	€10
Case 1: You will have the amount you keep and your share of the public good. How much do you give into the public good?			
Case 2: If only one player puts in €0, the amount in the public good will be lost for all players and you will win the amount you have retained. How much do you give into the public good?			
Case 3: The total amount deposited by the players will be divided equally *only among the players who contributed to the public good*, regardless of the amount each of you contributed. How much do you give into the public good?			

Sector P/R

The following three games (in the three cases format) are played with 4 players.
So, you'll be playing with 3 other players from the **horticultural production** and **independent garden centers**.
You will be **2 horticultural production players** and **2 independent garden center players**.
For each game, we'll give you €10 to get started.
Each game is played independently.
You have €10 to start each game.
You each put whatever amount you like into the public good (0€, 5€, or 10€).
The total amount deposited by all players will be multiplied by 2.
This amount will be divided equally between the four of you, regardless of how much each of you has contributed.
So, you'll each receive a quarter of the public good, in addition to the amount you've kept.

Choose the appropriate answer for each item:

	€0	€5	€10
Case 1: You will have the amount you keep and your share of the public good. How much do you give into the public good?			
Case 2: If only one player puts in €0, the amount in the public good will be lost for all players and you will win the amount you have retained. How much do you give into the public good?			

Case 3: The total amount deposited by the players will be divided equally *only among the players who contributed to the public good*, regardless of the amount each of you contributed. How much do you give into the public good?			

Individual strategy games

Game 4:

In this game we give you €10.

For each of these 5 suggestions, you have the choice to play (option A) or (option B).

Choose the appropriate answer for each item:

	Option A	Option B
Option A: you have a 1/2 chance of winning €10, and a 1/2 chance of losing €9. **Option B**: no win, no loss: €0		
Option A: you have a 1/2 chance of winning €10, and a 1/2 chance of losing €6. **Option B**: no win, no loss: €0		
Option A: you have a 1/2 chance of winning €10, and a 1/2 chance of losing €5. **Option B**: no win, no loss: €0		
Option A: you have a 1/2 chance of winning €10, and a 1/2 chance of losing €4. **Option B**: no win, no loss: €0		
Option A: you have a 1/2 chance of winning €10, and a 1/2 chance of losing €1. **Option B**: no win, no loss: €0		

Game 5:

You can choose between 2 options.

For each of these 5 suggestions, would you choose option A or option B?

Choose the appropriate answer for each item:

	Option A	Option B
Option A: 1 / 10 to win €5 and 9 / 10 to win €4. **Option B**: 1 / 10 to win €9 and 9 / 10 to win €0.20		
Option A: 4 / 10 to win €5 and 6 / 10 to win €4. **Option B**: 4 / 10 to win €9 and 6 / 10 to win €0.20		
Option A: 5 / 10 to win €5 and 5 / 10 to win €4. **Option B**: 5 / 10 to win €9 and 5 / 10 to win €0.20		
Option A: 6 / 10 to win €5 and 4 / 10 to win €4. **Option B**: 6 / 10 to win €9 and 4 / 10 to win €0.20		
Option A: 9 / 10 to win €5 and 1 / 10 to win €4. **Option B**: 9 / 10 to win €9 and 1 / 10 to win €0.20		

Game 6 :

You can choose between 2 options.

For each of these 5 suggestions, would you choose option A or option B?

Choose the appropriate answer for each item:

	Option A	Option B
Option A: earn €19 in 10 weeks. **Option B**: earn €10 now		
Option A: earn €16 in 10 weeks. **Option B**: earn €10 now		
Option A: earn €15 in 10 weeks. **Option B**: earn €10 now		

Option A: earn €14 in 10 weeks. **Option B**: earn €10 now		
Option A: earn €11 in 10 weeks. **Option B**: earn €10 now		

Your perception of innovation

1.1. In your opinion, what does **innovation** mean for the **plant sector**?
Please write your answer here:

1.2. In your opinion, what does **innovation** mean for your **company**?
Please write your answer here:

1.3. Innovation is a key factor in remaining competitive.
Please select only one of the following:

- Strongly agree.
- Somewhat agree.
- Neither agree nor disagree.
- Somewhat disagree.
- Strongly disagree.

1.4. In your opinion, what does «**open innovation**» mean for your **company**? *
Please enter your answer here:

Open innovation refers to developing with external partners (suppliers, customers, various institutions, etc.), as well as internal employees of all hierarchical levels. Open innovation translates into knowledge sharing, as well as formal and informal cross-collaboration. The aim is to improve the efficiency of the company and/or the industry.

Open innovation is a key component in generating innovation.
Please select only one of the following:

- Strongly agree.
- Somewhat agree.
- Neither agree nor disagree.
- Somewhat disagree.
- Strongly disagree.

1.5. Are you affiliated with an organization that promotes innovation?
Please select all that apply:

- Competitiveness cluster
- University laboratory or research organization (such as INRAE)
- Start-up incubator
- Living lab
- Other
- No, I'm not affiliated.

Your perception of open innovation

1.6. Choose the appropriate answer for each item:
Generally speaking, you have good relationships with

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees					
your suppliers					
your customers					
other companies in your sector					

institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...)					

1.7. Choose the appropriate answer for each item:

Generally speaking, you are in regular discussions with

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees					
your suppliers					
your customers					
other companies in your sector					
institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...)					

1.8. Choose the appropriate answer for each item:

Generally speaking, you share the same collective objectives and ambitions with

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees					
your suppliers					
your customers					
other companies in your sector					
institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...)					

1.9. Choose the appropriate answer for each item:

Generally speaking, sharing knowledge is beneficial with

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees					
your suppliers					
your customers					
other companies in your sector					
institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...)					

1.10. Choose the appropriate answer for each item:

Generally speaking,

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees think you should share your knowledge, experience, or know-how.					
your suppliers think you should share your knowledge, experience, or know-how.					
your customers					

think you should share your knowledge, experience, or know-how.					
other companies in your sector think you should share your knowledge, experience, or know-how.					
institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...) think you should share your knowledge, experience, or know-how.					

1.11. Choose the appropriate answer for each item:

Generally speaking, your exchanges (knowledge, know-how, experience) are reciprocal with

	Totally agree	Rather agree	Neither agree nor disagree	Rather disagree	Totally disagree
your colleagues or employees					
your suppliers					
your customers					
other companies in your sector					
institutional organizations (e.g., interprofession, unions, Astredhor stations, or other organizations...)					

Your comments

Would you like to receive the results of this study by e-mail in 2023?
Please select only one of the following:

- Yes
- No

1.12. Please specify your e-mail address.

Please enter your answer here:

To receive your Illicado gift card, please enter your full name and address.

Please enter your answer here:

If you have any comments, please use the section below.
Please write your comments here:

Thank you for your participation.
Thank you for filling in this questionary.

Additional results

Figure D.1: Producer $N = 70$

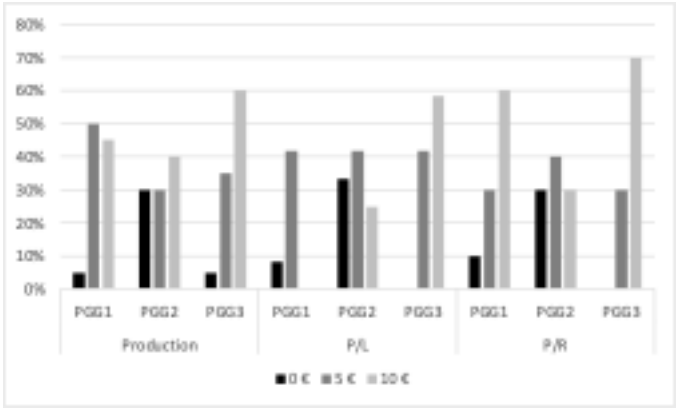


Figure D.2: Landscaper $N = 70$

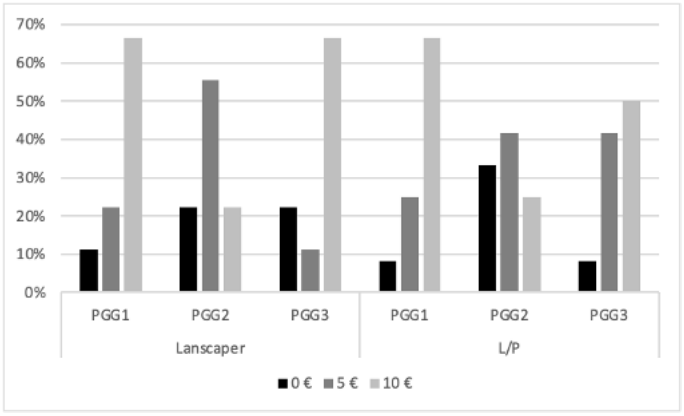
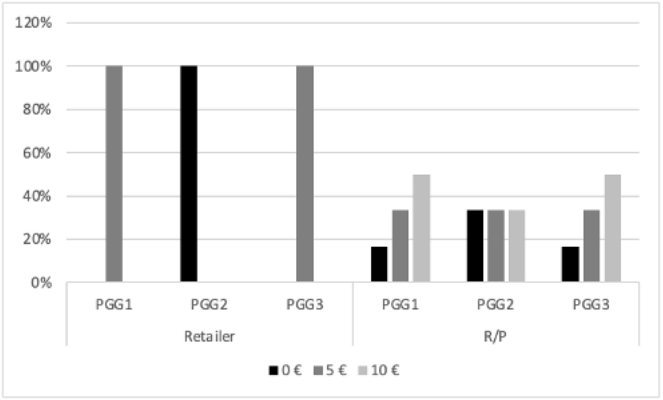


Figure D.3: Retailer $N = 70$



General conclusion

Contributions

This thesis contributes to the literature on cooperation, and more specifically that of professionals in the horticultural sector. It provides new findings on the determinants of horizontal, and vertical cooperation, and shows that it is obstructed by barriers that are primarily psychological in nature. Despite an uncertain economic context that demonstrates the obvious urgency of cooperation, individuals behave strategically in their interests, even if this contradicts the collective interest. Given the economic and social stakes involved in generating cooperation in the industry, the results of this thesis underline the need to focus on the determinants of cooperation to reinforce collective actions already implemented and generate new ones.

Within the framework of strategic games, we have shown that simultaneous strategic interactions (chapter 1), and repeated strategic interactions (chapter 2) in cooperation are primarily influenced by individual interest. Cooperation in the collective interest ceases when it contradicts individual interest.

More specifically, the first chapter looks at how horticulturists behave when faced with the urgent need to cooperate on collective actions. While cooperation between the stakeholders in the industry does exist, it is often the result of one-time projects or does not last. A public-good game configuration reveals altruistic and cooperative behavior, but this is tainted by a bias: they believe themselves to be more cooperative than others,

when in reality they are not. This bias is not limited to cooperation but also affects other behaviors such as skills (driving) (Svenson, 1981) or honesty (Mouminoux and Rullière, 2021). This effect explains why collective action is not sustained, and why the chain of reciprocity breaks down.

In the second chapter, we show that group identity promotes cooperative behavior in the supply chain. However, in the case of repeated interactions, cooperation emerges, and stabilizes only when the player anticipates the other's cooperation regardless of the sector to which they belong (growers or landscapers). Conversely, cooperation comes to a halt as soon as a lack of trust appears (again, irrespective of group identity). Contextualizing the prisoner's dilemma had no significant impact (except for the first day). Attitudes towards collective action, on the other hand, have a more lasting impact on cooperation.

The third chapter focuses on value sharing in a context of uncertain gain. We have situated the experiment in the context of open innovation, a context in which the ability to generate cooperation is a determining factor in the success or failure of the project. We observed 67% risk-averse behavior, and a drop in the endowment to 49% in the version of the public good game, where there is a probability of losing but it depends on the other players. These results confirm that cooperative behavior in the industry is affected by psychological disincentives to collective action, such as a lack of confidence in each other's behavior. This third chapter identifies the factors that increase cooperation, such as taking free rider behavior into account when sharing the collective's results. It helps us to understand the obstacles to cooperation and reveals the motivations for overcoming them.

The results of this thesis reveal that the obstacles are psychological and therefore call for improved interaction between the various players in the industry. It's not just a question of creating interactions between professionals in the same sector, but of creating

lasting links between all the stakeholders in the industry. The industry stands to gain by bringing all players together towards a common goal, a single vision for the industry. To this end, the role of organizations is essential as trusted third parties in the arbitration between individual, and collective interests. Today, however, this role is inadequate, as our surveys show that professionals distrust the organizations that organize them (Chapter 1 and Chapter 3). For links to be re-established, and for organizations to play this role to the full, they need to get closer to the field, for example, by bringing knowledge, and information directly to professionals, rather than simply «making it available».

Cooperation can only emerge, and stabilize when trust is established, and interactions are repeated (Chapter 2). The results show the existence of a psychological lock-in effect, reinforced by a path dependency effect. Professionals anticipating selfish behavior on the part of others act accordingly. The collective actions that are put in place must take this psychological lock-in effect into account, to further multiply exchanges, and unlock the logic of the circle (Chapter 2). Today, exchanges are insufficient to overturn the beliefs and representations of players in the industry. They think the other is different, when in fact they share the same problems and difficulties. This is the case for the recycling of plastic pots or water restrictions in the event of drought. This is an industry-wide issue, which we can even extend to the consumer (what's the point of buying a plant if you can't water your garden?). So, we need to step up communication and education.

The results show that education and communication are key factors for the industry. Today, professionals feel that they are not understood, both internally, with intergenerational conflicts, and externally through «agri-bashing». The sector is not attractive and is being deserted by the younger generations. This creates not only a shortage of skilled and unskilled labor but also problems with company takeovers. Training is therefore inadequate. The public authorities need to make the industry more attractive and

develop training programs to attract new generations, thereby opening up the industry's prospects, and changing attitudes.

Finally, the results of this thesis show that professionals have an aversion to free rider behavior. They are in a dynamic of failure, and end up adopting a behavior of strategic under-investment when they suspect the existence of free riders in the collective. For cooperation to be maintained, individuals who behave opportunistically, i.e., not contributing while benefiting from the efforts of those who do, must be excluded from the group (chapter 3). In this case, cooperation can continue. This alternative nonetheless generates an experience effect and a learning effect. Failing that is a starting point for increasing cooperation in the industry.

Limitations and perspectives

The conclusions drawn in this thesis are based on the results of specific field experiments. We have not run any laboratory experiments. There are several points to be made on this last point. The first is the difficulty of field experiments (Torres-Guevara and Schlüter, 2016; Weigel et al., 2021). The industry's professionals are not very receptive to academic research, especially as they are busy with the day-to-day running of the business. Time management is about managing priorities, as demonstrated by the failure of our experiment at the Salon du Végétal in Angers in September 2022. Although they are all gathered in the same enclosed space, business comes first, even if they are committed to participating. Several hypotheses can be put forward. The professionals didn't understand the meaning, and interest of our research approach. Professionals participate out of altruism. And finally, professionals are not at all sensitive to the remuneration of experiments. Our intuition is that there may be a bit of all three. Perhaps these hypotheses need to be confirmed by future research.

Our second observation is the limited size of our samples. We had 80, 93, and 70 participants. First, not all sectors are well represented. We had mainly growers (always over 58% in each experiment), and fewer distributors and landscapers. While growers represent the heart of the sector, and their participation is therefore essential, one of the limitations is that our results are not only specific but also partial. Second, we do recognize that small sample sizes may also lead to measurement errors, raising the question of the robustness of econometric analyses (see Perez et al. (2021) for risk aversion). Although the results have the merit of providing new information, they have yet to be confirmed. It might therefore be worthwhile conducting further studies on a larger sample.

Moreover, this thesis focuses on the behavior of industry players in the sense of the VALHOR interbranch, i.e., producer, retailer, and landscape. No attention has been paid to institutional organizations, private partners, or consumers. Private partners play essential roles in the industry. They can be suppliers, such as manufacturers of plant pots, or trusted third parties, such as platform services or logistics for roll returns. Institutional organizations can play a key role as trusted-third parties, helping to streamline interactions within the industry. Finally, in an era of resilience, and short supply chains, including consumers in discussions on better cooperation, could be a way of producing, and consuming differently. Including them in experiments could shed additional light on the analysis of cooperation in the supply chain.

In addition, we were only interested in the case of France, a high-income country with a strong agricultural culture. The effects could have been different in the case of low- and middle-income countries with an agricultural culture that is perhaps less assertive, such as Kenya, which is the leading producer of roses.

In this thesis, we used only field data. In light of the failure, we had at the Salon du Végétal to recruit industry professionals, we concentrated solely on field experiments,

including those with students from the Institut Agro Rennes-Angers (Chapter 2). It would be interesting to carry out laboratory experiments with students or professionals.

Finally, our designs are original and provide meaningful results. The designs have been conceived for replication in other sectors too. Cooperation is a key element of competitiveness, and identifying its determinants is an essential asset. An approach based on field experimentation and the use of game theory has brought new insights, especially with a sample of professionals. The approach of seeking responses from individuals who are not used to participating opens up relevant perspectives for future research, while also bringing concrete answers to the field. The contribution is therefore twofold, both academic and in the field. Replicating the experiments in other industries, with a more in-depth analysis of the results to confirm external validity, could provide interesting avenues for future research and literature development.

Bibliography

Adam, N. A. and Alarifi, G. (2021). Innovation practices for survival of small and medium enterprises (SMEs) in the COVID-19 times: the role of external support. *Journal of Innovation and Entrepreneurship*, 10(1):15.

Adhabi, E. A. R. and Anozie, C. B. L. (2017). Literature Review for the Type of Interview in Qualitative Research. *International Journal of Education*, 9(3):86.

Ahmad, S., Shankar, S., Steen, J., Verreynne, M.-L., and Burki, A. A. (2021). Using measures of efficiency for regionally-targeted smallholder policy intervention: The case of Pakistan's horticulture sector. *Land Use Policy*, 101:105179.

Ahn, T., Isaac, R. M., and Salmon, T. C. (2009). Coming and going: Experiments on endogenous group sizes for excludable public goods. *Journal of Public Economics*, 93(1-2):336–351.

Akerlof, G. A. and Kranton, R. E. (2000). Economics and Identity. *The Quarterly Journal of Economics*, 115(3):715–753.

Akhundjanov, S. B., Gallardo, R. K., McCluskey, J. J., and Rickard, B. J. (2020). Commercialization of a demand-enhancing innovation: The release of a new apple variety by a public university. *Economic Modelling*, 86:88–100.

Alaie, S. A. (2020). Knowledge and learning in the horticultural innovation system: A case of Kashmir valley of India. *International Journal of Innovation Studies*, 4(4):116–133.

Aleksić, D., Rangus, K., and Slavec Gomezel, A. (2022). Microfoundations of SME open innovation: the role of help, knowledge sharing and hiding. *European Journal of Innovation Management*, 25(6):178–203.

Alesina, A. and La Ferrara, E. (2000). Participation in Heterogeneous Communities. *The Quarterly Journal of Economics*, 115(3):847–904.

Algan, Y., Benkler, Y., Fuster Morell, M., and Hergueux, J. (2013). Cooperation in a Peer Production Economy Experimental Evidence from Wikipedia. *SSRN Electronic Journal*.

Ali, W., Abdulai, A., Goetz, R., and Owusu, V. (2021). Risk, ambiguity and willingness to participate in crop insurance programs: Evidence from a field experiment*. *Australian Journal of Agricultural and Resource Economics*, 65(3):679–703.

Alicke, M. D. and Govorun, O. (2005). The Better-Than-Average Effect. *The Self in Social Judgment*, 1(5):85–106.

Alicke, M. D., Klotz, M. L., Breitenbecher, D. L., Yurak, T. J., and Vredenburg, D. S. (1995). Personal Contact, Individuation, and the Better-Than-Average Effect. *Journal of Personality and Social Psychology*, 68(5):804–825.

Almeida, F. (2021). Open-Innovation Practices: Diversity in Portuguese SMEs. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(3):169.

Alpizar, F., Carlsson, F., and Johansson-Stenman, O. (2008). Anonymity, reciprocity, and conformity: Evidence from voluntary contributions to a national park in Costa Rica. *Journal of Public Economics*, 92(5-6):1047–1060.

Alós-Ferrer, C. and Garagnani, M. (2020). The cognitive foundations of cooperation. *Journal of Economic Behavior & Organization*, 175:71–85.

Amisse, S., Leroux, I., Muller, P., and Widehem, C. (2013). Les réseaux de communautés de pratique dans la dynamique de la gouvernance territoriale horticole : le cas de l'Anjou. *Géographie Economie Société*, 3:38.

Andreoni, J. (1990). Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *The Economic Journal*, 100(401):464.

Andreoni, J. (1993). An Experimental Test of the Public-Goods Crowding-Out Hypothesis. *The American Economic Review*, Vol. 83(No. 5):1317–1327.

Andreoni, J. and Miller, J. H. (1993). Rational Cooperation in the Finitely Repeated Prisoner's Dilemma: Experimental Evidence. *The Economic Journal*, 103(418):570.

Angeon, V., Magdalou, B., Célimène, F., and Logossah, K. (2013). Défauts de coordination au sein de l'élevage de bovidés à la Martinique : un test expérimental de terrain. *Revue d'Économie Régionale & Urbaine*, février(1):37–61.

Arpinon, T. and Espinosa, R. (2023). A practical guide to Registered Reports for economists. *Journal of the Economic Science Association*, 9(1):90–122.

Aslam, U., Termansen, M., and Fleskens, L. (2017). Investigating farmers' preferences for alternative PES schemes for carbon sequestration in UK agroecosystems. *Ecosystem Services*, 27:103–112.

Audretsch, B. D. and Belitski, M. (2023). The limits to open innovation and its impact on innovation performance. *Technovation*, 119:102519.

Axelrod, R. (1984). *The Evolution of Cooperation*. New York: Basic.

Axelrod, R. and Dion, D. (1988). The Further Evolution of Cooperation. *Science*, 242(4884):1385–1390.

Axelrod, R. and Keohane, R. O. (1985). Achieving cooperation under anarchy: Strategies and institutions. *World politics*, 38(1):226–254.

Bacharach, M. (1999). Interactive team reasoning: A contribution to the theory of co-operation. *Research in Economics*, 53(2):117–147.

Bahemia, H. and Roehrich, J. K. (2023). Governing open innovation projects: The relationship between the use of trust and legal bonds. *Industrial Marketing Management*, 110:17–30.

Baker, F. and Rachlin, H. (2001). Probability of reciprocation in repeated prisoner's dilemma games. *Journal of Behavioral Decision Making*, 14(1):51–67.

Balafoutas, L., García-Gallego, A., Georgantzis, N., Jaber-Lopez, T., and Mitrokostas, E. (2020). Rehabilitation and social behavior: Experiments in prison. *Games and Economic Behavior*, 119:148–171.

Balliet, D. and Van Lange, P. A. M. (2013). Trust, Punishment, and Cooperation Across 18 Societies: A Meta-Analysis. *Perspectives on Psychological Science*, 8(4):363–379.

Balliet, D., Wu, J., and De Dreu, C. K. W. (2014). Ingroup favoritism in cooperation: A meta-analysis. *Psychological Bulletin*, 140(6):1556–1581.

Bandiera, O., Barankay, I., and Rasul, I. (2005). Cooperation in collective action*. *The Economics of Transition*, 13(3):473–498.

Barr, A., Packard, T., and Serra, D. (2014). Participatory accountability and collective action: Experimental evidence from Albania. *European Economic Review*, 68:250–269.

Barr, J. and Saraceno, F. (2009). Organization, learning and cooperation. *Journal of Economic Behavior & Organization*, 70(1-2):39–53.

Barreda-Tarrazona, I., Jaramillo-Gutiérrez, A., Pavan, M., and Sabater-Grande, G. (2017). Individual Characteristics vs. Experience: An Experimental Study on Cooperation in Prisoner's Dilemma. *Frontiers in Psychology*, 8:596.

Bauer, M., Blattman, C., Chytilová, J., Henrich, J., Miguel, E., and Mitts, T. (2016). Can War Foster Cooperation? *Journal of Economic Perspectives*, 30(3):249–274.

Bavik, Y. L., Tang, P. M., Shao, R., and Lam, L. W. (2018). Ethical leadership and employee knowledge sharing: Exploring dual-mediation paths. *The Leadership Quarterly*, 29(2):322–332.

Baxter, J. and Eyles, J. (1997). Evaluating Qualitative Research in Social Geography: Establishing 'Rigour' in Interview Analysis. *Transactions of the Institute of British Geographers*, 22(4):505–525.

Baxter, J. and Eyles, J. (1999). The Utility of In-Depth Interviews for Studying the Meaning of Environmental Risk. *The Professional Geographer*, 51(2):307–320.

Bchir, M. A. (2011). What cooperative behaviour for farmers? Challenging experimental economics with field investigation. *Cahiers Agricultures*, 20(1-2):92–96.

Belderbos, R., Carree, M., Diederen, B., Lokshin, B., and Veugelers, R. (2004). Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization*, 22(8-9):1237–1263.

Bernard, C. (1992). La production de fraise à Huelva : les avantages de la filière espagnole sur le marché européen. *Économie rurale*, 212(1):12–18.

Berti, G. and Mulligan, C. (2016). Competitiveness of Small Farms and Innovative Food Supply Chains: The Role of Food Hubs in Creating Sustainable Regional and Local Food Systems. *Sustainability*, 8(7):616.

Bhat, M. (2017). Development of horticultural sector in india–the way forward. *Journal of Agroecology and Natural Resource Management*, 4(4):292–297.

Biely, K., Von Münchhausen, S., and Van Passel, S. (2022). Vertical integration as a strategy to increase value absorption by primary producers: The Belgian sugar beet and the German rapeseed case. *AIMS Agriculture and Food*, 7(3):659–682.

Binmore, K. (2006). Why do people cooperate? *Politics, Philosophy & Economics*, 5(1):81–96.

Biró, S., Hamza, E., and Rácz, K. (2016). Economic and social importance of vertical and horizontal forms of agricultural cooperation in Hungary. *Studies in Agricultural Economics*, 118(2):77–84.

Blais, M. and Martineau, S. (2006). L'analyse inductive générale: description d'une démarche visant à donner un sens à des données brutes. *Recherches qualitatives*, 26(2):1–18.

Blondel, S. and Noet, N. T. (2022a). Pour une meilleure compétitivité, coopérer ! *Le Lien Horticole*, (1121):44–45.

Blondel, S. and Noet, N. T. (2022b). Quels facteurs expliquent la faible coopération en horticulture? *⟨hal-03754777⟩*, page 31.

Blondel, S. and Widehem, C. (2006). Les producteurs en ornement sont-ils individualistes ? Une étude expérimentale. *Économie rurale*, 294(5):107–116.

Bluffstone, R., Dannenberg, A., Martinsson, P., Jha, P., and Bista, R. (2020). Cooperative behavior and common pool resources: Experimental evidence from community forest user groups in Nepal. *World Development*, 129:104889.

Bogers, M., Foss, N. J., and Lyngsie, J. (2018). The "human side" of open innovation: The role of employee diversity in firm-level openness. *Research Policy*, 47(1):218–231.

Bohm, P. (1972). Estimating demand for public goods: An experiment. *European Economic Review*, 3(2):111–130.

Bolle, F. and Kritikos, A. (2006). Reciprocity, Altruism, Solidarity: A Dynamic Model. *Theory and Decision*, 60(4):371–394.

Bolton, G., Dimant, E., and Schmidt, U. (2021). Observability and social image: On the robustness and fragility of reciprocity. *Journal of Economic Behavior & Organization*, 191:946–964.

Bowen, F. E., Rostami, M., and Steel, P. (2010). Timing is everything: A meta-analysis of the relationships between organizational performance and innovation. *Journal of Business Research*, 63(11):1179–1185.

Bowles, S. and Gintis, H. (2004). The evolution of strong reciprocity: cooperation in heterogeneous populations. *Theoretical Population Biology*, 65(1):17–28.

Brañas-Garza, P., Estepa-Mohedano, L., Jorrat, D., Orozco, V., and Rascón-Ramírez, E. (2021). To pay or not to pay: Measuring risk preferences in lab and field. *Judgment and Decision Making*, 16(5):1290–1313.

Breitmoser, Y. (2015). Cooperation, but No Reciprocity: Individual Strategies in the Repeated Prisoner's Dilemma. *American Economic Review*, 105(9):2882–2910.

Brewer, M. B. and Gardner, W. (1996). Who Is This "We"? Levels of Collective Identity and Self Representations. *Journal of Personality and Social Psychology*, 71(1):83–93.

Brito, L. A. L., Brito, E. P. Z., and Hashiba, L. H. (2014). What type of cooperation with suppliers and customers leads to superior performance? *Journal of Business Research*, 67(5):952–959.

Buchan, N. R., Brewer, M. B., Grimalda, G., Wilson, R. K., Fatas, E., and Foddy, M. (2011). Global Social Identity and Global Cooperation. *Psychological Science*, 22(6):821–828.

Camerer, C. (1988). Gifts as Economic Signals and Social Symbols. *American Journal of Sociology*, 94:180–214.

Cao, J. and Song, W. (2016). Risk assessment of co-creating value with customers: A rough group analytic network process approach. *Expert Systems with Applications*, 55:145–156.

Card, D., DellaVigna, S., and Malmendier, U. (2011). The Role of Theory in Field Experiments. *Journal of Economic Perspectives*, 25(3):39–62.

Carlsson, F., Johansson-Stenman, O., and Khanh Nam, P. (2015). Funding a new bridge in rural Vietnam: a field experiment on social influence and default contributions. *Oxford Economic Papers*, 67(4):987–1014.

Carrozzo Magli, A. and Manfredi, P. (2022). Coordination games vs prisoner's dilemma in sustainability games: A critique of recent contributions and a discussion of policy implications. *Ecological Economics*, 192:107–268.

Castañer, X. and Oliveira, N. (2020). Collaboration, Coordination, and Cooperation Among Organizations: Establishing the Distinctive Meanings of These Terms Through a Systematic Literature Review. *Journal of Management*, 46(6):965–1001.

Černe, M., Nerstad, C. G., Dysvik, A., and Škerlavaj, M. (2014). What goes around comes around: Knowledge hiding, perceived motivational climate, and creativity. *Academy of Management Journal*, 57(1):172–192.

Charness, G., Du, N., and Yang, C.-L. (2011). Trust and trustworthiness reputations in an investment game. *Games and Economic Behavior*, 72(2):361–375.

Charness, G., Gneezy, U., and Imas, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization*, 87:43–51.

Charness, G., Haruvy, E., and Sonsino, D. (2007). Social distance and reciprocity: An Internet experiment. *Journal of Economic Behavior & Organization*, 63(1):88–103.

Chaudhary, S., Kaur, P., Talwar, S., Islam, N., and Dhir, A. (2022). Way off the mark? Open innovation failures: Decoding what really matters to chart the future course of action. *Journal of Business Research*, 142:1010–1025.

Chaudhuri, A. (2011). Sustaining cooperation in laboratory public goods experiments: a selective survey of the literature. *Experimental Economics*, 14(1):47–83.

Chen, D. L., Schonger, M., and Wickens, C. (2016). oTree—An open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9:88–97.

Chen, Y. and Li, S. X. (2009). Group Identity and Social Preferences. *American Economic Review*, 99(1):431–457.

Chesbrough, H. and Crowther, A. K. (2006). Beyond high tech: early adopters of open innovation in other industries. *R&d Management*, 36(3):229–236.

Chesbrough, H. W. (2003). The Era of Open Innovation. *Sloan Management Review*, 44(3):35–41.

Chesbrough, H. W., Lettl, C., and Ritter, T. (2018). Value Creation and Value Capture in Open Innovation: Value Creation and Value Capture. *Journal of Product Innovation Management*, 35(6):930–938.

Chia, C. and Dubois, F. (2017). Impulsiveness does not prevent cooperation from emerging but reduces its occurrence: an experiment with zebra finches. *Scientific Reports*, 7(1):8544.

Chow, W. S. and Chan, L. S. (2008). Social network, social trust and shared goals in organizational knowledge sharing. *Information & Management*, 45(7):458–465.

Connelly, C. E., Černe, M., Dysvik, A., and Škerlavaj, M. (2019). Understanding knowledge hiding in organizations. *Journal of Organizational Behavior*, 40(7):779–782.

Cooper, R., DeJong, D. V., Forsythe, R., and Ross, T. W. (1996). Cooperation without Reputation: Experimental Evidence from Prisoner's Dilemma Games. *Games and Economic Behavior*, 12(2):187–218.

Croson, R. (2007). Theories of Commitment, Altruism and Reciprocity: Evidence From Linear Public Goods Games. *Economic Inquiry*, 45(2):199–216.

Czajkowski, M., Vossler, C. A., Budziński, W., Wiśniewska, A., and Zawojska, E. (2017). Addressing empirical challenges related to the incentive compatibility of stated preferences methods. *Journal of Economic Behavior & Organization*, 142:47–63.

Dahlander, L. and Gann, D. M. (2010). How open is innovation? *Research Policy*, 39(6):699–709.

Dal Bó, P. (2005). Cooperation under the Shadow of the Future: Experimental Evidence from Infinitely Repeated Games. *The American Economic Review*, Vol. 95(No. 5):1591–1604.

Dal Bó, P. and Fréchette, G. R. (2018). On the Determinants of Cooperation in Infinitely Repeated Games: A Survey. *Journal of Economic Literature*, 56(1):60–114.

Dal Bó, P. and Fréchette, G. R. (2019). Strategy Choice in the Infinitely Repeated Prisoner's Dilemma. *American Economic Review*, 109(11):3929–3952.

Darley, J. M. and Latane, B. (1968). Bystander intervention in emergencies: Diffusion of responsibility. *Journal of Personality and Social Psychology*, 8(4, Pt.1):377–383.

Dawes, R. M. (1980). Social Dilemmas. *Annual Review of Psychology*, 31(1):169–193.

Dawes, R. M., McTavish, J., and Shaklee, H. (1977). Behavior, Communication, and Assumptions About Other People's Behavior in A Commons Dilemma Situation. *Journal of Personality and Social Psychology*, 35(1):1–11.

Dawes, R. M. and Thaler, R. H. (1988). Anomalies: Cooperation. *Journal of Economic Perspectives*, 2(3):187–197.

Deffontaines, N. (2014). La souffrance sociale chez les agriculteurs: Quelques jalons pour une compréhension du suicide. *Études rurales*, (193):13–24.

Defrancesco, E., Gatto, P., Runge, F., and Trestini, S. (2007). Factors Affecting Farmers? Participation in Agri-environmental Measures: A Northern Italian Perspective. *Journal of Agricultural Economics*, Vol. 59(No. 1):114–131.

DellaVigna, S., Pope, D., and Vivalt, E. (2019). Predict science to improve science. *Science*, 366(6464):428–429.

Diekert, F. K. (2012). The Tragedy of the Commons from a Game-Theoretic Perspective. *Sustainability*, 4(8):1776–1786.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., and Wagner, G. G. (2011). Individual risk attitudes: measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3):522–550.

Dorrough, A. R., Glöckner, A., Hellmann, D. M., and Ebert, I. (2015). The development of ingroup favoritism in repeated social dilemmas. *Frontiers in Psychology*, 6.

Du, J., Leten, B., and Vanhaverbeke, W. (2014). Managing open innovation projects with science-based and market-based partners. *Research Policy*, 43(5):828–840.

Duffy, J. and Ochs, J. (2009). Cooperative behavior and the frequency of social interaction. *Games and Economic Behavior*, 66(2):785–812.

Duffy, J., Xie, H., and Lee, Y.-J. (2013). Social norms, information, and trust among strangers: theory and evidence. *Economic Theory*, 52(2):669–708.

Dufwenberg, M. and Kirchsteiger, G. (2004). A theory of sequential reciprocity. *Games and Economic Behavior*, 47(2):268–298.

Dugatkin, L. (2002). Animal cooperation among unrelated individuals. *Naturwissenschaften*, 89(12):533–541.

Duijf, H. (2021). Cooperation, fairness and team reasoning. *Economics and Philosophy*, 37(3):413–440.

Dukes, W. F. (1965). N=l. *Psychological Bulletin*, 64(1):74–79.

Elomri, A. (2015). Cooperation in supply chain networks: Motives, outcomes, and barriers. *Int J Sup Chain Mgt*, 4(1):10–1081.

Elsenbroich, C. and Payette, N. (2020). Choosing to cooperate: Modelling public goods games with team reasoning. *Journal of Choice Modelling*, 34:100203.

Elster, J. (1985). Rationality, Morality, and Collective Action. *Ethics*, 96(1):136–155.

Embrey, M., Fréchette, G. R., and Yuksel, S. (2018). Cooperation in the Finitely Repeated Prisoner's Dilemma*. *The Quarterly Journal of Economics*, 133(1):509–551.

Esteban, J. and Ray, D. (2001). Collective Action and the Group Size Paradox. *The American Political Science Review*, 95(3):663–672.

Falk, A. and Fischbacher, U. (2006). A theory of reciprocity. *Games and Economic Behavior*, 54(2):293–315.

Falk, A. and Zehnder, C. (2013). A city-wide experiment on trust discrimination. *Journal of Public Economics*, 100:15–27.

Falk, T., Kumar, S., and Srigiri, S. (2019a). Experimental games for developing institutional capacity to manage common water infrastructure in India. *Agricultural Water Management*, 221:260–269.

Falk, T., Kumar, S., and Srigiri, S. (2019b). Public good experiment data of a water game framed to Rajasthan/India. *Data in Brief*, 27:104556.

Fehr, E. and Rockenbach, B. (2004). Human altruism: economic, neural, and evolutionary perspectives. *Current Opinion in Neurobiology*, 14(6):784–790.

Fehr, E. and Schmidt, K. M. (1999). A Theory of Fairness, Competition, and Cooperation. *The Quarterly Journal of Economics*, Vol. 114:817–868.

Fidanoski, F. and Johnson, T. (2023). A z-Tree implementation of the Dynamic Experiments for Estimating Preferences [DEEP] method. *Journal of Behavioral and Experimental Finance*, 38:100805.

Finger, R., Grebitus, C., and Henningsen, A. (2023). Replications in agricultural economics. *Applied Economic Perspectives and Policy*, 45(3):1258–1274.

Fischbacher, U. and Gächter, S. (2010). Social Preferences, Beliefs, and the Dynamics of Free Riding in Public Goods Experiments. *American Economic Review*, 100(1):541–556.

Fleiß, J. and Leopold-Wildburger, U. (2014). Once Nice, Always Nice? Results on Factors Influencing Nice Behavior from an Iterated Prisoner's Dilemma Experiment: Once Nice, Always Nice? *Systems Research and Behavioral Science*, 31(2):327–334.

FranceAgriMer (2008). Commerce extérieur des produits de l'horticulture ornementale. Technical report, FranceAgriMer.

FranceAgriMer (2019). Commerce extérieur des produits de l'horticulture ornementale. Technical report, FranceAgriMer.

FranceAgriMer (2020). Étude veille concurrentielle. Technical report, FranceAgriMer.

FranceAgriMer (2022a). Chiffres-clés de l'horticulture ornementale. Technical report, FranceAgriMer.

FranceAgriMer (2022b). Études horticulture. Technical report, FranceAgriMer.

FranceAgriMer (2023). Fiche filière horiculture 2023. Technical report, FranceAgriMer.

Franzen, A. and Vogl, D. (2013). Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, 23(5):1001–1008.

Frederick, S., Loewenstein, G., and O'donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of economic literature*, 40(2):351–401.

Fu, X., Li, J., Xiong, H., and Chesbrough, H. (2014). Open Innovation as a Response to Constraints and Risks: Evidence from China. *Asian Economic Papers*, 13(3):30–58.

Félix, J. (2022). Open Innovation Strategy: A Systematic Literature Review. Working paper.

Gaignard, J.-L. (2016). *Du roi René à Végépolys: les plantes naissent et fleurissent en Anjou.* Terre des sciences Terra botanica Végépolys, Angers.

Gallo, E., Riyanto, Y. E., Roy, N., and Teh, T.-H. (2022). Cooperation and punishment mechanisms in uncertain and dynamic social networks. *Games and Economic Behavior*, 134:75–103.

Gassmann, O., Enkel, E., and Chesbrough, H. (2010). The future of open innovation: The future of open innovation. *R&D Management*, 40(3):213–221.

Geanakoplos, J., Pearce, D., and Stacchetti, E. (1989). Psychological games and sequential rationality. *Games and Economic Behavior*, 1(1):60–79.

Gillot, M., Blasquiet-Revol, H., and Jeanneaux, P. (2022). Différenciation et compétitivité : quelle performance pour les exploitations viticoles françaises sous signe de qualité ? *Cahiers Agricultures*, 31:2.

Gintis, H. (2004). Towards the Unity of the Human Behavioral Sciences. *Politics, Philosophy & Economics*, 3(1):37–57.

Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., and Soutter, C. L. (2000). Measuring Trust*. *Quarterly Journal of Economics*, 115(3):811–846.

Gneezy, U. and Imas, A. (2017). Lab in the Field: Measuring Preferences in the Wild. *In Handbook of economic field experiments*, Vol. 1:439–464.

Goel, R. K. (1999). On contracting for uncertain R&D. *Managerial and Decision Economics*, 20(2):99–106.

Goette, L., Huffman, D., and Meier, S. (2006). The Impact of Group Membership on Cooperation and Norm Enforcement: Evidence Using Random Assignment to Real Social Groups. *The American Economic Review*, 96(2):212–216.

Goette, L., Huffman, D., and Meier, S. (2012a). The Impact of Social Ties on Group Interactions: Evidence from Minimal Groups and Randomly Assigned Real Groups. *American Economic Journal: Microeconomics*, 4(1):101–115.

Goette, L., Huffman, D., Meier, S., and Sutter, M. (2012b). Competition Between Organizational Groups: Its Impact on Altruistic and Antisocial Motivations. *Management Science*, 58(5):948–960.

Gomber, P., Kauffman, R. J., Parker, C., and Weber, B. W. (2018). On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. *Journal of Management Information Systems*, 35(1):220–265.

Gouldner, A. W. (1960). The Norm of Reciprocity: A Preliminary Statement. *American Sociological Review*, 25(2):161–178.

Graubner, M., Koller, I., Salhofer, K., and Balmann, A. (2011). Cooperative versus non-cooperative spatial competition for milk. *European Review of Agricultural Economics*, 38(1):99–118.

Grega, L. (2012). Vertical integration as a factor of competitiveness of agriculture. *Agricultural Economics (Zemědělská ekonomika)*, 49(No. 11):520–525.

Guala, F., Mittone, L., and Ploner, M. (2013). Group membership, team preferences, and expectations. *Journal of Economic Behavior & Organization*, 86:183–190.

Guido, A., Robbett, A., and Romaniuc, R. (2019). Group formation and cooperation in social dilemmas: A survey and meta-analytic evidence. *Journal of Economic Behavior & Organization*, 159:192–209.

Guion, L. A., Diehl, D. C., and McDonald, D. (2011). Conducting an In-depth Interview. *EDIS*, 2011(8).

Gulliver, R. E., Star, C., Fielding, K. S., and Louis, W. R. (2022). A systematic review of the outcomes of sustained environmental collective action. *Environmental Science & Policy*, 133:180–192.

Gupta, G., Mahmud, M., Maitra, P., Mitra, S., and Neelim, A. (2018). Religion, minority status, and trust: Evidence from a field experiment. *Journal of Economic Behavior & Organization*, 146:180–205.

Güth, W., Marchand, N., and Rullière, J.-L. (1998). Équilibration et dépendance du contexte. une évaluation expérimentale du jeu de négociation sous ultimatum. *Revue économique*, pages 785–794.

Gächter, S. and Herrmann, B. (2011). The limits of self-governance when cooperators get punished: Experimental evidence from urban and rural Russia. *European Economic Review*, 55(2):193–210.

Gächter, S. and Renner, E. (2018). Leaders as role models and 'belief managers' in social dilemmas. *Journal of Economic Behavior & Organization*, 154:321–334.

Gächter, S. and Thoni, C. (2005). Social Learning and Voluntary Cooperation Among Like-Minded People. *Journal of the European Economic Association*, Vol. 3(2/3):303–314.

Hardin, G. (1968). The Tragedy of the Commons. *Science*, 162(3859):1243–1248.

Hardin, R. (1971). Collective action as an agreeable n-prisoners' dilemma. *Behavioral Science*, 16(5):472–481.

Harrison, G. W. and List, J. A. (2004). Field Experiments. *Journal of Economic Literature*, Vol. 42(No. 4):1009–1055.

Hergueux, J. and Jacquemet, N. (2015). Social preferences in the online laboratory: a randomized experiment. *Experimental Economics*, 18(2):251–283.

Herzberg, R., Schmidt, T., and Keck, M. (2022). Market power and food loss at the producer-retailer interface of fruit and vegetable supply chains in Germany. *Sustainability Science*, 17(6):2253–2267.

Hess, C. and Ostrom, E. (2007). Introduction: An overview of the knowledge commons. pages 3–26. Mit Press.

Heuer, L. and Orland, A. (2019). Cooperation in the Prisoner's Dilemma: an experimental comparison between pure and mixed strategies. *Royal Society Open Science*, 6(7):182142.

Ho, T.-H., Camerer, C., and Weigelt, K. (1998). Iterated dominance and iterated best response in experimental" p-beauty contests". *The American Economic Review*, 88(4):947–969.

Holgersson, M., Wallin, M. W., Chesbrough, H. W., Dahlander, L., et al. (2022). Closing open innovation. *Strategic Management Review*, pages 750–772.

Holt, C. A. and Laury, S. K. (2002). Risk Aversion and Incentive Effects. *The American Economic Review*, 92(5):1644–1655.

Huth, P. K. (1988). Extended Deterrence and the Outbreak of War. *American Political Science Review*, 82(2):423–443.

Isaac, R. M., Schmidtz, D., and Walker, J. M. (1989). The assurance problem in a laboratory market. *Public Choice*, 62(3):217–236.

Jiang, L. and Wu, J. (2019). Belief-updating rule and sequential reciprocity. *Games and Economic Behavior*, 113:770–780.

Jolly, C. M., Nyandat, B., Yang, Z., Ridler, N., Matias, F., Zhang, Z., Murekezi, P., and Menezes, A. (2023). Dynamics of aquaculture governance. *Journal of the World Aquaculture Society*, 54(2):427–481.

Jovanovic, B. (1982). Selection and the Evolution of Industry. *Econometrica*, 50(3):649.

Justin, J., Boulay, J., Geoffriau, E., Widehem, C., and Muller, P. (2009). Où se crée la valeur ? Une application de l'analyse de Porter aux filières du végétal spécialisé. *Management & Avenir*, 28(8):177–195.

Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1991). Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias. *Journal of Economic Perspectives*, 5(1):193–206.

Kahneman, D. and Thaler, R. H. (2006). Anomalies: Utility maximization and experienced utility. *Journal of economic perspectives*, 20(1):221–234.

Kahneman, D. and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2):263.

Kamei, K. (2017). Endogenous reputation formation under the shadow of the future. *Journal of Economic Behavior & Organization*, 142:189–204.

Kandul, S. and Lanz, B. (2021). Public good provision, in-group cooperation and out-group descriptive norms: A lab experiment. *Journal of Economic Psychology*, 85:102382.

Kapusta, V., Malécot, V., and Bap, D. (2015). Création variétale dans la filière ornementale. *Asirpa (analyse Socio-économique Des Impacts de la Recherche Publique Agronomique)*, [Rapport Technique]:1–21.

Keser, C. and Van Winden, F. (2000). Conditional Cooperation and Voluntary Contributions to Public Goods. *The Scandinavian Journal of Economics*, 102(1):23–39.

Kloosterman, A. (2020). Cooperation in stochastic games: a prisoner's dilemma experiment. *Experimental Economics*, 23(2):447–467.

Knack, S. and Keefer, P. (1997). Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. *The Quarterly Journal of Economics*, 112(4):1251–1288.

Knetsch, J. L. and Sinden, J. A. (1984). Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value. *The Quarterly Journal of Economics*, 99(3):507.

Kolm, S.-C. (1984a). *La bonne économie: la réciprocité générale*. Politique d'aujourd'hui. Presses universitaires de France, Paris, 1re éd edition.

Kolm, S.-C. (1984b). Théorie de la réciprocité et du choix des systèmes économiques. *Revue économique*, 35(5):871.

Kolm, S.-C. (2008). *Reciprocity: An Economics of Social Relations*. Federico Caffè Lectures. Cambridge University Press, Cambridge.

Kopp, T. and Sexton, R. J. (2021). Farmers, Traders, and Processors: Buyer Market Power and Double Marginalization in Indonesia. *American Journal of Agricultural Economics*, 103(2):543–568.

Kreps, D. M., Milgrom, P., Roberts, J., and Wilson, R. (1982). Rational cooperation in the finitely repeated prisoners' dilemma. *Journal of Economic Theory*, 27(2):245–252.

Kuntosch, A., König, B., Bokelmann, W., Doernberg, A., Siebert, R., Schwerdtner, W., and Busse, M. (2020). Identifying System-Related Barriers for the Development and Implementation of Eco-Innovation in the German Horticultural Sector. *Horticulturae*, 6(2):33.

Kvale, S. (1996). *Interviews: an introduction to qualitative research interviewing*. Sage Publications, Thousand Oaks, Calif.

Labrouche, G. and Levy, R. (2022). L'innovation ouverte est-elle adaptée aux villes moyennes ? Le cas de 14 innovations ouvertes de petites et moyennes entreprises (PME) agroalimentaires du sud-ouest de la France:. *Innovations*, N° 67(1):103–134.

Lamani, O., Ilbert, H., and Khadari, B. (2015). Differentiation strategies by origin of olive oil in the Mediterranean region. *Cahiers Agricultures*, 24(3):145–150.

Laursen, K. and Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2):131–150.

Le, K. and Nguyen, M. (2021). Education and political engagement. *International Journal of Educational Development*, 85:102441.

Ledyard, J. O. (1995). Public goods: A survey of experimental research. *The handbook of experimental economics*, pages 111–194.

Leroux, I., Muller, P., Plottu, B., and Widehem, C. (2014). Innovation ouverte et évolution des business models dans les pôles de compétitivité : le rôle des intermédiaires dans la création variétale végéta. *Revue d'économie industrielle*, (146):115–151.

Levitt, S. D. and List, J. A. (2007). What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World? *Journal of Economic Perspectives*, 21(2):153–174.

Li, C., Li, Z., and Wakker, P. P. (2014). If nudge cannot be applied: a litmus test of the readers' stance on paternalism. *Theory and Decision*, 76(3):297–315.

Li, S. X. (2020). Group identity, ingroup favoritism, and discrimination. *Handbook of labor, human resources and population economics*, pages 1–28.

Li, S. X., de Oliveira, A. C., and Eckel, C. (2017). Common identity and the voluntary provision of public goods: An experimental investigation. *Journal of Economic Behavior & Organization*, 142:32–46.

Lichtenthaler, U. (2011). Open innovation: Past research, current debates, and future directions. *Academy of management perspectives*, 25(1):75–93.

Lichtenthaler, U. and Lichtenthaler, E. (2009). A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity. *Journal of Management Studies*, 46(8):1315–1338.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 140:5–55.

Linåker, J. and Regnell, B. (2020). What to share, when, and where: balancing the objectives and complexities of open source software contributions. *Empirical Software Engineering*, 25(5):3799–3840.

List, J. A. (2008). Introduction to field experiments in economics with applications to the economics of charity. *Experimental Economics*, 11(3):203–212.

Locey, M. L. and Rachlin, H. (2012). Temporal Dynamics of Cooperation: Dynamics of Cooperation. *Journal of Behavioral Decision Making*, 25(3):257–263.

Madanaguli, A., Dhir, A., Talwar, S., Clauss, T., Kraus, S., and Kaur, P. (2023). Diving into the uncertainties of open innovation: A systematic review of risks to uncover pertinent typologies and unexplored horizons. *Technovation*, 119:102582.

Madani, K. (2013). Modeling international climate change negotiations more responsibly: Can highly simplified game theory models provide reliable policy insights? *Ecological Economics*, 90:68–76.

Masclet, D., Noussair, C., Tucker, S., and Villeval, M.-C. (2003). Monetary and Nonmonetary Punishment in the Voluntary Contributions Mechanism. *American Economic Review*, 93(1):366–380.

Mastrocinque, E., Lamberti, E., Ramirez, F. J., and Petrovic, D. (2022). Measuring open innovation under uncertainty: A fuzzy logic approach. *Journal of Engineering and Technology Management*, 63:101673.

McCarthy, N., Dutilly-Diané, C., and Drabo, B. (2004). Cooperation, collective action and natural resources management in Burkina Faso. *Agricultural Systems*, 82(3):233–255.

Mengel, F. (2014). Learning by (limited) forward looking players. *Journal of Economic Behavior & Organization*, 108:59–77.

Mesnel, B. (2017). Les agriculteurs face à la paperasse: Policy feedbacks et bureaucratisation de la politique agricole commune. *Gouvernement et action publique*, VOL. 6(1):33–60.

Ministère (2018). Plan Ecophyto II. Technical report, Ministère de la Transition écologique et solidaire.

Ministère (2020). Stratégie Nationale Bas-Carbone. Technical report, Ministère de la Transition écologique et solidaire.

Ministère (2022). Stratégie Nationale Biodiversité 2030. Technical report, Ministère de la Transition écologique et solidaire.

Mitani, Y. (2022). Is a PD game still a dilemma for Japanese rural villagers? A field and laboratory comparison of the impact of social group membership on cooperation. *The Japanese Economic Review*, 73(1):103–121.

Mouminoux, C. and Rullière, J.-L. (2021). Are we more honest than others think we are? working paper or preprint.

Musa, S. b., Boniface, B., and Tanakinjal, G. (2014). Relationship Marketing Moderating Effect on Value Chain of Horticulture Produce: An Intermediaries' Perspective. *UMK Procedia*, 1:82–92.

Nitzan, S. and Ueda, K. (2014). Intra-group heterogeneity in collective contests. *Social Choice and Welfare*, 43(1):219–238.

Noireaux, V., Cassière, F., and Edzengte, J. E. (2020). Stratégie collective logistique des agriculteurs: une difficile équation. *AIRL 13 ème Rencontres Internationales de la Recherche en Logistique et en Supply Chain Management*, LE HAVRE, France.(hal-03420581):27.

North, D. C. (1994). Economic Performance Through Time. *The American Economic Review*, Vol. 84(No. 3):359–368.

Noussair, C. N., van Soest, D., and Stoop, J. (2015). Punishment, reward, and cooperation in a framed field experiment. *Social Choice and Welfare*, 45(3):537–559.

Nowak, M. A. and Sigmund, K. (2005). Evolution of indirect reciprocity. *Nature*, 437(7063):1291–1298.

Nunn, G. E. and Watkins, T. H. (1978). Public Goods Games. *Southern Economic Journal*, 45(2):598.

Ockenfels, A. and Werner, P. (2014). Beliefs and ingroup favoritism. *Journal of Economic Behavior & Organization*, 108:453–462.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups, Second Printing with a New Preface and Appendix*. Harvard University Press, harvard university press cambridge edition.

Orenga, L. (2022). Stratégies collectives : réconcilier agriculture et citoyens:. *Paysans & société*, N° 393(3):41–43.

Ostrom, E. (2000). Collective Action and the Evolution of Social Norms. *The Journal of Economic Perspectives*, Vol. 14(No. 3):137–158.

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, 325(5939):419–422.

Ostrom, E. (2010). Analyzing collective action. *Agricultural Economics*, 41:155–166.

Ostrom, E., Burger, J., Field, C. B., Norgaard, R. B., and Policansky, D. (1999). Revisiting the Commons: Local Lessons, Global Challenges. *Science*, Vol. 284(No. 5412):278–282.

Paillé, P. and Mucchielli, A. (2016). *L'analyse qualitative en sciences humaines et sociales-4e éd.* Collection U. Armand Colin, Malakoff.

Pavie, C. (2013). De l'horticulture au végétal: patrimoine et identité angevine. In *Les nouveaux patrimoines en Pays de la Loire.*, pages 425–436. Presses Universitaires de Rennes.

Perc, M., Jordan, J. J., Rand, D. G., Wang, Z., Boccaletti, S., and Szolnoki, A. (2017). Statistical physics of human cooperation. *Physics Reports*, 687:1–51.

Perez, F., Hollard, G., and Vranceanu, R. (2021). How serious is the measurement-error problem in risk-aversion tasks? *Journal of Risk and Uncertainty*, 63(3):319–342.

Piller, F. and West, J. (2014). Firms, users, and innovation. *New frontiers in open innovation*, 29(1):29–49.

Piperopoulos, P. and Scase, R. (2009). Competitiveness of small and medium sized enterprises: towards a two dimensional model of innovation and business clusters. *International Journal of Business Innovation and Research*, 3(5):479.

Pisano, G. and Verganti, R. (2008). Which kind of collaboration is right for you? *Harvard Business Review*, 86(12):78–86.

Porter, M. E., Miraillès, P., Barthélémy, C., and Dayre-Mielcarski, E. (1993). *L'avantage concurrentiel des nations*. InterEd, Paris.

Potters, J. and Suetens, S. (2009). Cooperation in Experimental Games of Strategic Complements and Substitutes. *The Review of Economic Studies*, 76(3):1125–1147.

Purdy, L., Eslami, H., Eshghi, K., and Rod, M. (2023). Technology sourcing and the dark side of open innovation: Evidence from the biopharmaceutical sector. *Technovation*, 119:102521.

Rabin, M. (1993). Incorporating Fairness into Game Theory and Economics. *The American Economic Review*, 83(5):1281–1302.

Rabinovich, A. and Morton, T. A. (2011). Subgroup identities as a key to cooperation within large social groups: Identity salience and shared resources. *British Journal of Social Psychology*, 50(1):36–51.

Rand, D. G. and Nowak, M. A. (2013). Human cooperation. *Trends in Cognitive Sciences*, 17(8):413–425.

Reinhard, S., Naranjo, M. A., Polman, N., and Hennen, W. (2022). Modelling choices and social interactions with a threshold public good: Investment decisions in a polder in Bangladesh. *Land Use Policy*, 113:105886.

Richards, C., Hurst, B., Messner, R., and O'Connor, G. (2021). The paradoxes of food waste reduction in the horticultural supply chain. *Industrial Marketing Management*, 93:482–491.

Richardson, G. B. (1972). The Organisation of Industry. *The Economic Journal*, 82(327):883–896.

Richardson, G. B. (1995). The Theory of the Market Economy. *Revue economique*, 46(6):1487–1496.

Roberts, R. E. (2020). Qualitative interview questions: Guidance for novice researchers. *Qualitative Report*, 25(9).

Robotka, F. (1947). A Theory of Cooperation. *Journal of Farm Economics*, 29(1):94.

Rosenbusch, N., Brinckmann, J., and Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, 26(4):441–457.

Samoggia, A., Monticone, F., and Esposito, G. (2022). Governance in the Italian Processed Tomato Value Chain: The Case for an Interbranch Organisation. *Sustainability*, 14(5):2749.

Santoro, G., Quaglia, R., Pellicelli, A. C., and De Bernardi, P. (2020). The interplay among entrepreneur, employees, and firm level factors in explaining SMEs openness: A qualitative micro-foundational approach. *Technological Forecasting and Social Change*, 151:119820.

Schuch, E., Dirks, S., Nhim, T., and Richter, A. (2021). Cooperation under social and strategic uncertainty – The role of risk and social capital in rural Cambodia. *Journal of Behavioral and Experimental Economics*, 90:101642.

Sedikides, C. and Gregg, A. P. (2008). Self-Enhancement: Food for Thought. *Perspectives on Psychological Science*, 3(2):102–116.

Sexton, R. J. (2013). Market Power, Misconceptions, and Modern Agricultural Markets. *American Journal of Agricultural Economics*, 95(2):209–219.

Shaikh, I. and Randhawa, K. (2022). Managing the risks and motivations of technology managers in open innovation: Bringing stakeholder-centric corporate governance into focus. *Technovation*, 114:102437.

Smith, A. (2013). Estimating the causal effect of beliefs on contributions in repeated public good games. *Experimental Economics*, 16(3):414–425.

Smith, A. (2015). Modeling the dynamics of contributions and beliefs in repeated public good games. *Economics Bulletin*, 35:1501–1509.

Spithoven, A., Vanhaverbeke, W., and Roijakkers, N. (2013). Open innovation practices in SMEs and large enterprises. *Small Business Economics*, 41(3):537–562.

Stevens, J. R. (2004). The economic basis of cooperation: tradeoffs between selfishness and generosity. *Behavioral Ecology*, 15(2):255–261.

Sugden, R. (1984). Reciprocity: The Supply of Public Goods Through Voluntary Contributions. *The Economic Journal*, 94(376):772.

Sultan, F. and Winer, R. S. (1993). Time preferences for products and attributes and the adoption of technologydriven consumer durable innovations. *Journal of Economic Psychology*, 14(4):587–613.

Sunshine Hillygus, D. (2005). The MISSING LINK: Exploring the Relationship Between Higher Education and Political Engagement. *Political Behavior*, 27(1):25–47.

Sutan, A. and Willinger, M. (2009). Guessing with negative feedback: An experiment. *Journal of Economic Dynamics and Control*, 33(5):1123–1133.

Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers? *Acta psychologica*, 47(2):143–148.

Tajfel, H., Billig, M. G., Bundy, R. P., and Flament, C. (1971). Social categorization and intergroup behaviour. *European Journal of Social Psychology*, 1(2):149–178.

Tan, C. H. (2021). The effects of group decision-making on social preferences: An experimental study. *Journal of Economic Behavior & Organization*, 190:134–153.

Teerikangas, S. (2012). Dynamics of acquired firm pre-acquisition employee reactions. *Journal of management*, 38(2):599–639.

Teyssier, S. (2009). Inequity and Risk Aversion in Sequential Public Good Games. *SSRN Electronic Journal*.

Thaler, R. H. (2016). Behavioral Economics: Past, Present, and Future. *American Economic Review*, 106(7):1577–1600.

Thom, J. M., Afzal, U., and Gold, N. (2022). Testing team reasoning: Group identification is related to coordination in pure coordination games. *Judgment and Decision Making*, 17(2):284–314.

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American journal of evaluation*, 27(2):237–246.

Tiwari, S., Ścigała, K. A., Schild, C., and Zettler, I. (2022). Indian caste names and cooperation in the Prisoner's Dilemma. *Asian Journal of Social Psychology*, 25(3):489–503.

Torchia, M. and Calabrò, A. (2019). Open Innovation in SMEs: A Systematic Literature Review. *Journal of Enterprising Culture*, 27(02):201–228.

Torres-Guevara, L. E. and Schlüter, A. (2016). External validity of artefactual field experiments: A study on cooperation, impatience and sustainability in an artisanal fishery in Colombia. *Ecological Economics*, 128:187–201.

Trivers, R. L. (1971). The Evolution of Reciprocal Altruism. *The Quarterly Review of Biology*, 46(1):35–57.

Tversky, A. and Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *American Association for the Advancement of Science*, 185:9.

Vaidyanatha, A. and Charness, G. (2020). In-group identification and motivation crowding. *Journal of Economic Behavior & Organization*, 178:866–874.

VALHOR (2021). Etude d'impact économique du Covid-19. Technical report, VALHOR.

VALHOR (2023). Charte d'engagement pour une éco-conception des poteries horticoles plastiques favorisant leur recyclage. Technical report, VALHOR.

Van Zomeren, M. and Iyer, A. (2009). Introduction to the Social and Psychological Dynamics of Collective Action. *Journal of Social Issues*, 65(4):645–660.

Vasse, V. and Wolff, F.-C. (2022). Cooperation and sales revenue of fisheries: Evidence from France. *Ecological Economics*, 198:107459.

Viceisza, A. C. G. (2016). Creating a lab in the field: Economics experiments for policymaking. *Journal of Economic Surveys*, 30(5):835–854.

Vigdor, J. L. (2004). Community Composition and Collective Action: Analyzing Initial Mail Response to the 2000 Census. *Review of Economics and Statistics*, 86(1):303–312.

Viguier, M. (2006). Les perspectives des secteurs économiques de l'horticulture. Technical report, Conseil Économique et Social.

Voslinsky, A. and Azar, O. H. (2021). Incentives in experimental economics. *Journal of Behavioral and Experimental Economics*, 93:101706.

Vossler, C. A. and Watson, S. B. (2013). Understanding the consequences of consequentiality: Testing the validity of stated preferences in the field. *Journal of Economic Behavior & Organization*, 86:137–147.

Walter, B. F. (2006). Building Reputation: Why Governments Fight Some Separatists but Not Others. *American Journal of Political Science*, 50(2):313–330.

Weigel, C., Paul, L. A., Ferraro, P. J., and Messer, K. D. (2021). Challenges in Recruiting U.S. Farmers for Policy-Relevant Economic Field Experiments. *Applied Economic Perspectives and Policy*, 43(2):556–572.

Weng, Q. and Carlsson, F. (2015). Cooperation in teams: The role of identity, punishment, and endowment distribution. *Journal of Public Economics*, 126:25–38.

West, J. (2020). Localized Knowledge Flows and Asymmetric Motivations in Open Innovation:. *Journal of Innovation Economics & Management*, n° 32(2):181–196.

West, J. and Bogers, M. (2014). Leveraging External Sources of Innovation: A Review of Research on Open Innovation: Leveraging External Sources of Innovation. *Journal of Product Innovation Management*, 31(4):814–831.

Widehem, C., Cadic, A., and Couteaudier, Y. (2006). *L'horticulture ornementale française: structures, acteurs et marchés*. Institut National de la Recherche Agronomique, Paris. OCLC: 846955731.

Williams, C. C. and Nadin, S. (2012). Joining up the fight against undeclared work in europe. *Management Decision*, 50(10):1758–1771.

Wuepper, D., Clemm, A., and Wree, P. (2019). The preference for sustainable coffee and a new approach for dealing with hypothetical bias. *Journal of Economic Behavior & Organization*, 158:475–486.

Yamagishi, T. and Kiyonari, T. (2000). The Group as the Container of Generalized Reciprocity. *Social Psychology Quarterly*, 63(2):116.

Yamagishi, T. and Mifune, N. (2008). Does Shared Group Membership Promote Altruism?: Fear, Greed, and Reputation. *Rationality and Society*, 20(1):5–30.

Yuan, Y., Viet, N., and Behdani, B. (2019). The impact of information sharing on the performance of horizontal logistics collaboration: A simulation study in an agri-food supply chain. *IFAC-PapersOnLine*, 52(13):2722–2727.

Zahra, S. A. and George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, 27(2):185–203.

Zhang, H. (2019). Common fate motivates cooperation: The influence of risks on contributions to public goods. *Journal of Economic Psychology*, 70:12–21.

Zhu, Y., Chen, T., Wang, M., Jin, Y., and Wang, Y. (2019). Rivals or allies: How performance-prove goal orientation influences knowledge hiding. *Journal of Organizational Behavior*, 40(7):849–868.

Zuckerman, E. W. and Jost, J. T. (2001). What Makes You Think You're so Popular? Self-Evaluation Maintenance and the Subjective Side of the "Friendship Paradox". *Social Psychology Quarterly*, 64(3):207–223.

COLLEGE ECONOMIE DOCTORAL ET GESTION PAYS DE LA LOIRE

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Titre : La coopération en horticulture : trois expérimentations.

Mots clés : actions collectives, coopération, expérimentations, horticulture, jeux non- coopératifs

Résumé : Dans un environnement économique international fortement concurrentiel, la coopération est un déterminant clé pour favoriser la compétitivité. Alors que la France est une puissance agricole majeure, la filière horticole française est vulnérable et subit une très forte concurrence européenne. Malgré des actions publiques et privées significatives pour stimuler les actions collectives, la coopération reste très faible dans la filière, et la capture de la valeur dans la *supply chain* est déséquilibrée entre les différents acteurs de la filière. S'il existe dans la littérature de nombreuses études sur les caractéristiques et les spécificités horticoles, il en existe très peu sur les caractéristiques comportementales des acteurs de la filière face à la coopération.
Cette thèse, composée de trois études empiriques, vise plusieurs objectifs. Le premier est de définir les facteurs expliquant la faible coopération dans la filière horticole. Le deuxième est de caractériser les déterminants pour mettre en lumière les freins et les leviers à mettre en œuvre pour les surmonter les obstacles. Enfin, le dernier objectif est de discuter des types d'actions collectives pour permettre aux acteurs de la filière de capturer une part plus importante de la valeur pour promouvoir une coopération pérenne. Nos études sont concentrées sur le cas de l'horticulture en France. Nous utilisons des données d'expériences de terrain qui mobilisent des jeux d'interactions stratégiques dont les choix reflètent des dilemmes sociaux, comme le jeu dilemme du prisonnier où l'intérêt individuel se retrouve confronté à l'intérêt collectif.

Title: Cooperation in horticulture: three experiments.

Keywords: collective action, cooperation, field experiments, horticulture, non-cooperative games

Abstract: In a highly competitive international economic environment, cooperation is a crucial factor in fostering competitiveness. Although France is a major agricultural powerhouse, the French horticultural industry is vulnerable and subject to tough European competition. Despite significant public and private initiatives to stimulate collective action, cooperation in the industry remains very weak, and value capture in the supply chain is unbalanced between the different players in the industry. While there are numerous studies in the literature on the characteristics and specific features of horticulture, there are very few on the behavioral characteristics of the industry's players when it comes to cooperation.
This thesis, consisting of three empirical studies, has several objectives. The first is to define the factors behind the low level of cooperation in the horticultural industry. The second is to characterize the determinants to identify the obstacles and the levers to be implemented to overcome them. Finally, the last objective is to discuss the types of collective action that would enable players in the sector to capture a larger share of the value to promote sustainable cooperation. Our studies focus on the case of horticulture in France. We use data from field experiments that mobilize strategic interaction games whose choices reflect social dilemmas, such as the prisoner's dilemma game where individual interest is confronted with collective interest.