



Comparing distribution channels and their impact on supply chains : a case study on online groceries in France and Germany

Saskia Seidel

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Humboldt Universität zu Berlin
Université Paris-Est

Comparaison des canaux de distribution et de leur impact sur les chaînes d'approvisionnement : une étude de cas sur l'épicerie en ligne en France et en Allemagne

Dissertation

Cotutelle

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Eidesstattliche Erklärung

Ich versichere hiermit, dass ich die Dissertation selbstständig und ohne unerlaubte Hilfe angefertigt habe. Ich habe die Dissertation im Rahmen eines gemeinsamen Promotionsverfahren, welches durch einen Kooperationsvertrag zur Cotutelle geregelt wird, an der Humboldt Universität zu Berlin und der Universität Gustave-Eiffel eingereicht und besitze keinen Doktorgrad im Fach Geographie.

Die Promotionsordnung der Mathematisch-Naturwissenschaftlichen Fakultät der Humboldt-Universität zu Berlin vom 03. August 2006, veröffentlicht im Amtlichen Mitteilungsblatt der Humboldt-Universität Nr. 34/2006, ist mir bekannt.

Je déclare sur l'honneur être l'unique auteur du présent mémoire, ne pas avoir utilisé d'autres sources et/ou ressources que celles mentionnées et avoir clairement identifié comme tels les passages cités, tant par la forme que par le fond.

Berlin, den 24.06.2021

Saskia Seidel

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Abstract

In e-commerce, one of the segments with the most significant growth is online grocery retailing. The main actors in this sector are currently the brick-and-mortar traders who are becoming multichannel retailers via their online offerings. Online grocery services include home deliveries and pick-up options such as drive-throughs (*drives*). The latter are comparatively underdeveloped in Germany, while they are widespread in France. Regardless of the form of distribution to the customer, offering groceries online requires an adaptation of logistics and transport organisations. The initially strong fluctuations in the market show that a successful positioning in online food retailing is not trivial, even for large retail chains.

Even though multichannel distribution strategies are the subject of many research studies, few have addressed their impact on logistics and transport organisations. The present research addresses this gap by investigating the central questions: ‘How do commodity flows change through the introduction of online grocery services? Can different configurations of online grocery services, and thus different commodity flows, be observed in France and Germany?’

For this cumulative dissertation, data from France and Germany were analysed. The impact of online grocery sales on supply chains was examined through a comparative analysis, and the relevance of different settings and contextual environments was established. To open up the topic area, a three-tier approach was chosen, which also corresponds to the three articles of the thesis. First, the existing distribution structures of the major grocery retailers in France and Germany were analysed. Second, the different forms of online grocery offerings and the new structures for their implementation were examined in depth. Furthermore, a categorisation based on the types of offerings was developed. Third, the innovative forms and distribution concepts primarily used by players other than multichannel providers were analysed.

This study adopted a mixed-methods approach, focusing on qualitative methods, an in-depth analysis of the market participants (expert interviews) and supplementary quantitative analyses of location data.

Through this methodology, the work offers a comprehensive reflection of both markets. The analyses show that the decision to offer goods online impacts the entire supply chain of the grocer, and the impact differs in France and Germany. Order processing, last-mile delivery and upstream structures in the supply chain are experiencing three fundamental areas of change: I) new locations for the organisation of online food distribution – usually close to the customers – are being developed; II) a decentralisation of distribution structures is taking place; and III) new relationships between actors in the supply chain are emerging.

This paper systematically records and describes adaptation mechanisms (logistical practices) and reveals the differences in the supply chain structures compared to the stationary food trade. Based on the structured analysis of two neighbouring but distinct markets, further insights relevant to research and practice could be generated. The results of the analyses contribute to a better systematic understanding of online food practices among researchers and practitioners. Furthermore, recommendations for future research are derived. These concern the grocers’ upstream supply chain, the effects of the re-organisation of transshipment structures on existing urban structures, developments during and following COVID-19, urban spaces, and environmental protection concerns vs. customers’ comfort needs.

Keywords: food retailing, online grocery services, transport and logistics organisation, supply chains, logistics networks, typology, case study

Résumé

Dans le domaine du commerce électronique, l'un des segments ayant la plus forte progression est celui de la distribution alimentaire en ligne. Outre les nouveaux acteurs, tels que les fabricants et les producteurs, les détaillants traditionnels deviennent également des fournisseurs multicanaux grâce à leurs offres en ligne. Les différents types de commerces alimentaires en ligne incluent les livraisons à domicile ainsi que les options de retrait des commandes dans les *drives*. Les marchés du *pick-up* sont comparativement peu développés en Allemagne, alors qu'ils sont très avancés et répandus en France. Quel que soit le type de vente choisi (livraison ou retrait en magasin), l'offre de produits d'épicerie en ligne nécessite une adaptation de la logistique, des transports et des chaînes d'approvisionnement des épiceries.

Bien que les stratégies de distribution multicanal fassent l'objet de nombreuses recherches, peu d'études traitent de leur impact sur l'organisation de la logistique et des transports. Par conséquent, notre problématique est la suivante : comment les flux de marchandises évoluent-ils suite à l'introduction de l'épicerie en ligne ? Et quels sont les impacts des différentes formes d'offres en ligne sur les chaînes d'approvisionnement ?

Pour ce mémoire de synthèse, des données provenant de France et d'Allemagne ont été analysées et comparées. L'accent est mis sur l'impact du commerce d'alimentaire en ligne sur la totalité de la chaîne d'approvisionnement. En outre, l'objectif de ce mémoire est de comprendre les stratégies logistiques et de transport des distributeurs en fonction du contexte géographique dans lequel ils interviennent. Afin d'explorer le sujet, une approche tripartite a été choisie, qui correspond aux trois étapes du mémoire. Dans un premier temps ont été analysées les structures de distribution des plus grands détaillants en alimentaire de France et d'Allemagne. Ensuite, les différents types d'offres alimentaires en ligne ainsi que les nouvelles structures de distribution ont été recensés, classés et analysés. Dans une dernière partie, les types d'offres innovants utilisés principalement par des acteurs autres que les fournisseurs multicanaux ont été analysés.

La recherche est basée sur un ensemble de méthodes, en mettant l'accent sur les méthodes de la recherche qualitative et les analyses quantitatives complémentaires.

Grâce à la comparaison de la situation en France et en Allemagne, et à l'analyse approfondie des acteurs du marché (*via* des entretiens avec des experts), le mémoire offre une réflexion complète sur les deux marchés. Les résultats des analyses montrent que l'offre des biens alimentaire en ligne modifie le flux des marchandises toute au long de la chaîne d'approvisionnement, depuis le traitement des commandes jusqu'à la livraison. En effet : 1) de nouveaux sites pour l'organisation de la distribution alimentaire en ligne sont développés, souvent situés à proximité des clients ; 2) on observe une décentralisation des structures de distribution ; 3) de nouvelles relations entre les acteurs de la chaîne d'approvisionnement apparaissent.

Les résultats de ces analyses contribuent à une meilleure compréhension systématique des pratiques de la distribution alimentaire en ligne. Des pistes pour les recherches futures sont également formulées. Elles concernent l'organisation de l'approvisionnement par les vendeurs alimentaires, l'impact sur les structures et espaces urbains, le développement de ces activités après la crise de la COVID-19, l'environnement.

Mots clés : commerce de détail alimentaire, distribution alimentaire en ligne, organisation du transport et de la logistique, chaînes d'approvisionnement, réseaux logistiques, typologie, étude de cas

Zusammenfassung

Kaum ein Segment im Onlinehandel wächst so schnell wie der Lebensmittelonlinehandel mit seinen diversen Akteuren. Den größten Anteil machen die stationären Einzelhändler aus, die durch ihr Onlineangebot zu Multichannel-Anbietern werden. Im internationalen Vergleich zeigt sich, dass es zuweilen deutliche Unterschiede bezüglich der letzten Meile gibt. So haben sich in Frankreich vor allem Abholungspunkte, sog. *Drives*, etabliert, während in Deutschland die Heimbeflieferung die bevorzugte Option darstellt. Unabhängig von der Form erfordert, der Onlineverkauf von Lebensmitteln eine Anpassung der Logistik- und Transportorganisationen. Dabei zeigt die anfänglich starke Fluktuation am Markt, dass der Aufbau einer wirtschaftlichen Supply Chain im Lebensmittelonlinehandel selbst für große Handelsketten nicht trivial ist.

Auch wenn Multichannel-Vertriebsstrategien Gegenstand vieler Untersuchungen sind, befassen sich nur wenige Studien mit ihren Auswirkungen auf Logistik- und Transportorganisation. Die zentralen Fragen lauten daher: Wie verändern sich die Warenströme durch die Einführung des Lebensmittelonlinehandels? Und haben verschiedene Formen von Onlineangeboten unterschiedliche Auswirkungen auf die Warenströme?

Für die vorliegende kumulative Dissertation wurden Daten aus Frankreich und Deutschland analysiert. Im Mittelpunkt standen die Auswirkungen des Lebensmittelonlinehandels auf die Lieferkette, einschließlich der letzten Meile. Darüber hinaus war es das Ziel, die Strategien und den logistischen Transport der Distributoren im Hinblick auf den Kontext, in dem sie auftreten, zu verstehen. Um das Themenfeld zu erschließen, wurde ein dreigliedriges Vorgehen gewählt, das auch den drei Artikeln der Arbeit entspricht: Zunächst wurden die bestehenden Distributionsstrukturen der großen Lebensmittelhändler in Frankreich und Deutschland analysiert. Im zweiten Schritt wurden die unterschiedlichen Angebotsformen von Onlinelebensmitteln sowie die neuen Strukturen für deren Umsetzung tiefgehend untersucht und ein an die Angebotstypen angelehntes Klassifizierungsschema entwickelt. In einem letzten Schritt wurden innovative Formen, die vor allem bei anderen Akteuren als den Multichannel-Anbietern zum Einsatz kommen, sowie deren Strukturen analysiert und beschrieben. Für die Untersuchung wurde ein Methodenmix mit einem Fokus auf qualitativen Methoden, in diesem Fall einer Tiefenanalyse der Marktteilnehmer (Experteninterviews), und ergänzenden quantitativen Analysen von Standortdaten eingesetzt.

Die Arbeit bietet eine umfassende Untersuchung der beiden Märkte Deutschland und Frankreich. Die Ergebnisse einer vergleichenden Analyse zeigen, wie unterschiedlich sich die Warenflüsse über die gesamte Supply Chain durch das Angebot von Onlinewaren verändern. Neben der letzten Meile erfahren auch die vorgelagerten Strukturen in der Lieferkette eine Veränderung: I) Neue Standorte in Kundennähe für die Organisation der Onlinelebensmitteldistribution werden erschlossen. II) Eine Dezentralisierung von Distributionsstrukturen findet statt. III) Es entstehen neue Beziehungen zwischen Akteuren der Lieferkette.

Die Ergebnisse der Analysen tragen zu einem besseren systematischen Verständnis von Onlinelebensmittelpraktiken bei Forschern und Praktikern bei. Darüber hinaus werden Empfehlungen für zukünftige Forschungsarbeiten abgeleitet. Diese betreffen die Beschaffungsseite, Auswirkungen der Re-Organisation der Umschlagstrukturen auf bestehende Stadtstrukturen, Entwicklungen nach COVID-19, urbane Räume, sowie Belange des Umweltschutzes versus Komfortgewinn.

Schlagwörter: Lebensmitteleinzelhandel, Onlinelebensmittel, Transport und Logistikorganisation, Lieferketten, Logistiknetzwerke, Typologie, Fallstudie

Abbreviations

CC	Click and Collect
CEP	Currier, Express and Parcels services
DC	Distribution Centre
DIY	Do it yourself
Drive	Drive Through
FMCG	Fast Moving Consumer Goods
F	France
G	Germany
HD	Home Delivery
ICT	Information and Communication Technologies
IT	Information Technology
PoS	Point of Sale
RDC	Regional Distribution Centre
RQ	Research question
SCM	Supply Chain Management
SRQ	Sub-research question

Overview of papers

The thesis is based on the following three papers:

- Paper I** **Seidel, S,** Blanquart, C, Ehrler, V (2015) Same–same but different? A comparison of food retail and distribution structures in France and Germany, *Case Studies on Transport Policy* 4 (1), p. 29-37 <http://dx.doi.org/10.1016/j.cstp.2015.09.001>
- Paper II** **Seidel, S** (2021) One goal, one approach? A comparative analysis of online grocery strategies in France and Germany, *Case Studies on Transport Policy* (in press), <https://doi.org/10.1016/j.cstp.2021.10.013>
- Paper III** **Seidel, S,** Mareï, N, Blanquart, C (2016) Innovations in e-grocery and logistics solutions for cities, *Transportation Research Procedia* 12, p. 825 – 835, <https://doi.org/10.1016/j.trpro.2016.02.035>

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I. INTRODUCTION, STATE OF THE ART, AND RESEARCH DESIGN

1. Introduction

E-groceries: Brick-and-mortar retailers embrace e-commerce

In the 21st century, online shopping is playing an ever-increasing role. Convenience, accessibility around-the-clock, broad access to a great variety of products and the ability to compare quality, experience and price are among the most appreciated features of internet shopping. In Europe, e-commerce turnover in 2018 was €547 billion (2019). While growth rates are becoming marginal for some product groups – such as the top-selling categories books, electronic items and fashion – other sectors such as leisure and hobbies, DIY and groceries are rising (HDE 2020; Post Nord & Direkt Link 2021).

The penetration status of online sales varies between European countries. For online grocery retail, the countries with the highest turnover range in 2019, were the UK (7.6%) France (6.2%) and Germany (2.5%) (Kantar 2019; HDE 2020). Even though stationary retail still dominates, the online grocery market is growing steadily, increasing in Germany by 17% per year (Nicolai 2020). The importance of the market is undoubted: In Europe, the food¹ retail sector achieved a turnover of approximately €1.6 trillion in 2020, which is about €1,800 per capita (Statista 2021). The potential of the food market segment is considered large given its overall size.

Despite the vast volume of the grocery market, the business is low-margin and highly competitive. To differentiate from competitors, enterprises have evolved various strategies to increase market share and create larger turnover. One strategy long been pursued by brick-and-mortar retailers is the expansion of surface area. However, effective expansion of food retail space is increasingly challenging. Thus, retailers try to introduce new or exclusive products to improve their market position, aiming to retain and attract customers. Since these products are often of a higher quality than standard products, it is assumed that customers are willing to spend more money on them. Examples include chilled or convenience products and organic, regional or vegan foods, promoted through innovative marketing. However, there is limited potential for focusing only on products as a unique selling point.

To further differentiate themselves from competitors, retailers pursue new strategies such as offering additional services. The focus is often on comfort. Here, comfort does not just mean convenience goods such as ready meals but primarily focuses on the shopping process. As a result, traditional business models evolve to incorporate innovative formats such as convenience stores in city centres, or retailers offer the possibility to order goods from home with subsequent home delivery or pick-up options for the pre-sorted goods. The expansion of services, including the online offer as an independent sales channel, leads to a multichannel strategy. Accordingly, the retail landscape is subject to constant change. E-commerce and its impact on transport are becoming increasingly interesting for transport research.

1.1 Motivation and scope

Implementing an online distribution channel is a strategy adopted by many brick-and-mortar retailers to increase market share in the long term. Existing retailers are targeting e-commerce, and new players are penetrating the market and trying to gain a foothold. The players are very diverse in size and structure and range from producers and start-ups to global companies such as Amazon.

Despite these international tendencies and circumstances, the design of the new sales channels and services differs from company to company and country to country. This becomes particularly clear when

¹ The terms ‘grocery’ and ‘food’ are used synonymously. The terms are also discussed in chapter 2.1

making an international comparison of online grocery services. The German market focuses primarily on home deliveries, whereas French retailers focus on drive-through pick-up services. These different distribution strategies require different supply chain structures to reach the high levels of efficiency necessary in the grocery business. The differing forms of supply impact transport and logistics, as they require specific adaptations of the logistics structures and transport organisation.

Understanding whether structures are changing is relevant for various actors. On the one hand, the new business models can change the flow of goods. This can impact many areas, including spatial requirements (size and spatial choice of location), traffic flows, traffic volume and the environment. A better understanding could therefore provide insight into future requirements and help steer and shape them in a targeted manner. On the other hand, a better understanding of the different forms of design could also be a decision-making aid for future providers and food retailers concerning the development of their logistics networks.

This study focuses on insights into supply chain organisation for online distribution channels and compares the supply structures in France and Germany. The motivation is to investigate the impact of new distribution channel developments on transport and logistics structures. The insights will contribute to many areas such as retail management, transport research, retail research and transport policy.

Gaps in e-grocery transport research

As online grocery services are still in the early stage of development and highly dynamic, many research questions can be addressed here. Currently, no other online sector is growing as fast as online groceries. The COVID-19 pandemic has added momentum to e-commerce and has further increased online sales in the food sector. Hence, its transport and logistics requirements are all the more relevant.

Studies that look at online grocery services often focus on front-end logistics, and the optimisation of the last mile with a focus on home deliveries is the subject of many works (Kämäräinen *et al.* 2001a; Kämäräinen & Punakivi 2002; Boyer *et al.* 2009; Leyrer *et al.* 2020). The last kilometre in the B2C supply chain represents the shortest but most complex section in terms of management and expenses. Kämäräinen & Punakivi (2002) considered the supply chain, but only from the point of view of the picking process and the retailer's downstream operations. The question arises whether upstream parts of the supply chain are also changing, especially for companies that have previously focused on the stationary market alone. Furthermore, the extent to which the different design of online services impacts logistics and transport organisation is not clear.

Aim of the research project

The nature of these changes informs this study of the German online grocery market. The focus is on stationary retail, the brick-and-mortar retailers, although other providers are also examined. The central question is: How do commodity flows change through the introduction of online grocery services?

This work deals with new forms of food retail and their effects on transport and logistics using the example of online food retail. It focuses on the impact on the supply chain², including the last mile.

The results of the analyses contribute to a better systematic understanding of online food practices among researchers and practitioners.

²The term supply chain generally refers to the network of organisations involved in processes and activities of creating value in the form of products and services for the end customer through upstream and downstream links. However, in the scope of this thesis, the supply chain is only considered in the context of the finished product, i.e. from producer to retailer or customer.

Case selection and methodology

To extend the situation analysis of online groceries in Germany into an international perspective, another European country was included in the empirical work. Since this work is carried out in the context of a co-tutelle doctoral procedure, a bi-national procedure in Germany and France, France was chosen as the comparative market. Apart from pragmatic reasons, this comparison is particularly apposite, as online grocery services (also called e-grocery services hereafter) are implemented differently in France and Germany. In Germany, the focus is on home deliveries, and the drive-in format is comparatively underdeveloped, while in France, pick-up points are widespread and much more developed.

As the market structures, and thus the initial situation, differs in each country, there will probably be different developments in other locations. Nevertheless, the analyses in this study are limited to the German and French food markets during the period 2014 to 2020.

The retail trade's transport and logistics systems were the focus of the 'Survey of Trade' project by French Institute IFSTTAR in Marne la Vallée, today Université Gustave-Eiffel, and the DLR, Institute for Transport Research. The project showed that online sales are becoming increasingly relevant for many companies. Since effects on the transport sector are also to be expected, the idea to study the online grocery market arose after considering this project. The study was then conducted as an independent research work.

An explorative approach in the form of expert interviews was chosen for the investigation, supplemented by quantitative data analysis.

1.2 Structure of the thesis

This doctoral thesis is a cumulative dissertation consisting of three articles. The individual sections highlight different areas and aspects of the food market. Each article is dedicated to one aspect, representing an actor group in grocery retail to obtain an overall picture.

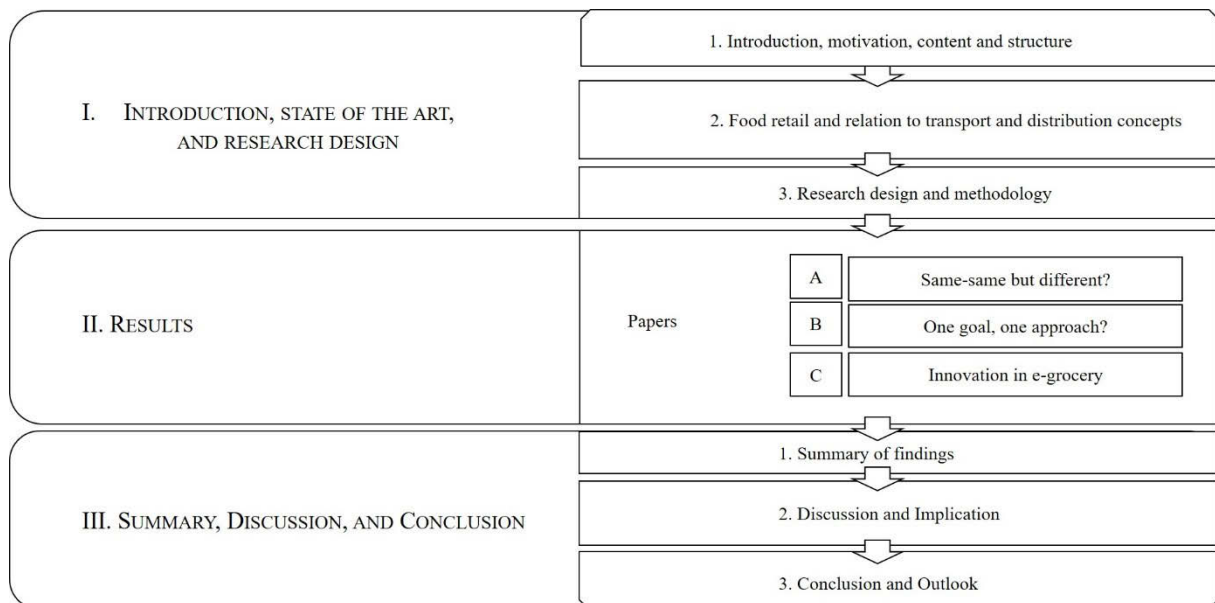


Figure 1: Structure of work

Figure 1 illustrates the structure of the present work, which is divided into three main sections with each three subsections. In the second chapter of the first main section, as a basis, a market overview of the food retail market and the development of the online market is given, followed by the study's theoretical foundations.

Derived from the state of the art in science, chapter 3 introduces the research questions followed by the research design and methods. The second section ‘results’ contains the three publications produced in the course of the work. Accordingly, the section is divided into sections A, B and C (Figure 1).

The last section is structured as follows: Chapter 1 summarises the findings, and chapter 2 presents discussions and implications. Chapter 3 contains the conclusion and outlook.

During the course of this study, I conducted supplementary research work related to the topic of food retail and online grocery services, which is not included in the thesis. The results of this supplementary work were published in journal papers or other research publications. An overview of these works is provided in appendix A.

2. Food retail and associated transport and distribution concepts

To provide a better understanding of the considered market, section 2.1 provides an overview of the food retail market in France and Germany. A brief overview of the historical development and characteristics of the online grocery market in France and Germany is given in section 2.2. Section 2.3 shows how a change in retail formats went hand in hand with a change in the organisation of transport and logistics. Additionally, a literature review on food retail-related transport and distribution concepts is given in section 2.4, providing the context for the research questions presented in chapter 3.

2.1 Food retail market in France and Germany

Before looking at the food retail market and its developments, it is useful to clarify the concept. In food retailing, the term ‘groceries’ encompasses retail food products and other household supplies sold in shops (supermarkets) that predominantly offer food products. In practice, food retail is often a generic term. In this work, and most literature dealing with retail markets, the words groceries and food are used interchangeably. In the retail context, groceries are divided into the categories of food, near food (e.g., hygiene articles) and non-food. According to Law (2009), groceries can also be classified as fast-moving consumer goods (FMCG), as these kinds of consumer goods are needed daily and are usually purchased in short repurchase cycles. As most supermarkets sell all kinds of FMCG, the figures for (online) food retail turnover often include food and all other types of FMCG. For this reason, and because net and gross values are not always declared when considering retail turnover, statistics may differ. The orders of magnitude are nevertheless meaningful.

The total turnover of the European food retail trade is currently €1,559.117 million, of which the majority is generated in the stationary, brick-and-mortar sector (Statista 2021). Germany and France, together with the UK, constitute the largest market and reach FMCG sales between €210 billion and €225 billion (Nielsen 2014; Statista 2019; Nielsen 2020). The size of sales is mainly related to the country’s population. There are other factors that play a role though – for example, the total expenditure on food is considered. These statistical values are also frequently consulted to illustrate the importance of food in the individual countries. However, the values should be interpreted with caution. According to official statistics from Destatis (2020), the consumption expenditure of private households on food is 10.3% in Germany and around 13% in France. French consumers spend €181 on fresh food³ per month, and those in Germany spend €131. Nonetheless, according to a survey by Bizerba (2017), Germans eat more fresh food in total, and the reasons for eating less fresh food in France seem to be financially motivated. The level of expenditure on groceries could indicate the importance of food, but there are also differences in price levels between countries. In Europe, Germany is one of the countries with the lowest food prices, although these have risen in recent years (Ahrens 2020).

To better understand the market, it is helpful to compare market structures and distinguish between different food retail businesses. The shops are classified according to the sales area, the number and assortment of products, the pricing policy and the service principle (Heinritz *et al.* 2003). Accordingly, a distinction can be made between small supermarkets (<400 m²), supermarkets, consumer markets and hypermarkets, discounters, and others (organic PoS, freeze stores, etc.). The market shares in France and Germany differ. In line with the low competitive price levels, the discounters are strongly

³ Fresh food is food that has not yet been preserved (e.g. by canning, cooking or freezing) and must therefore be consumed quickly. Fresh food includes vegetables, fruit, meat, fish and milk.

represented in Germany⁴. They account for 40% of food retail shops and have a share of sales revenue of over 30%, compared to 15% in France (Nielsen 2016). Supermarkets are most frequently represented in terms of numbers, and hypermarkets have the largest share of turnover.

The highest density of point of sales (PoS) is found in Germany, with around 350 PoS per million inhabitants, two to three times more than in France and the UK (Nielsen 2018b). The figure for France is 182 PoS (>400m² sales area) per million inhabitants (Nielsen 2017). In addition to supermarkets, food is sold in specialist outlets such as butchers or cheese shops. These are particularly widespread in France.

However, in both markets, the top five and six retailers account for around 75.5% of total sales (Statista 2019; Nielsen 2020). The food markets are saturated with little room for growth. With many, such as the hypermarkets in France, experiencing stagnation of sales, the internet offers the possibility of reinitiating growth (Picot-Coupey *et al.* 2009).

2.2 The online grocery market: characteristics and developments

The online provision of groceries⁵ has developed over the last 20 years and is a relatively recent trend despite its importance in food retailing. Market shares of 18% and 20% for China and South Korea respectively reflect the strong potential for online grocery retail in principle (Nielsen 2019a). In Europe, though, the situation is different. Pioneering markets for online groceries in Europe are the UK, with a market share of 6.3%, and France, with a share of 7.1% in 2019 (Table 1). Due to its population and total turnover in food retailing, Germany is often cited as a European country with great potential for online grocery retail. With a market share of 1.4%, it has not yet lived up to the expectations for growth. However, the actual value of a total turnover of around €1.5 billion in 2019 represents a big market.

Table 1: Market share of consumer goods (FMCG) sold online in different countries, according to Nielsen (Nielsen 2019b, 2019a) and Statista (Statista 2020a, 2020b)

Country	Market share 2019	Turnover 2019 in million €	Most common form of delivery service
China	18%	19,453	HD
South Korea	20%	10,797	HD
France	7.1%	7,369	pick-up via <i>drive</i>
UK	6.3%	11,848	HD
USA	5.6%	16,272	HD
Mexico	2%	0.872	HD
Sweden	2.5%	0.555 (2017)	HD
Germany	1.4%	1,472	HD
Italy	1.6%	1,600	HD

Online grocery services in Europe were first offered in 1997.⁶ The market has increased slowly since then. Depending on which source is consulted, online sales account for 1.4 to 2.5% of retail food sales,

⁴ The strong situation of the discounters is reflected in German food prices. Or the other way around, the price sensitivity of Germans has given the discounters such a strong market presence.

⁵ Like brick-and-mortar grocery, e-grocery contains categories of food, near food (such as hygiene articles) and non-food. Ready-cooked meals, such as those offered in restaurants or cafés, do not count in the category and are therefore not considered in the work.

⁶ The starting date of trading differs between countries; for example, LeShop.ch was already offering food online in 1997. In Germany, the first regional delivery service, *bringmeister.de* which was later taken over by edeka, also started in 1997. Otto, as the first German national provider, started to offer e-grocery service (www.otto-supermarkt.de) in May 2000 but stopped in 2003 due to trading at a loss.

including FMCG in Germany (e.g. table 1; Kantar 2019; HDE 2020). One reason for the slow rise of online groceries has been the logistical challenges of ensuring that fresh and perishable products arrive with customers in good condition. Moreover, in Germany, one challenging factor for online sales is that products are readily available close to consumers at bricks-and-mortar grocery stores.

In France, the turnover of food purchased online is slightly higher than in Germany, at 3.5% in 2017 and 7.1% in 2019. A driving factor for this could be that (even if the range of specialist food shops such as butchers or cheese dairies is greater) supermarket density is much lower in France, which only has half the number of supermarkets found in Germany (Nielsen 2019b; 2018a). Food suppliers are often situated on the outskirts of towns and need to be reached by car, making convenient, ad hoc and daily purchases on foot difficult. Moreover, online purchasing takes less time than shopping in hypermarkets with large sales areas. The fact that drive-through pick-up points were introduced relatively early in France (in 2000) means that they are now commonplace, and many French consumers shop by car, encouraging the further success of online grocery shopping (Mareš *et al.* 2016). Another favourable factor for online grocery retail is that the French market is less price-sensitive than Germany, partly due to the lower share of discounters (see 2.1). This favours a high-value service.

Due to favourable conditions such as increasing consumer demand for convenience (food) and better technology, online FMCG growth is rising worldwide (Nielsen 2019a). Further growth has been triggered by recent global developments – the Covid-19 pandemic has brought online grocery shopping to the fore. The mixture of confinement, avoiding public spaces and limiting people to small gatherings have contributed to making local shopping more difficult or even impossible, and may even have had a favourable effect on online shopping. As soon as official sales figures for 2020 are available, it is likely that this development will be statistically apparent and will reveal whether there has been sustained growth in online grocery sales.

Currently, the online groceries sector is still mostly in deficit despite rising sales figures (PwC - PricewaterhouseCoopers 2018). To keep the deficits as low as possible and achieve maximum turnover, providers pursue different (starting) strategies. The most apparent distinction is the method of delivery for the ordered groceries. This can be achieved by delivery to the customers' home, to a pick-up point or to one of the grocery retailer's outlets.

While, home delivery is the first choice for online groceries in Germany, the *drive* system for picking up online ordered goods is the dominant delivery format in France. A brief outline of the history of the development of online grocery sales will help to pinpoint the differences in these geographically close markets.

The German market is characterised by a high volatility of online grocery providers since its beginnings in 1997. This study identified 93 online shops functioning in 2014, but only 66 were operating in 2020. The latter figure included some early providers and several recent entrants to the field. Looking at the assortment, very few online shops offer a full range of products, with most specialising in individual product groups (e.g., delicatessen products, dry food and near food or fruits and vegetables) or in ingredients for recipes. The supply of non-perishable food prevails for many providers. In addition to the traditional supermarket chains, several start-ups offer their goods online, along with producers, manufacturers and farm shops. Figure 2 shows the distribution of sales via the providers. The share of online sales by traditional brick-and-mortar retailers is the largest and is increasingly slightly (HDE & IFH KÖLN 2018; HDE 2020).

Very few online German grocery distributors operate nationwide, but rather are represented regionally. In addition to home delivery, a few providers also offer pick-up stations for online groceries.

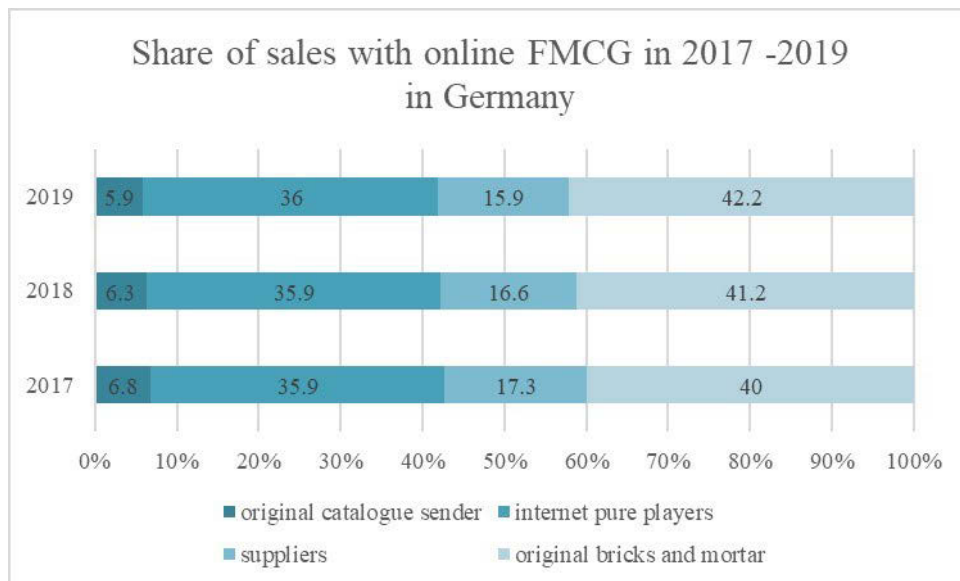


Figure 2: Share of online FMCG sales by providers in Germany (data source: HDE & IFH KÖLN 2018; HDE 2020)

In contrast to Germany, the concept of picking up groceries from drive-throughs (or *drive*) is well developed throughout France. A *drive* is a service where customers can collect their online orders and prepared baskets of FMCG. The acceptance of *drives* for online deliveries varies drastically between Germany and France. Whereas several supermarkets initially tried to set up this delivery format in Germany, it has not yet been fully established. Of the five brick-and-mortar retailers who originally offered pick-up for customers in Germany, only one is left. In France, however, each retailer currently operates several *drives*.

In contrast to the German pick-up stations, at a *drive* it is not necessary to collect the online order from a counter at the supermarket, but the pick-up occurs mainly at stations in the car park of a distributor's outlet or sometimes even at warehouses which offer *drive* services only. The first French *drive* was not connected to the internet but was developed for bulky and heavy goods such as beverages or hygiene products. It was only in 2004 that *drives* went online and ordering via the internet became possible. From 2008 to 2014, approximately 3,000 *drives* opened throughout France. Initially, these were mainly markets to which a *drive* was added. The concept saw rapid growth within the first five years. By 2013, depending on the specific supermarket chain, between 10% and 90% of all stores had a *drive* connected to their site. Four per cent of total turnover had already been achieved via *drives* in 2014. To counteract this burgeoning of the *drives* and regulate their development, article 129 of the ALUR (l'accès au logement et un urbanisme rénové) Act was adopted in 2014. The new law made *drives* subject to a commercial development permit, whereas they were previously exempt from this requirement (supplement to Article L 752-1). Under the law, there are only two circumstances in which authorisation is not required: one concerns already existing stores, the other is a transitional measure. The first case refers to *drives* integrated into a retail store open to the public after 26 March 2014 and involving the creation of a usable floor area of no more than 20m². The transitional measure applies to projects for which a permit has been granted or a decision of non-opposition to a prior declaration has been taken before the entry into force of the ALUR Act (Viart 2014).

There were 4,014 *drives* and 1,263 hypermarkets in France in autumn 2017, with more than four times as many *drives* as hypermarkets. In January 2019, 5,205 *drives* with a turnover of €6.8 billion had been registered across France (Dauvers 2020). *Drives* accounted for 81% of all food online (Nielsen 2019a), and HD accounted for 1.4% of FMCG sales in France.

However, as approximately 80% of online grocery sales are generated by the *drives*, and these are operated almost exclusively by the stationary trade, it can be assumed that the majority is generated by brick-and-mortar stores.

2.3 Development of food retail structures and related changes in transport

Offering food online is not the first innovation to occur in food retailing. There have been several changes over the last hundred years, accompanied by changes in distribution structures. The developments demonstrate that changes in retailing and transport are intertwined.

Since at least the 1960s, structural change in retailing has occurred in most European countries (Bahn & Potz 2007). In general, the food retailing landscape has changed from service to self-service shops and supermarket chains. New business formats such as hypermarkets and discounters have arisen, and supermarkets that combine food and general merchandise are common today. The latter use product variety to differentiate themselves from competitors. Cost savings, generated by a decrease in personal costs and primarily achieved through economies of scale, was a key driver in the transformation process. Despite many attempts to achieve cost savings while experiencing growth in the market, the easiest and fastest way to make significant gains in sales and market significance is through company takeovers. Thus, a concentration process in the food retail market was initiated based on acquisitions and strategic alliances, and this process is still ongoing (Markin & Duncan 1981; Heinritz *et al.* 2003; Petzinna 2007; Kulke 2008).

This restructuring was accompanied by a re-organisation of the food retailing sector's transport and logistics structures. Initially, the management of flow was performed by manufacturers and wholesalers, and retailers progressively internalised logistics processes (Ferne *et al.* 2000). In the 1970s, there were many small and medium-sized enterprises of local and regional importance. These enterprises did not organise themselves collectively. Most grocery shops were supplied directly by suppliers or wholesalers (Ferne & Sparks 2009; JLL 2013). In the 1980s, initial processes of concentration took place, and retailers began to centralise their shop deliveries by developing regional warehouses to supply their outlets (Figure 3). This development favoured direct contact with the suppliers and enabled costs reduction.

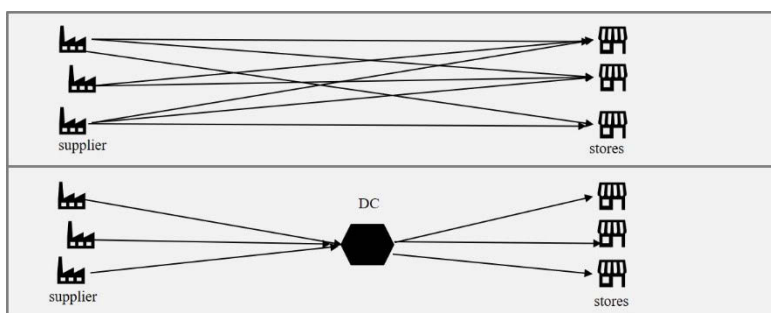


Figure 3: From direct shop deliveries to centralising shop deliveries

Over the last 30 years, most processes have been absorbed by retailers. Whereas earlier supply was mainly supply-driven, today's supply chains are increasingly demand-driven. As a result, retailers can adapt their logistics to their specific requirements. With efficient design of the supply chain from the retailer's perspective, the term supply chain management (SCM), which was initially used for military operational solutions in the Second World War, has been used frequently in a retail context since the 2000s (Hesse & Rodrigue 2004). Today, SCM is an integral part of the logistical organisation of companies and uses an overarching management model to achieve a continuous improvement process. As it develops, logistics is looked at increasingly from an operational perspective. The focus is on

service, reliability and flexibility with the aim of increasing turnover and assuming a leading position in the market (Heiserich *et al.* 2011). The logistical tasks thus relate to production, procurement, distribution and disposal (Pfohl 2018). In the process, logistics reaches beyond company boundaries to the interfaces of suppliers and customers (*ibid.*). The relationships between companies and locations are also changing. An economic geographical view of production and distribution processes from the producer's perspective takes the 'filière' concept (Lenz 1997). From the retailer's point of view, it is not only the relationships that are changing – companies' growing interest in controlling processes is also reflected in transport. The flow of goods is increasingly bundled via the locations of the individual retailers. In 2010, direct deliveries – meaning deliveries from the manufacturer or wholesaler without involving the retailers' DC – only accounted for 17% of deliveries, according to estimates by Thonemann *et al.* (2005). Kuhn and Sternbeck (2013) confirmed these findings. Accordingly, highly optimised logistics concepts for branch deliveries exist. With their distribution centres, food retailers manage their own vertically integrated logistics network (Kuhn & Sternbeck 2013). The trend of recent decades is also seen in the change from the distribution logistics of manufacturers to the procurement logistics of retail companies. Retail-related transport was primarily considered in the context of these changes. Studies that consider these changes from a supplier-controlled to a retail-controlled supply chain include Blanquart *et al.* (2012), Sparks (2010), and Fernie *et al.* (2000).

Overall it can be stated that, as the retail landscape changed, so did the supply structures. From another perspective, the savings generated by consolidations in the supply chain enabled the transformation of the retail landscape. Cost savings were achieved through economies of scale, which was a key driver.

The transformation of the food retail landscape did not stop in the 1990s. Since the late 90s and early 2000s, e-commerce has expanded, slowly at first, but now ubiquitously. The internet triggered the next significant change, as it made easy price comparisons possible, and consumers began to search for the best deals. Simultaneously, manufacturers realised that they could bypass intermediaries or costs for shops and warehousing. Attempts were made to further minimise inventory and stock and to retain margins.

It quickly became apparent that the online placement of goods was not just a technological process but a new operating (sales) channel that could be established (Boschma & Weltevreden 2005). In addition to brick-and-mortar retailers, other suppliers have entered the market, including online-only retailers (pure players) and actors originating in the food market who had not been in contact with consumers before known as 'filière players'⁷. The completely new providers, are referred in the following as 'newbies' or start-ups. Thus, e-commerce is part of the further restructuring of the retail sector. Today, the (revenue-generating) grocery landscape can be portrayed as in Figure 4⁸. In this condensed presentation, all the different stationary operating formats are grouped together as stationary retail.

⁷ Actors originated in the initial food supply chain

⁸ This figure does not claim to be complete; weekly markets, farm shop sales or specialised shops like butchers, for example, are excluded.

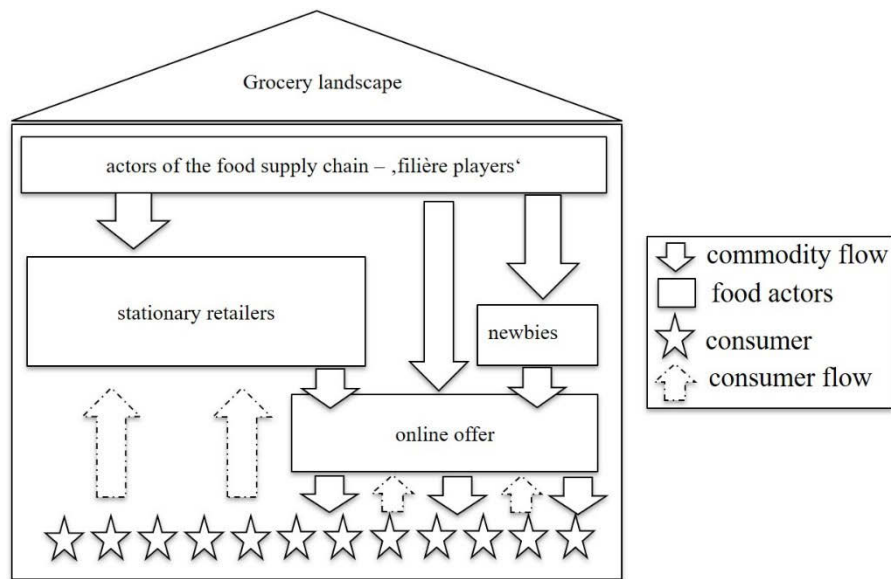


Figure 4: Schematic view of the grocery landscape

Based on the pattern of previous developments, it can be assumed that the offer of e-grocery services will involve adjustments in commodity flows and thus in logistics and transport organisation.

2.4 E-grocery-related transport and distribution concepts: changes and challenges

The developments described in section 2.3 lead to the question: what changes do e-grocery services involve for transport and related distribution concepts?

The existing literature dealing with transport and distribution concepts in retailing has looked primarily at changes in distribution structures and the shift from deliveries by manufacturers and wholesalers to deliveries by the retail trade (Bell *et al.* 1997; Fernie & Sparks 2004). The retail-related distribution processes ranged mainly from the supplier and ended up at the point of sale. In the vast majority of cases, the last mile was handled by the customer. This is also characteristic for the analysis of food retail related transport and distribution concepts (Fernie & Sparks 2004; Blanquart *et al.* 2012).

The particular characteristic of e-commerce from a logistical point of view is that until its advent, the logistics and transport chain ended at the PoS. Accordingly, the literature has focused on this aspect (Paché & Colin 2001; Fernie & Sparks 2004). With the advent of online retailing, the need arose to extend the logistics and transport chain to the customer. Since delivery to the customer represents new territory for most companies, the majority leave the delivery to courier, express and parcels (CEP) service providers. In the non-food segment, there are only a few exceptions where companies arrange the deliveries themselves – Amazon, for example.

These general changes in delivery processes were considered by JLL (2013) and Rodrigue (2020), among others. The authors illustrated the processes and their changes (compare Figure 5), from initial direct deliveries to transshipment via the retailers' distribution centres. Developments such as global sourcing and the latest innovations in online commerce have also attracted attention. New structures for e-commerce have been established, demand for new logistics facilities has increased and last-mile structures are also used by parcel service providers. One shortcoming is that many researchers have considered retail as a single sector and have not differentiated according to sector specifics (Hesse & Rodrigue 2004; Agatz *et al.* 2008). Furthermore, differentiation according to products has tended not to occur. Particularly in the case of grocery retailing, the structures shown in Figure 5 cannot be transferred directly. This can be seen in the overseas centres, for example. In the food sector, these are mainly

limited to fruits, certain vegetables and specialities. Here, procurement usually takes place via wholesalers.

The evolution of general retail logistics

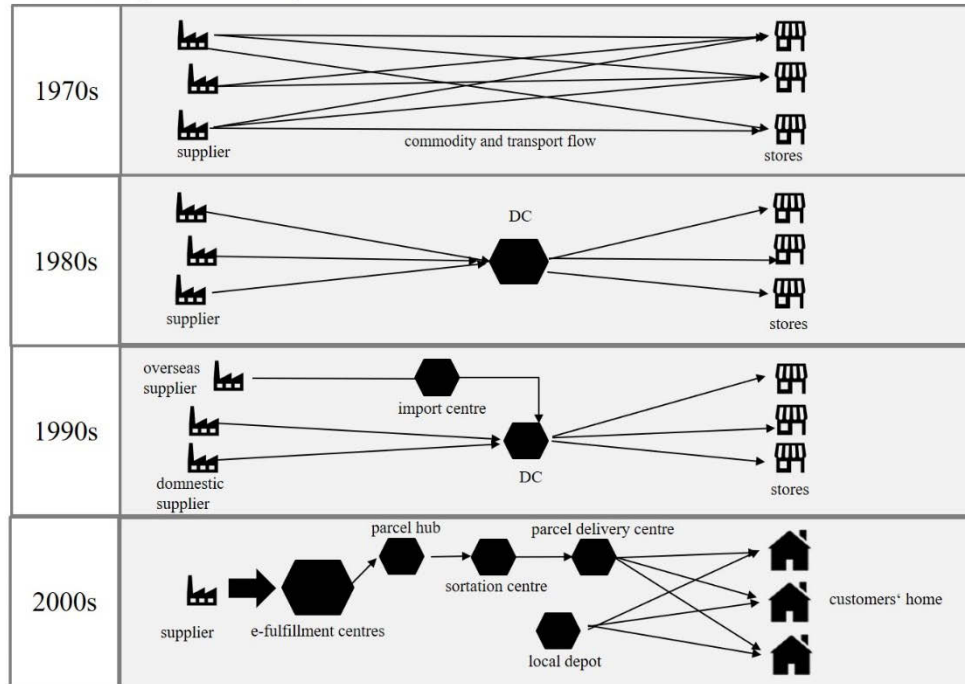


Figure 5: The evolution of general retail logistics (source: adapted from Jones Lang LaSalle 2013; Rodrigue & Dablanc 2020)

The presentation of the online segment in Figure 5 suggests that goods in e-commerce are operated via CEP providers and transported via their network. This procedure mainly impacts non-food areas. Non-food products are usually packed in cartons and parcels that can easily be sorted in the distribution centres of the transport service providers, and articles of different types can be shipped next to and with each other. However, this handling is trickier for FMCG, especially fresh food, where the requirements are not compatible with the structures used for non-food items. Issues of short shelf life, sensitive product handling, the need for refrigeration and, above all, the mix of different products with different packaging requirements makes it difficult to rely on traditional parcel service providers. Another factor is the successful delivery of fresh food. Shipments cannot easily be handed to a neighbour, be deposited at a storage location or a parcel shop or station, with hygiene and cooling restrictions adding to the dilemma. This brings further complexity to the planning and implementation of e-grocery deliveries. Hence, considering FMCG, CEP services are more likely to be found in the non-food or dry goods segment.

Because it is difficult to deliver food ordered online with traditional CEP service providers, the question of how the goods get to the customer arises. Food retailers pursue different solutions, including collection by the customer themselves, setting up their own delivery services and using service providers that specialise in food delivery. The various concepts are considered in transport science, especially the challenges that accompany the delivery or deal with the factors of their failure (Hays *et al.* 2005). Tanskanen *et al.* (2002) argued that e-grocery companies failed as an electronic copy of a supermarket does not work. The authors related this primarily to the added value compared to stationary shopping. According to Tanskanen *et al.* (2002), the added value of e-grocery services consists solely of the commissioning and delivery of the goods, but is still time-consuming for the customer. Failure has also been attributed to the following factors: high delivery costs, inefficient logistics, and over-fast

expansions resulting in casualties such as the dot-com (pure player) Webvan in the US (Yrjölä & Tanskanen 1999; Hays *et al.* 2005; Fernie & McKinnon 2009).

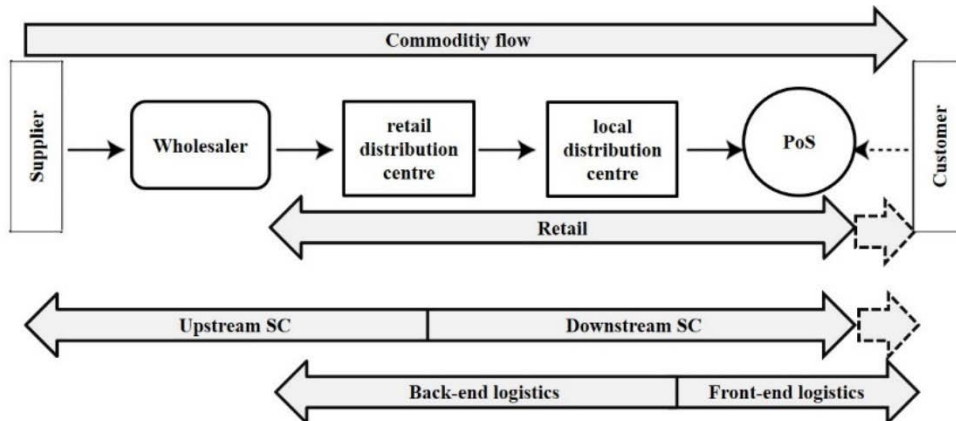


Figure 6: Simplified presentation of a supply chain for fresh food (modified according to Hesse 2002; Fernie & Sparks 2004; Vanelslander *et al.* 2013; Hübner *et al.* 2018)

Guaranteeing service and product quality to customers is a logistical challenge for retailers (Agatz *et al.* 2008). Therefore, if traditional food retailers decide to offer their products online, it is necessary for logistics processes to be modified or redesigned. This involves not only front-end logistics change but also requires change in the supply chain. The supply chain can be divided into upstream and downstream – that is, incoming goods and outgoing goods (Tatikonda & Stock 2003). If actors rather than goods are considered, manufacturers, suppliers and wholesalers represent the upstream, and retailers and PoS represent the downstream supply chain. Currently, when a brick-and-mortar retailer introduces an online offer, the downstream supply chain is extended by the customers (Figure 6). However, if the supply chain from the producer to the household is considered as an integrated process, it is logical that different forms of preparation and delivery entail different types of supply chains (Yrjölä *et al.* 2000; Yrjölä 2002; Fernie & Sparks 2018; Hübner *et al.* 2018). The six boxes with dashed lines in Figure 7 show the individual stations of the supply chain from the retailers' perspective in a simplified way, whereas this illustration shows a commodity process-oriented visualisation.

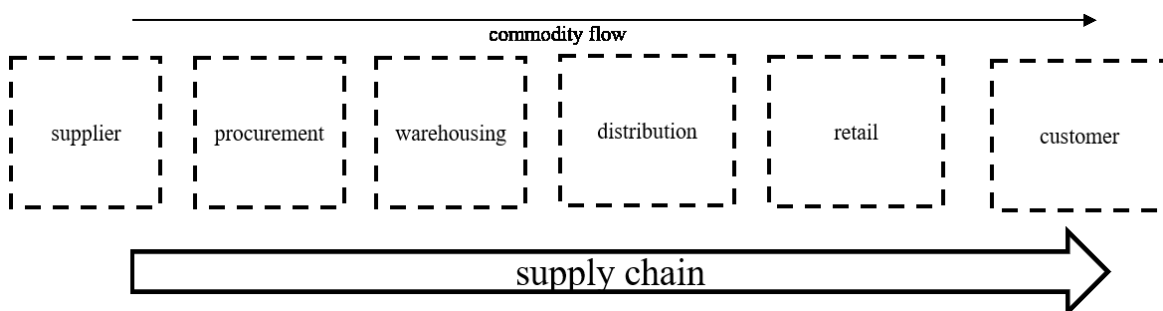


Figure 7: Stations of a supply chain from the retailers' perspective (modified according to Hesse 2002; Vanelslander *et al.* 2013)

A fundamental requirement for coordinating warehouse and delivery is to make the supply chain efficient in the retailing context (Kotzab & Schnedlitz 1999; Kotzab & Bjerre 2005). Products need to be available on demand. In addition to procurement and storage, the delivery of the products is of particular importance. Hence, logistics and transport organisation play a fundamental role. Logistics involves ensuring the transport and storage of goods between different supply chain stations. To ensure the availability of goods, a functioning, efficient upstream supply chain is crucial. Nevertheless, a successful delivery to the final customer is equally important. The latter is taken into account above all other considerations in the literature. Boyer & Hult (2005) observed that the ease of receiving a delivery

is more important than the actual price of the product for customers. Different studies (Yrjölä 2001; Agatz *et al.* 2008; Durand 2008; Agatz *et al.* 2013) have underlined that the ordering process and delivery are also the main success factors. These factors encourage repeat orders from online customers, which in turn means that better forward planning can simultaneously reduce costs and increase profitability (Xing *et al.* 2010; Rao *et al.* 2011). However, the willingness to pay for the delivery is low (Huang & Oppewal 2006), so that for the merchant, deliveries at the lowest possible cost are decisive. The majority of the cost of order fulfilment is therefore shifted to the online retailer and must be managed effectively, as these costs can have a significant impact on retailers' profitability (Goethals *et al.* 2012).

Some studies have analysed the design of the last mile and how a delivery can be successfully made – for example, by introducing delivery windows (Boyer *et al.* 2009) or using a reception box (Kämäräinen *et al.* 2001a; Punakivi & Saranen 2001; Goethals *et al.* 2012). However, unattended deliveries have not become established in Europe with the exception of Switzerland and some short-chain deliveries such as boxes of vegetables in Germany and France.

With the emergence of different online sales channels, the term multichannel strategy has been coined for retailers that offer both online and offline channels. In the last 20 years, the food retail sector has developed these multichannel strategies to open up new customers and markets, satisfy customer needs, and not lose market dominance to competitors. Studies of the phenomenon of multichannel selling also mention omnichannel retailing when the different sales channels are very closely interlinked (Hübner *et al.* 2016a; Lazaris & Vrechopoulos 2014; Hübner *et al.* 2018; Buldeo Rai *et al.* 2019). The focus of the research dealing with the multichannel phenomena is often on analysing critical factors for the success or failure of multichannel distribution, such as product availability and planning (Handfield *et al.* 2013). Besides product availability, the attention is primarily on the consumer approach. Many analyses focus on how to address consumers best by analysing their channel selection decisions (Nicholson *et al.* 2002) or ascertaining the influence shopping orientations have on the attractiveness and choice of grocery channels (Cervellon *et al.* 2015). Analyses of online grocery services also centre on consumer behaviour, consumer preferences and consumer groups (e.g. Kempia & Fox 2002; Teller *et al.* 2006; Goethals *et al.* 2012). The focus on consumers is particularly striking but also justified, as retailers focus on the customer to build or maintain market power. In the past, the spotlight was on costs. Since profit margins in food retailing are very low, success with end consumers is vital. In addition to the customer approach, the transport of products is a key aspect of multichannel retailing, and the delivery of goods to the customer plays an important role for success. This makes logistics a crucial factor when extending selling strategies to multichannel selling. However, the focus of previous research is mainly on the last mile, and the holistic view has been neglected.

The existing literature has focused primarily on individual aspects of online retailing, and a schematic view of the processes has been lacking. Hübner *et al.* (2016a) partly closed this gap. They developed a first schematisation, revealing that operations planning can be structured according to fulfilment and delivery concepts whereby retailers select various options depending on the development stage, market, growth and efficiency. However, the effects on transport and supply chains were given little consideration. Boyer & Hult (2005) considered e-grocery services as an extension of the supply chain but omitted the upstream supply chain. The change from the original supply chain of the brick-and-mortar to a new supply chain of the 'brick and click retailer' was considered by Yrjölä (2001). Since the structures of both are connected, he referred to them as hybrid models. As developments are not the same in all countries, there may be different impacts on the supply chain. However, few studies have compared the effects in different countries. To my knowledge, Wollenburg *et al.* (2018) is the only study that makes international comparisons and takes the supply chain into account. This article, which was not available when this work commenced, is compared with my results in the discussion. Wollenburg *et*

al. (2018) analysed the internal logistics networks used to address and serve customers via different channels in various countries. The work identified different concepts, each with subgroups: 1) retaining existing structures; 2) using independent online distribution centres; and 3) using channel-integrated distribution centres. However, the study did not consider whether initial situations have different impacts on transport and logistics organisation, and non-brick-and-mortar players were not considered.

The role played by the initial situation of the retailer has not yet been satisfactorily investigated. Moreover, the design of supply chains by new actors who have not previously been active in the food sector or who have not yet had contact with customers, as they have hitherto operated upstream in the supply chain, is missing from previous research. The changes in the commodity flows are of particular interest, as there is an assumption that commodity flow, supply chain and logistics are strongly intertwined, so they should always be considered together.

The state of the current research is presented in Figure 8. The question marks represent the areas that have not yet been extensively studied and still need to be investigated.

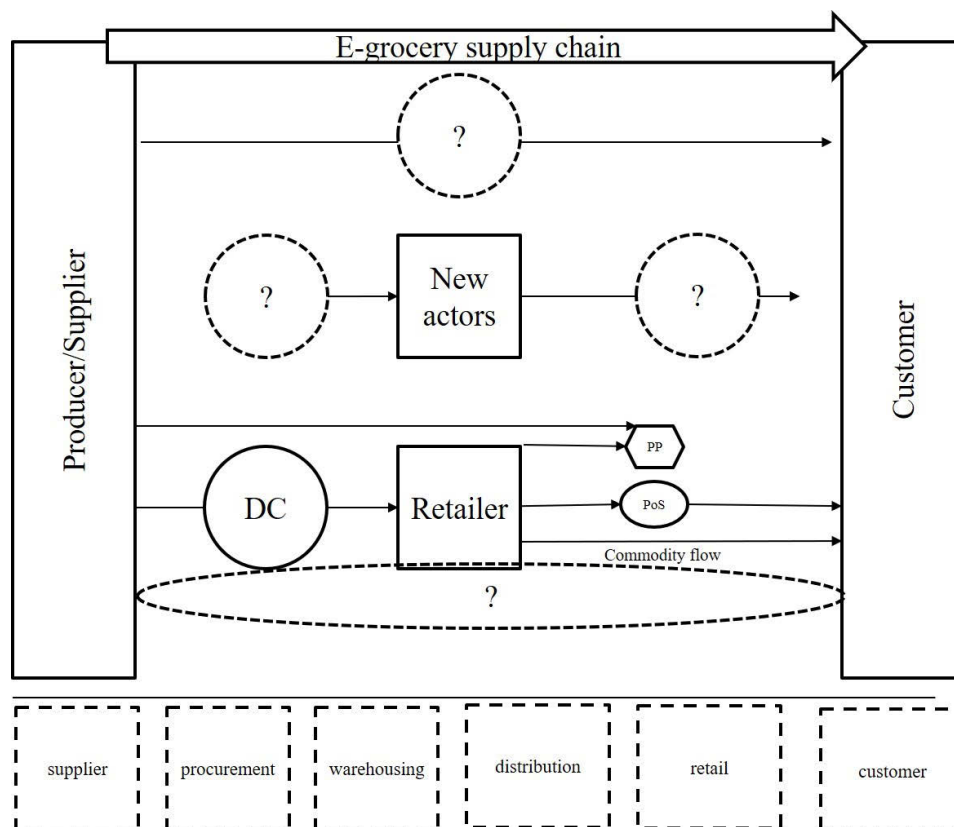


Figure 8: Knowledge about the e-grocery supply chain according to literature

3. Research design and methodology

This chapter briefly explains the cumulative dissertation. Section 3.1 gives the questions, 3.2 justifies the case selection, 3.3 explains the methods used, and 3.4 explains the documentation in articles.

3.1 Study focus and research questions

The literature review revealed that companies offering online sales focus mainly on the design of the last mile. Bringing together customer expectations and satisfaction with cost and logistics efficiency are the most significant drivers here. Only a few authors have focused on the reorganisation of the supply chain. Due to the low margins, companies are forced to be as efficient as possible in this segment. This necessity is strengthened by the fact that new players specialising in online services are entering the market (e.g., Amazon).

The literature lacks insights into whether and how companies reorganise their transport chains and what their prerequisites were. Therefore, I am particularly interested in the changes that accompany online grocery retailing. Focusing on Germany and France, which have different approaches to offering online groceries, my thesis aims to highlight the developments and analyse and assess the impact of changing structures on logistics and freight transport. It looks at changes in transportation and logistics and investigates whether overarching schemes can be developed despite the differences between countries. Furthermore, it examines the supply chain, looking at how different designs impact it and how companies reorganise it. The new players in the market are identified, along with their methods of organisation.

Against the background of the current developments in food retailing, the following research questions (RQ) were formulated, and they are answered within the framework of this study:

- RQ1** *How do commodity flows change through the introduction of online grocery services?*
- RQ2** *Can different configurations of online grocery services, and thus different commodity flows, be observed in France and Germany?*

In answering these questions, it is not only the design of the last mile that is of interest but also the preceding supply chain. From the key questions, further research questions can be derived, which were analysed for both market of interests.

The research sub-questions are important in the context of changing market structures, and they are addressed in this study in order to fulfil the primary aim of the research. This work focuses on changes that have taken place. The areas that experience a change are then compared between the two countries. First of all, it is essential to record the initial situation. Once that has been analysed, it is possible to understand the changes taking place and their context. Therefore, the main research question can be broken down into the following sub-research questions (SRQ):

- SRQ1** *What is the initial situation of brick-and-mortar retailers' supply of goods?*
- SRQ2** *How is the fulfilment and delivery of online orders implemented?*
- SRQ3** *What influence does the retailers' 'initial situation' have on the design of the new distribution channel?*
- SRQ4** *What impact does the offer of e-grocery services have on transport and logistics organisation?*
- SRQ5** *What changes can be observed following the introduction of an additional distribution channel in terms of cooperation with other actors, supply chains, and logistics?*
- SRQ6** *Who, beside brick-and-mortar retailers, are the other market participants? How do they organise transport and logistics? What is changing in the supply chain?*

To answer the research questions in a targeted manner, empirical data material was used.

In the following sections, the methods used in this thesis are presented. This includes a justification for choosing a case study approach and an explanation of the general procedure and research method.

3.2 The case study approach and case selection

A case study is a qualitative research method that allows detailed observations to be made and theories to be generated. It is particularly suitable ‘*when the focus is on contemporary phenomenon within some real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used*’ (Yin 2003:13). Furthermore, it allows the generation of a framework or systematic scheme to evaluate and analyse complex issues. Thereby, the following property is attributed to it: ‘*the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result*’ (Schramm 1971 cited in Yin 2003:12). Ergo, a research strategy is suitable for exploring the fundamental principles’ causes.

According to Robson (2002), there are various applications of case studies, including cross-national comparative studies. Unlike other qualitative or quantitative research strategies, such as grounded theory or surveys, virtually no specific requirements guide case research (Meyer 2001). The case study approach is primarily qualitative, but may also include quantitative elements. It can therefore be considered flexible depending on the object of study. Thus, it is adaptable in its application. As Meyer (2001) pointed out, this has advantages and disadvantages. One drawback is that the open design method has resulted in several substandard case studies, but the open method also has immediate advantages. The procedure of data collection and the research approach can be adapted precisely to the research question, and they allow the consideration of a holistic view.

In geography research, case studies have experienced a renaissance since the 1990s (Sedlacek 2001). Here, a case is understood as an entity with its history of individuation, having identifiable boundaries created mentally and in terms of action by the internal and external actors (Ibid.). Therefore, cases can differ widely and may concern individuals, institutions, cities, regions or countries. The object of a case study is understood as the reconstruction of the structure of a case. That is, there are regularities and structures that cause reality to be the way it is (Ibid.). The aim of the case study is to uncover these structures in such a way that they can be translated into ordered sequences or decision patterns.

For this thesis, the specific consideration of a case study is suitable, as the objective is to understand what online grocery retailing means for transport and logistics, especially among the original stationary retailers, and further to develop a framework making a characteristic possible. The development of online food retailing and its preconditions in terms of characteristics and market structures are very different around the world. It is difficult to capture changes in logistics and transport structures, and thus in distribution systems, in general and for all countries (i.e., globally). There are various applications in different markets, and the thesis aims to reveal how the flows of goods change. Furthermore, it develops schemes that are transferable to other markets.

Against this background, the analysis of two different markets is reasonable. To provide an accurate view and deeper insights, it is useful to pick specific markets. A cross-national case study is therefore suitable, as it represents a complementary strategy for reaching a profound understanding of the phenomena (Yin 2003; Saunders *et al.* 2009).

France and Germany were selected as study areas as e-grocery services are implemented differently in the two countries (see Section 2.2). In France, the focus is on pick-up points called *drives*, whereas German e-grocery providers concentrate on HD.

For both markets, research was undertaken to find available data on online food retail, but only a few official statistics are available (see Section 2.2). The following resources were utilised: official sources such as the Federal Statistical Office; Institut national de la statistique et des études économiques (Insee); data published by associations such as La Fédération du e-commerce et de la vente à distance (FEVAD) and Bundesverband E-Commerce und Versandhandel Deutschland e.V. (BEVH); and statistics included in market studies by consulting firms such as the Nielsen Company. The freely available data addresses the following categories: turnover, number of online shoppers, average expenditure on (online) purchases, and preferred delivery options. Only the first category is available from official statistics sources, and the rest is published by the other organisations. In addition, turnover figures and information on the type of online offer can be found on company pages. One difficulty that emerged when looking at the data is that official statistics are usually not up to date and the categories to which the data are assigned are not always the same. Some consider only food, while others include all types of FMCG, also often the exact designation is missing, whether net or gross values are referred (see also section 2.2). In the framework for the project ‘Survey of Trade’ by French Institute IFSTTAR in Marne la Vallée (currently the Université Gustave-Eiffel) and the DLR, Institute for Transport Research, data on the locations of brick-and-mortar food retailers and their associated distribution centres collected by Nielsen TradeDimensions was purchased. This data was suitable for analysis and evaluation within the scope of this work.

In addition to statistical data, an extensive literature search on distribution (food) retail was conducted. In terms of media, the search focused primarily on journals, along with monographs, collected works, websites, newspapers, magazines and lectures. For this, in addition to libraries, the search engines of Elsevier, Google Scholar, Scopus and, for press, standard search engines were used. The search keywords ranked around all terms in the area of e-grocery, multichannel retail, logistics, SC and consumer. More than 500 documents, including scientific articles, market studies, statistics, company reports, newspaper articles and blogs were collected and sighted. Of these articles, the 140 listed in the references section of this thesis are the most important ones consulted in this work. However, the central part of this study involved the findings from the interviews conducted with the various actors (see Table 2).

Table 2: Overview of conducted interviews with different actors

	brick-and-mortar		multi-channel		‘filière players’		newbies	
	Germany	France	Germany	France	Germany	France	Germany	France
Paper I	8	15						
Paper II			3	3				
Paper III				1	1	2	2	1

3.3 Explorative research approach

The online grocery market is a relatively new phenomenon, and although already researched in part, it is rapidly changing (see Sections 2.2, 2.4). Thus, an explorative qualitative approach is suitable. In planning the research, the first step was to consider how the questions could best be addressed systematically. To understand the changes taking place and to understand changes in logistics and transport organisation, empirical methods, which also align with case study research, were chosen. A mixture of descriptive and explorative research is especially suitable for this purpose to examine the overall context and the e-grocery supply chain.

The methodological approach of this thesis is a mixture of inductive and abductive research that aims to explain and classify the different forms of online grocery trade and their impact on transport and logistics organisation. Building on an in-depth literature analysis, the primary method used in this research is extensive empirical research combining quantitative elements in the form of retail data analysis and qualitative elements in the form of expert interviews.

3.3.1 Research process

During the work on the ‘Survey of Trade’ project mentioned above, the changes occurring in the food market were perceived. This led to the idea to investigate the changes and their effects on the transport and logistics market. After a first literature review in 2013, it was found that only a few scholars had dealt with the e-grocery market. Existing analyses focused mainly on the British, American and Finnish markets. After reviewing the data, the research question was adapted, and the research design was chosen. Because only a few actors were active in the German and French markets and company data is difficult to access, a qualitative approach was adopted. This would allow the internal restructuring processes of the actors to be studied. To work through the research questions systematically, a tripartite approach was chosen, which is reflected in the three articles of this thesis. As this is a topical issue, it was essential to continue the literature analysis throughout the study process. The overall research process is illustrated in Figure 9.

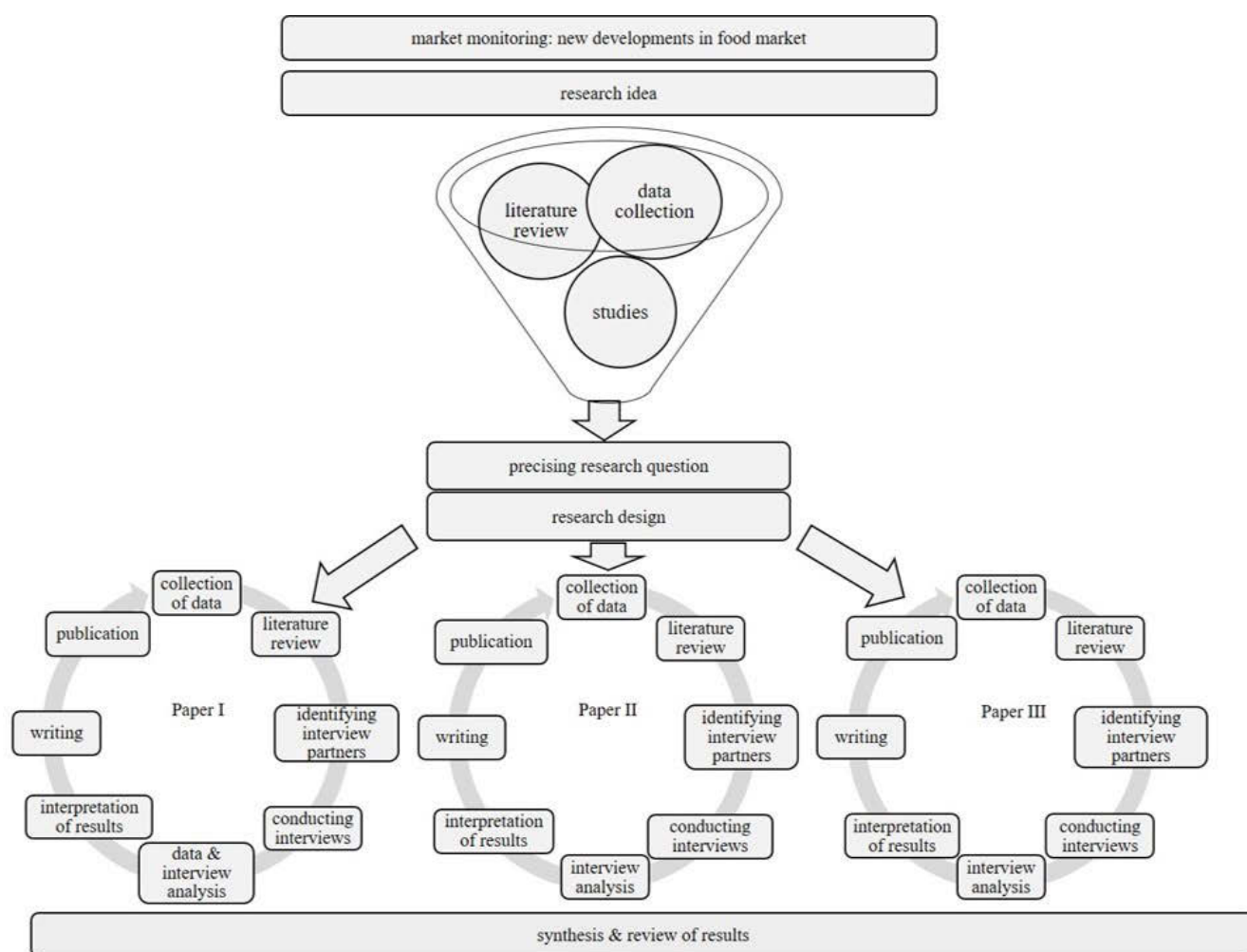


Figure 9: Research process

3.3.2 Methods of data collecting

There are already first research insights on the topic, although details such as a schematic and full coverage are missing, and observations in areas such as the supply chain are incomplete. These gaps make this study's chosen approach particularly suitable. The focus of my work is primarily based on semi-structured expert interviews. To understand the changes taking place in food distribution as a result of online food offerings, it was necessary to cover diverse actors in the online food market. Based on Figure 4, the interviews with the groups of actors can be illustrated as follows. The clouds mark the groups of actors with whom interviews were conducted. The numbering corresponds to that of the articles (Figure 10).

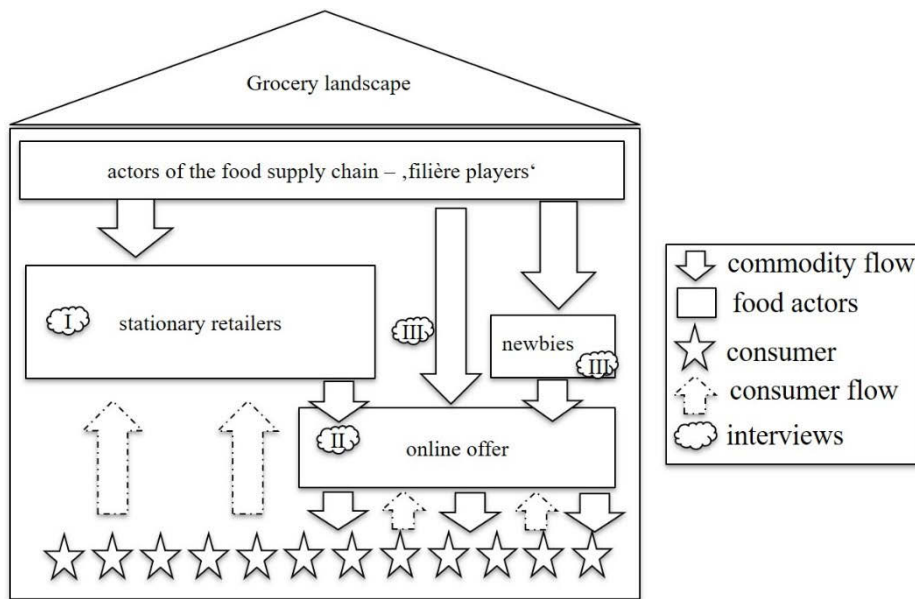


Figure 10: Schematic view of the grocery retail landscape

This research approach also provides in-depth insight and background information about distribution strategies and logistics processes from the perspective of the relevant stakeholders. The questions were individually assigned to the following three categories in advance: general information about the company, sales strategy and consumers. The other categories correspond to classical logistics processes: procurement and inbound logistics, orders and distribution characteristics. The thematic areas 'relation to actors in the supply chain', 'physical assets' and '(future) challenges and outlook' were also raised.

To systematically capture changes in transport and logistics organisations and further impacts, it was necessary to understand the initial situation before the effects and changes could be recorded. Therefore, in addition to interviews, location data of food retail distribution was also collected and analysed, which allowed statements to be made about the traditional relationships of the locations. Overall, therefore, a mixed method was applied.

In contemplation of the state of research, a comprehensive analysis of existing retail trade-related literature, articles and books was conducted. To capture the latest developments, grey literature such as specialist media (e.g., 'Lebensmittelzeitung' and 'Handelsblatt') and magazine articles were included.

3.3.3 Methods of data analysis

Even though there was an interview guide, some adaptations took place during the interview. Most of the interviews were recorded and transcribed afterwards. A simplified transcription was made, with sentence breaks, stutters and word duplications omitted. Punctuation was added for the sake of

readability. For those interviews where no recording permission was given by the participants, notes were made during the interview, supplemented by a memory transcript made afterwards. After transcription, the data material was analysed according to Mayring's procedure (2010). First, an explicative form of content analysis was selected. This meant that the interview material was supplemented with information available from the company website or information from expert reports referred to by the interviewees. Subsequently, statements from the interviewees were assigned to categories and keywords. The criteria of coding had been established in advance to ensure the quality of the criteria. The coding was oriented towards the stations of a supply chain from the retailers' perspective. The stations were identified during the literature review as relevant (Figure 7) and set by the structure to which the questions were assigned: 1) company characteristics; 2) sales concept; 3) suppliers; 4) procurement and inbound logistics; 5) warehousing; 6) distribution; 7) network of PoS/drives; 8) physical assets; 9) customer; and 10) challenges and outlook. The main categories were then expanded and populated with subcategories (Table 3). The subcategories were set according to key figures and derived from interviewees' answers. This procedure made it possible to derive quality data and ensure that the content of the individual interviews could be systematically compared. The analyses were performed in Excel and partly with the software Maxqda 2020 (VERBI Software 2019). The results were then interpreted.

Table 3: Example for setting the subcategories

Quote from a retailer	Main category	Subcategory	Subcategory	Details
‘It varies, so we are supplied daily by the central warehouse and sometimes only once a week by the direct suppliers, e.g. [...]. However, we do not order on demand, i.e. we set up a stock and the customer can order on the basis of the stock and not the other way around.’	Procurement & Inbound logistics	Origin of goods	Product-based	- Direct deliveries from supplier - Transshipment via central warehouse
		Strategy of stock	Traditional	Forecast-driven
		Frequency of delivery	Product based	- Weekly - Daily

3.3.4 Documentation and publication of the results

This section introduces the three dissertation papers. Chapter II then presents the individual articles in sections A, B, and C. An overview is given of the research questions addressed in the papers and the specific methods used to address them. Furthermore, a transition section shows how the papers are interconnected.

The overall research questions were divided into individual sub-questions, which are addressed in the three studies as shown in Table 4.

Table 4: Comparison of the research questions and separate articles

RESEARCH QUESTIONS	ARTICLE
I. What is the initial situation of the supply of goods of brick-and-mortar retailers' supply of goods?	A. Paper I focuses on the brick-and-mortar food retailers in France and Germany and compares the structures and distribution concepts
II. How is the fulfilment and delivery of online orders implemented?	B. Paper II addresses these questions by analysing the original brick-and-mortar traders and their online offer in France and Germany.
III. What influence does the retailers' 'initial situation' have on the design of the new distribution channel?	
IV. What impact does the offer of e-grocery services have on transport and logistics organisation?	
V. What changes can be observed following the introduction of an additional distribution channel, in terms of - Cooperation with other actors - Supply chains - Logistics	
VI. Who, beside brick-and-mortar retailers, are the other market participants? How do they organise transport and logistics? What is changing in the supply chain?	C. Paper III focuses on non-brick-and-mortar actors in the online market. The focus is on innovative offers and the role of logistics. The focus is again on e-grocers in France and Germany.

The three papers address different actors. In Paper I, all actors in the stationary food market are considered, regardless of whether they offer online food, to cover the initial situation comprehensively. Paper II focuses on the original stationary retailers that have started offering e-groceries. Paper III focuses on the other non-retail providers. Each article is dedicated to a single aspect representing an actor group in grocery retail, to obtain an overall picture. All analyses are conducted for Germany and France. The following is an overview of the content of the individual papers and the methods used in each, along with a description of how the papers are related to each other.

A. Paper I: This paper aims to provide insight into how food retailers supply their PoS and whether differences between countries and companies can be identified. The content was presented at the international conference Transport Research Arena (TRA) 2014 in Paris and at the International Freight Transport Modelling Workshop held in Berlin in 2014. The work was subsequently published in the journal *Case Studies on Transport Policy*. Prof. Dr. Corinne Blanquart and Dr. Verena Ehrler contributed to the article. The publication is based on a peer-review process and was finalised after a round of revisions.

To answer the initial research question (see Table 4), a two-step approach was chosen, involving quantitative and qualitative elements. The first step was to analyse the locations, both the food retailers' point of sales and their distribution centres, and the relationships between the locations. For this purpose, the Nielsen Trade Dimensions (2012) data set was used, which includes the food retail locations in Germany and France. The data allowed a mapping of the location and an analysis of the average distance between locations along with the size of the catchment area of the distribution centres. For the analysis, Excel and SPSS (IBM Corp. 2017) were used. Mapping was performed with the help of ArcGIS (Esri). The data were obtained during the research project 'Survey of Trade' (see Section 1.1).

In addition, semi-structured interviews with 23 brick-and-mortar food retailers were held. This included interviews with retailers in France (15) and Germany (eight). The interviews covered the various food retail formats, including hypermarkets, supermarkets and discounters. The same questions were asked to German and French participants. The aim was to obtain information about supply structures and the supply chain – for example, the retailer's relationship with suppliers, wholesalers and service providers.

This also included information about communication and the organisation of distribution. Most of the interviews were recorded and transcribed afterwards. The individual statements were keyworded during the evaluation and could thus be systematically compared.

The study results show that there are differences in the distribution channels, and the underlying supply chains vary, too. Not all food retailers have the same approach. Even though framework structures are similar, approaches differ in many respects. The paper shows this clearly. The results are also examined from the point of view of modelling aspects of transport models. This thread is insightful and shows that there is still a need for additional research. However, for the thesis, the strand of the different supply structures and how supply chains are structured will be considered for further work of the thesis. It examines the influence of the online grocery sector on the design of the food retail giants' distribution structures. The knowledge derived from this study provides the basis for capturing the changes that could occur due to online grocery retailing, and this is the topic of paper II.

B. Paper II: This study analyses the changes occurring in the transport and logistics sector of food retail companies. It looks at what does the online sale of groceries mean for supply structures, including the supply chain, and the role the initial situation and the choice of online offer plays. This article was written without co-authors and submitted to the journal *Case Studies in Transport Policy* in February 2021.

To prepare for the analysis of the e-grocery market, a comprehensive literature review was conducted. Building on this, as in the first article, the main method chosen was extensive qualitative and empirical research in the form of expert interviews. In total, three interviews were conducted in both France and Germany. The questions were assigned to different categories beforehand: 1) the company; 2) the concept of e-grocery; 3) procurement and inbound logistics; 4) orders; 5) delivery logistics; 6) delivery characteristics; and 7) future developments and challenges. Despite the interview guide, some adaptations took place during the interview.

The transcribed answers were subsequently analysed with the help of Maxqda 2020 (VERBI Software 2019). By categorising the responses, a structured comparison between the individual interviews was possible and a schematisation could be generated in conclusion.

Looking at the changes in the stationary retail trade, the study results show that changes occur due to the offer of online groceries. Thereby, the initial infrastructure of the company is an important factor. To get a complete picture of the changes in the flow of goods and how firms deal with the last mile and supply chain design, paper III focuses on the other players, the non-brick-and-mortar actors.

C. Paper III: This paper looks at which innovative offers providers are presenting to gain a foothold in the food market and the logistics and transport organisation they choose. It also investigates the implications for transport. The content of this paper was presented at two international conferences, the 9th International Conference on City Logistics and the NECTAR City Logistics and the Freight Transport conference on the topic of 'Sustainable freight transport – are cities willing and ready for the recent advances?' in 2015. The article was written in cooperation with Dr. Nora Marei and Prof. Dr. Corinne Blanquart and published within the City Conference context in an open-access journal after peer review.

A qualitative approach was chosen for this paper. In addition to an extensive literature review, interviews were conducted with e-grocery providers. The paper focuses on innovative concepts in e-grocery services and their consequences for transport and logistics. The focus was primarily on actors who were new to the online grocery business or had little contact with end consumers before establishing themselves online. Scientific literature was analysed for the role of logistics in online retailing. But since there is little scientific work on non-brick-and-mortar providers, the market is very fast-moving, and the providers frequently change, the literature review for analysing the concepts of newbies or 'filière players' focused on grey literature. This included newspaper articles, including the online press; an

intensive examination of providers' websites; and annual reports. In addition, interviews with seven e-grocery companies in France and Germany were conducted. The interviews focused on the nature of the online offer, the forms of transfer to the end consumer, the role of logistics in the company and the relationships with other actors in the supply chain.

The interviews, which were all conducted on-site and face-to-face, were recorded and transcribed afterwards. Subsequently, all answers and statements were assigned to categories and keywords. The answers were not only assigned to the categories established at the beginning of the process but were supplemented by further categories identified during the interview. This made it possible to compare the content of the individual interviews systematically. Together with the literature review, the results were sorted into the following themes: institutional context (including law), economic context (level of competition), actors involved in the e-grocery business, spatial context, and consumer patterns.

This article complements the existing findings, focusing on the other players – the non-brick-and-mortar actors – in the online market, showing how transportation and logistics are essential elements of any e-grocery strategy. Furthermore, the paper underlines urban freight transport challenges concerning changes in distribution and consumption practices. The following table gives an overview of the three articles.

Table 5: Assignment of the three articles to the research contributions of this dissertation

Chapter	Authors	Year	Title	Journal
II A	Seidel, Blanquart, Ehrler	2015	Same–same but different? A comparison of food retail and distribution structures in France and Germany	Case Studies on Transport Policy
II B	Seidel	2021 <i>submitted</i>	One goal, one approach? A comparative analysis of online grocery strategies in France and Germany	Case Studies on Transport Policy <i>(submitted)</i>
II C	Seidel, Mareï, Blanquart	2016	Innovations in e-grocery and logistics solutions for cities	Transportation Research Procedia

In Chapter II, sections A, B and C correspond in content and structure to the versions published in or submitted to the journals. Only the numbering of the chapters and tables (tab.) and figures (fig.), the standardised British spelling and the citation method have been adapted to fit the format of this dissertation. The printed versions of the articles are given in appendix B. Further articles have been written within the framework of my research activities are summarized in a table and included in dissertation appendix A.

II. RESULTS

A. Same–same but different? A comparison of food retail and distribution structures in France and Germany

Saskia Seidel, Corinne Blanquart, Verena Charlotte Ehrler

Seidel, S., Blanquart, C., Ehrler, V. C. (2015) Same–same but different? A comparison of food retail and Distribution structures in France and Germany. *Case Studies on Transport Policy*, 4 (1), pp. 29-37. Elsevier. DOI: [10.1016/j.cstp.2015.09.001](https://doi.org/10.1016/j.cstp.2015.09.001)

A 1. Introduction

With the continuous spread of the same labels across high streets all over the world, one could expect to encounter similar logistical retail structures everywhere, at least for similar market segments, e.g. food or fashion. Therefore, when modelling international freight transport, it is tempting to assume almost identical logistical structures within national markets and for the same market segments all over the world. However, this is not the case. Despite a globalization of brands, distribution structures within industry still vary significantly from one country to the next and even on a regional level such as Europe. As a consequence, different logistics distribution systems with different freight transport demand can be found.

With its high number of selling points, its important revenue volumes and its relevance for every-day life, the food retail market lends itself as an interesting market for a closer analysis of the impact of retail structures on distribution logistics and transport demand. Therefore, and against the described background, this paper takes a closer look at the food retail industry's structures, using the example of two neighbouring EU countries, France and Germany, as they are among the European countries with the highest revenue in food sales.

Like most other retail industries, the food sector is characterized by growing market competition and increasing cost pressure. At the same time, fostered also by online experiences, customers' expectations towards instant availability of an interesting and diverse product assortment are rising continuously. As a consequence, the necessity of optimizing the efficiency of processes and logistics structures is growing, with retailers having to cope with the complex mixture of supply chains of local, regional and global sourcing at the same time. This complexity of today's retailers' businesses is often further increased by their geographical spread. Furthermore, growing awareness of environmental concerns, demand for sustainable products and the need to optimize the efficiency of processes in order to keep costs at a minimum add to the challenges that the retail sector faces. These are further enhanced by more transport specific issues such as congestion, resulting difficulties to time deliveries and increasing energy prices, namely fuel. These challenges and the competitive environment of the retail industries have resulted in distinctly different spatial patterns, both on an industrial as well as on a geographical level. This differentiation is due to the fact that retailers try to differentiate themselves from their competitors through their network structure, and that they try to optimize their logistics efficiency: "Retail and service networks are developing and as competition is increasing in the retail environment, the best location is one of the most critical criteria of network performance. This location criterion deals not only with the single store location but also with the global network location." (Cliquet 1998).

Based on an analysis of the structure of food retailers in France and Germany (Section A 3), the present paper investigates their spatial distribution patterns, including logistics hubs, distribution centres and warehouses. These analyses build the basis for the following comparison of distribution structures of

the French and German food retail industry. The paper closes with a summary of the findings and an outlook of the impact of the findings on international freight transport modelling and its related data sourcing.

A 2. Method

This research is based on empirical data, both existing and the authors' own (empirical research in the format of structured interviews). In order to achieve a comparable data basis for the two markets Germany and France, TradeDimensions (2012) data was chosen as it is one data-source that contains data for both countries, covering about 92% of food points of sale (PoS) and distribution centres (DC) and wholesalers linked to food PoS in Germany, as well as about 59% of PoS in France. The 92% for Germany include about 36,000 food PoS and 1,163 related DCs and wholesalers. The 59% for France cover data of about 18,470 PoS and 360 DCs and wholesalers. Whilst all locations of big retailers are captured, it is important to bear in mind that small-scale supermarkets or 'superettes' are often independent and therefore can be missing in the TradeDimensions data.

The TradeDimensions data is organized in three excel-spreadsheets (for France and Germany each). One table lists the PoS and describes them by using 39 different variables, including a variable for the type of format of the PoS. A second excel file of the TradeDimensions data-set lists all DCs and wholesalers. The third table links the PoS to the warehouses by using an individual ID per PoS, DC and wholesaler. This way, it is possible to identify each DC and warehouse supplying an individual PoS. Then, using the information of the three tables, an adjacency matrix has been created for France and Germany, to describe the link between the PoS and the distribution centres in more detail (2014).

Based on these data analysis, individual retail chains (rather than retail groups) and their spatial distributions were analysed. In a next step, retailers' locations, relations between outlets and wholesalers, internal and external warehouses/distribution centres were investigated. For this purpose, locations of PoS and their related DC were geo-referenced and visualized by the means of ArcGIS. Subsequently, the impact of these structures on the related freight transportation structures were described for France and Germany separately, followed by a comparison of their characteristics. The TradeDimensions data analysis was complemented with empirical research in the form of interviews, which were conducted with food retailers in France and Germany. All major food retailers in both countries were requested for an interview. In total, 23 interviews were held, of which about 15 were conducted in France and eight in Germany. Most of the interviews, held in the period from January to April 2012, were conducted on the phone. Questionnaires for France and Germany were identical. The interviews covered the full range of food retail formats, i.e. hypermarkets, supermarkets, discounters and others. The following paper reflects this research work and compares the distribution systems in food retail in France and Germany. Differences of distribution structures and their impact on transport demand are discussed. The text closes with an analysis of the impact of such differences on the data sourcing for transport modelling and an outlook on what is needed in order to improve data sourcing for freight transport modelling.

A 3. The food retail systems in France and Germany

A 3.1 Characteristics of the food retail system in both countries

The increase in complexity of structures described in the introduction, combined with rising cost pressure and customer expectations in the food market, is a process that has been going on for a long time. The efforts to further improve distribution structures of food supply chains started about a hundred years ago: The first logistics initiatives took place early in the 1920s, when branch firms implemented a network of regional warehouses for the procurement of their stores. The first steps for creating these

networks were taken by major food retailers (Paché & Crespo de Carvalho 2002). With retailers usually being the last element prior to the end-consumer in an entire supply system, they are challenged with the need to align their logistics system to those of their suppliers and intermediaries in order to achieve efficient stock management and delivery systems. Consequently, big retailers began to build distribution centres where goods were bundled before their delivery to the points of sale and retailers' warehouses became the major node of the traffic and transport patterns. In the 1990s the organization of food distribution changed from mainly direct store deliveries to a just-in-time format (Ferne *et al.* 2000), enabled by the advancing developments and use of IT, forecasting and just-in-time deliveries. The downstream actors of the sector, retailers, progressively imposed the location, the volumes and the frequencies of the deliveries to rationalize and optimize the flows and to obtain a lasting competitive advantage (Blanquart *et al.* 2012). This centralization, combined with the outsourcing of services formerly provided inhouse contributed to the creation of a market for third party logistics providers (Ferne *et al.* 2000). The establishment of delivery structures through retailers' central and regional distribution centres seems complete nowadays. In theory, one would expect that food retail structures of France and Germany, two adjacent European countries, should be similar to each other. In reality though, several differences can be found instantly. When comparing their food retail market structures, differences can be noticed already in their framework and basic characteristics (Table 6).

Table 6: Food retail – framework data 2012

Country	Number of inhabitants in millions	Number of grocery shops/outlets	Number of employees in millions	Food turnover in billion €
France	65.43	31,970	0.5	183.7**
Germany	81.8	38,866*	1.2	161.7

* without drugstores and specified stores; **without specified stores like bakeries or butchers

Data source: EHI Retail Institute, Nielsen Company 2014, Eurostat 2013, INSEE 2012

There are 21% more grocery shops in Germany than in France. In line with this, the number of employees is higher in Germany. It is noticeable that, despite these values, turnover in food retail is much higher in France. Furthermore, there is a difference in the consumer habits between these two countries when it comes to the budget spent on food and non-alcoholic drinks: whereas German households spent around 11% of their total consumer spending on food and non-alcoholic drinks in 2010, French households spent around 13.5% (Bundesvereinigung der deutschen Ernährungsindustrie 2012). Also, selling concepts vary between both countries, both concerning the size of stores as well as the sales concepts (e.g. click-and-drive is a successful concept in France but not in Germany) and the assortment (e.g. frozen food stores, popular in France and scarce in Germany). The following definition will be applied for the various concepts and formats:

- Small supermarkets (< 400 m²)
- Supermarkets (400-1,499 m² Germany, 400-2,499 m² France)
- Consumer markets & Hypermarkets $\geq 1,500\text{m}^2$ Germany, $\geq 2,500\text{m}^2$ France)
- Discounters (low-price strategy; normally 300-900 m²)
- Others (click & drive, organic PoS, freeze stores etc.)

Whereas in Germany discounters dominate the market, in France supermarkets have the highest share in terms of number of outlets. On the other hand, the share of small-scale supermarkets is nearly the same for both countries, as is the share of hypermarkets, which seems to be approximately identical in Germany and France (Figure 11). But there is a noticeable difference when it comes to the size of these hypermarkets, though, with the French hypermarkets being considerably bigger with an average of 5416 m². The smaller sales areas in Germany and the high share of discounters can be explained to a large extent by regulations: in most urban areas, shops are limited to a maximum sales area of 800 m². All food retailers who strive for bigger sales areas have to prove that their shops will not have negative

effects on adjacent shops and central shopping areas. Discounters, whose sale areas normally fall below this, are favoured by this law (Blanquart et al., 2013). Looking at the turnover by type of format, a similar picture emerges for the spread of format shares: In Germany, with a total turnover of 62.1 billion euros, which represents 44% of the grocery market share, discounters have the highest turnover of all formats (USDA Foreign Agriculture Service, 2012). In contrast, discounters in France hold a market share of only around 10% (Bosshammer, 2011). There the highest share of food turnover is generated by the large-scale supermarkets (hypermarché). Comparing the percentage of sales per shop size in both countries, it becomes apparent that discounters with a sales area of 400-999 m² are well established and dominate the food retailing market in Germany. They account for 52% of all food sales. In contrast, the small-scale supermarkets and discounters in France cover only 20% of all food sales. A general trend in both countries is a decrease in numbers of food outlets in the last years, but an expansion in the total sales area, which is in line with the concentration also observed in other industries.

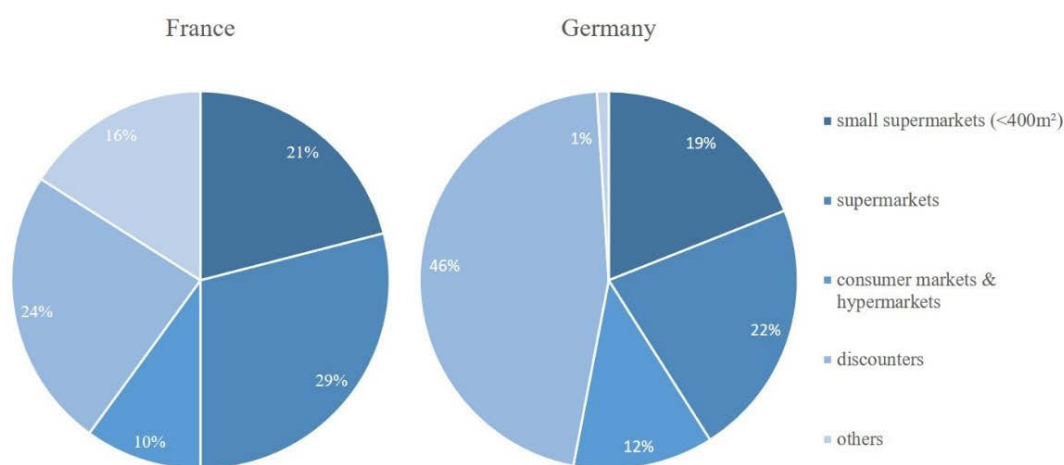


Figure 11: Share of total number of PoS by type of format in 2012 (specialist shops not included)
Data source: TradeDimensions 2012

Another interesting difference between both markets is related to the ownership of the retailers: the German market is characterized by independent small and medium-sized food retailers. Most of them are family owned and often they are organized in networks and cooperatives. On the French market, groups and corporate stores are dominant. Both countries have one thing in common: a small number of retail groups dominate the grocery market. In Germany the top five retail groups are responsible for three quarters of all food sales (TradeDimensions 2012). In France, the picture is similar: 77% of food sales are generated by the top seven food retailers. In both countries the leading retailers operate several differently branded chains with various types of retail formats, such as small neighbourhood stores, discounters, consumer markets or hypermarkets. Of particular interest is that, besides one Danish discounter we rarely find non-German supermarket chains on the German market, whereby German food retailers can be found in other European countries, e.g. in France. French retailers are present in most European countries but not in Germany. Summarizing, it is to be said that, despite their geographical vicinity and the fact that both countries are part of the EU and its legislation, remarkable differences can be found between the markets of food retail in Germany and France. These differences are the result of various factors: historic developments, local legislation differences, different regulations, geographical constraints, varying consumer behaviour and many more. The comparison reflects that, even for a small fragment of our overall economy – food retail – the market structures and sources of data available to describe these markets vary substantially. A comparison of the markets is

feasible, but achieving full transparency is not possible, as quality of data, coverage of markets, data access, clustering of data and data definitions vary. The following section analyses how far the differences in market structures impact the spatial patterns of the retail and, subsequently, its transport demand. Based on this understanding the requirements towards improvement of data sourcing for freight transport modelling will be derived.

A 3.2 Spatial patterns of the retail systems

There are different ways to illustrate the spatial distribution of PoS. One possibility is to map them out, (Figure 12), which instantly makes visible the higher number and concentration of PoS in Germany. As expected, most PoS and their highest density are to be found in urban areas. With more than 0.9 PoS per square kilometre, the highest food store density exists in these areas. Furthermore, more retailers can be found next to the sea and near the country border in France. In Germany, the highest density of PoS can be found in Berlin and the western part of the country. These regions also have a higher number in population and a higher purchasing power per capita. In general, the eastern part of Germany has fewer big cities and more rural areas than the western part.

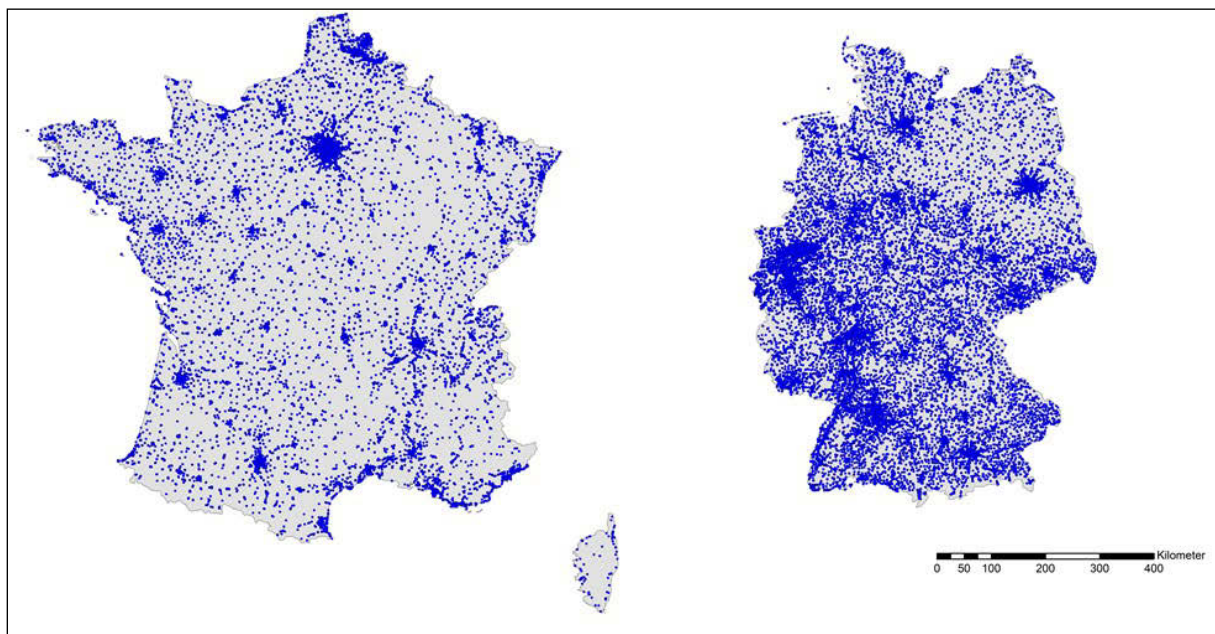


Figure 12: Distribution of PoS in France and Germany

Data source: TradeDimensions 2012

The high concentration of PoS in urban areas suggests that the number of outlets can be directly linked to the number of populations. The relationship between commercial activity and urban space has long been discussed in the field of urban geography. Most theoretical models assume that retail establishments follow movements of households, rather than households being attracted by existing retail structures that match their needs. It seems that there is a better coverage of PoS in southern Germany than in the north. This is true for the total number of PoS, but when the total number of PoS is linked to the number of inhabitants of an area, it becomes obvious, that in total there is a higher offering per capita in the north (Figure 13). In absolute numbers we find 2,194 inhabitants/PoS in the north and 2,289 inhabitants/ PoS in the south of Germany.

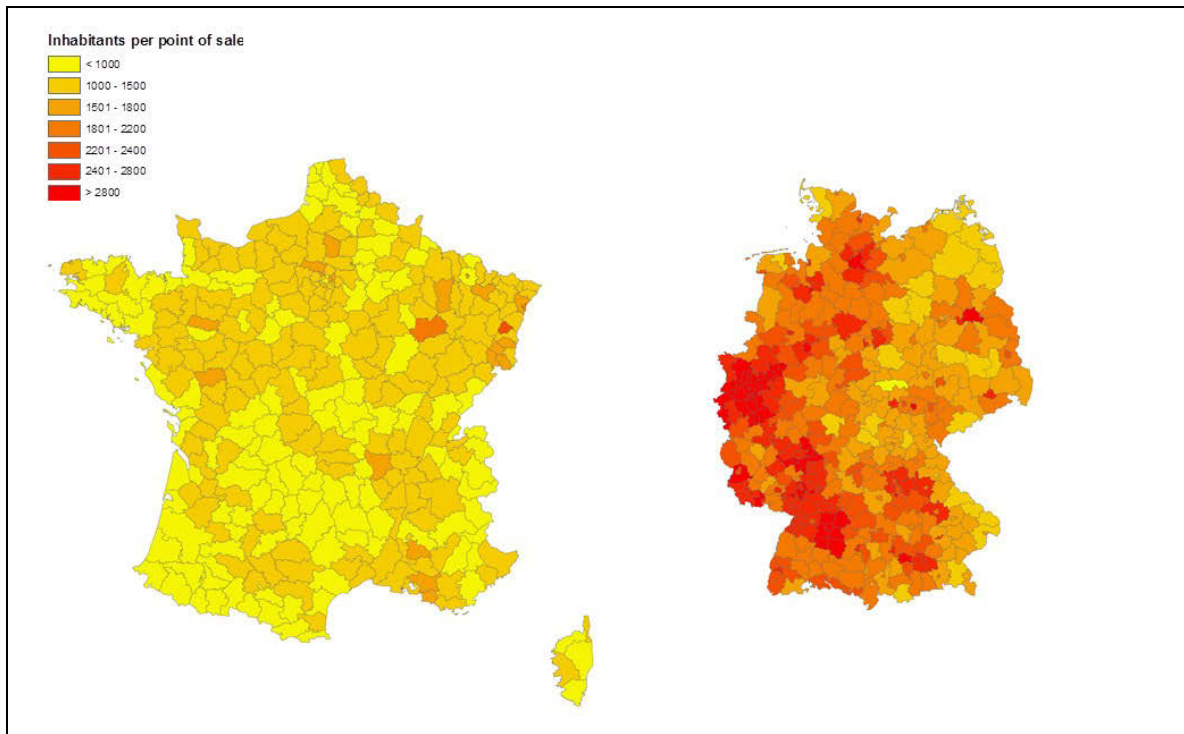


Figure 13: Inhabitants per point of sale in France and Germany

Source: TradeDimensions (2012), Statistisches Bundesamt, INSEE (2012)

Like in Germany, in the north of France more PoS per inhabitant can be found than in the south. This higher offering per capita is further emphasized by the sales area per inhabitant. In total, there is more sales area per inhabitant in the north than in the south of both countries. On a country level, though, the average sales area per inhabitant in France (300– 400 m² /1,000 inhabitant) is smaller than in Germany (400– 600 m² /1,000 inhabitant), even though the shop sizes are much bigger (Metro Group 2014). Comparing both countries, we find considerably more inhabitants per PoS in Germany than in France, as illustrated in Figure 13. This confirms the observation made earlier: PoS are smaller in Germany, often located in centres of towns.

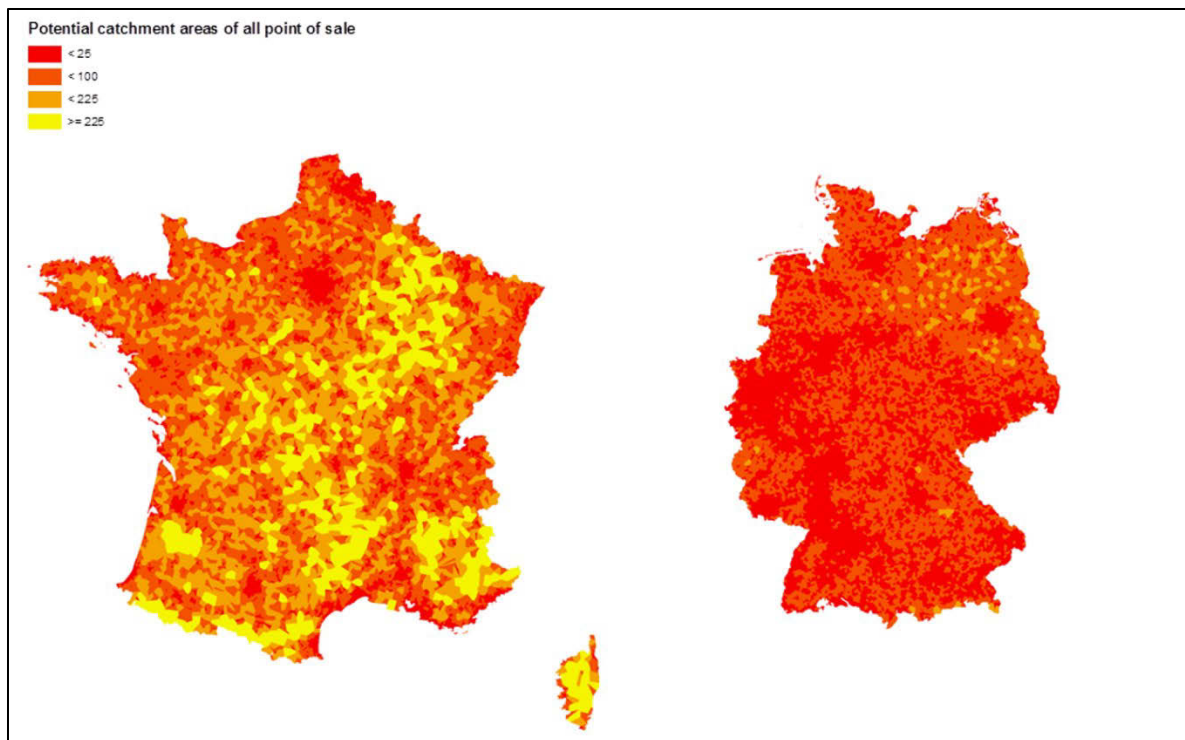


Figure 14: Potential catchment areas of all PoS in km²

Data source: TradeDimensions 2012

To further visualize the difference in spatial distribution of PoS in France and Germany, Thiessen-Polygons are used in the following. For the calculation of these polygons, perpendicular bisectors of the PoS are defined. The intersections of the lines form vertices which result in Thiessen-polygons. By this method the distance between all given POSs is considered, so that the potential catchment area can be illustrated. Figure 14 illustrates this Thiessen-polygon-Calculation for all PoS. As a result, the high network density of PoS in Germany becomes obvious (the darker the colour the denser is the network of PoS). There are only a few regions that have a catchment area bigger as 100km². The density of inhabitants per PoS, which is highest in urban areas, at the borders, and in coastal areas in France is in line with the above described absolute number of PoS. The overall network of PoS is not as dense as in Germany, which is not surprising as the population density is lower in France, too, so that such a dense network is not needed. After analysing the spatial distribution of PoS, the locations of the retailers' distribution centres will now be analysed. To have product-filled shelves and yet not to overstock, an efficient supply system is of utmost importance.

A 4. Consequences for the geography of retail warehousing and transport demand

A 4.1 Distribution structures in France and Germany

Retail companies continuously try to rationalize their distribution infrastructure and to make more efficient use of their resources. A core characteristic of the resulting logistics development in recent years is the continued tendency to centralized procurement by means of distribution centres. This leads to a reduction in the number and size of wholesalers' warehouses, and to the consolidation of stocks at a small number of very large regional distribution centres (RDC). Warehouses and distribution centres play an important role as their location can be crucial for an optimized delivery structure for a retailer's supply chain. Despite their relevance, not all DCs are owned by retailers, though. DC can be company internal, owned by the same owner as the PoS they supply to, or external, belonging to a third company, e.g. a wholesaler.

Due to the fact that no information is available on whether the management of external warehouses is outsourced or not, the following analysis focuses on internal warehouses, as these can be indicative of retailers' spatial strategies. Looking at the TradeDimensions (2012) data in more detail, an initial dissimilarity between France and Germany is notable straight away: there are more distribution centres and warehouses in Germany (over 530 sites) used for deliveries to PoS than in France (around 360 warehouses in total). Around half of the 530 sites in Germany are owned by retailers, others belong to service providers and wholesalers which deliver their goods directly to the PoS.

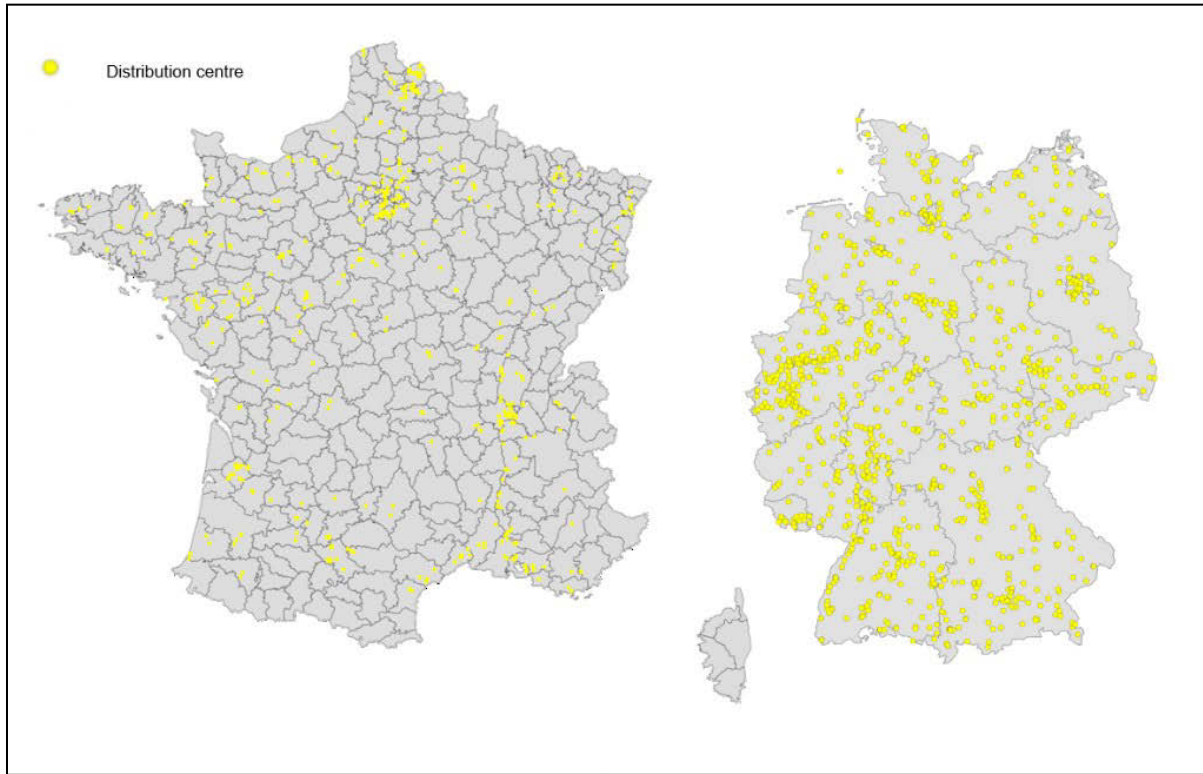


Figure 15: Distribution centres in France and Germany

Data source: TradeDimensions 2012

In spatial terms, German DCs are relatively evenly distributed throughout the country, while in France they are concentrated around Paris and partly around Lyon (Figure 15). Looking at transportation access, all German distribution centres have an average distance to motorways of two (up) to five kilometres. The only exception is a discounter that is solely represented in a small northern part of Germany. Also, in France, the sites of distribution centres are located near motorways. Furthermore, in both countries the distribution centres are located near to urban areas, close to the agglomerations of PoS. As the total number of DC on its own cannot explain differences in distribution structures, the differences between retail formats will be analysed hereafter in order to understand the extent to which the choice of a logistical organization is influenced by the location of a retail shop and the retail format.

A 4.2 Distribution centres by retail formats

As the empirical research in the form of interviews revealed, there is a general difference between the DC network of supermarkets and discounters in Germany. This is also confirming TradeDimensions (2012) data: supermarkets, consumer markets and department stores use a lot of third-party warehouses and distribution centres, whereas discount retailers use primarily their own (internal) distribution centres. Exceptions are warehouses for fruits and vegetables. These are usually run by wholesalers who directly distribute the goods from their site to the discounters' PoS. All in all, supermarkets have the

highest number of distribution centres, which can be related to their dense network all over Germany. Hypermarkets have only a few of their own warehouses and supplement their distribution network with several external warehouses. Furthermore, they use wholesalers' sites as distribution centres.

In Germany, discounters have the highest number of company-dedicated distribution centres, which can be explained by their big network structure of PoS and the fact that they do not use external warehouses. For comparing retailers' internal warehouse structures, all company-owned warehouses and their related PoS were visualized in maps on the basis of the TradeDimensions (2012) data. Through the visualization of the affiliation of PoS to DC, dissimilarities between different retail formats become apparent.

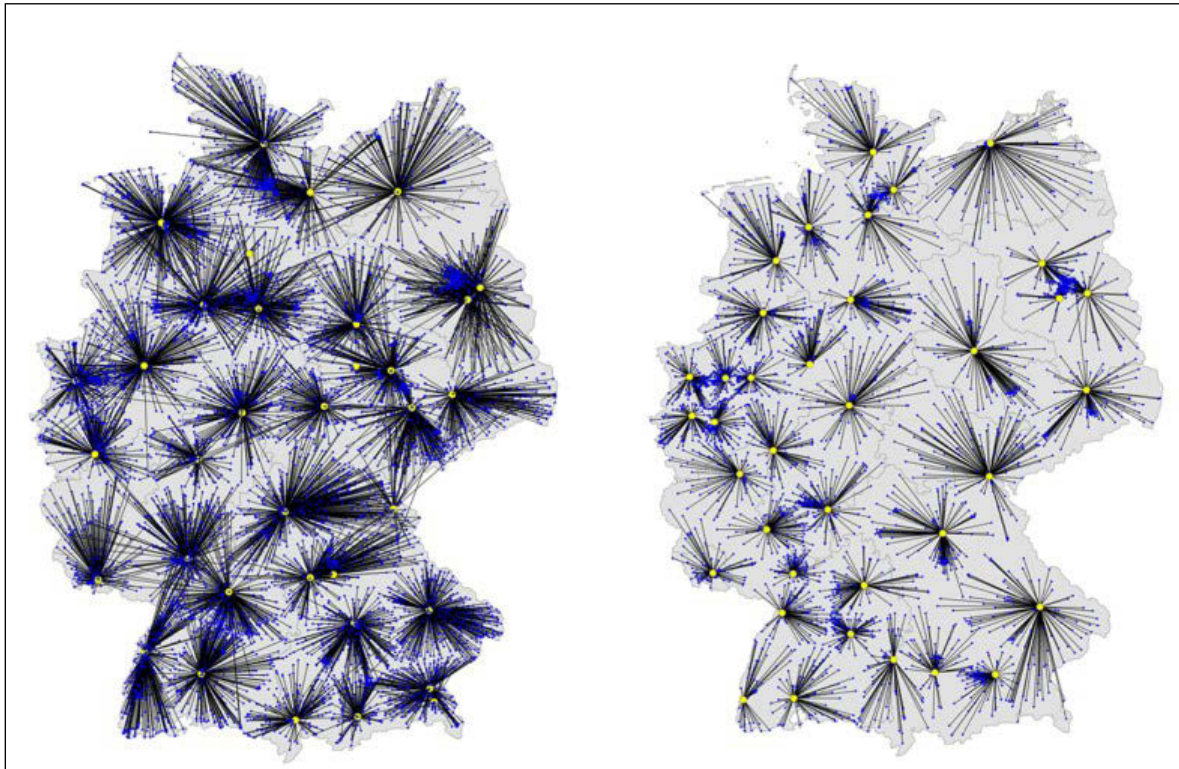


Figure 16: Spatial distribution of a supermarket (left) and a discounter with their related distribution centres (right); Data source: TradeDimensions 2012

Figure 16 compares exemplary spatial patterns of a supermarket chain's distribution centres with those of a discounter in Germany. The lines demonstrate the links between the distribution centres (indicated in yellow) and the PoS (indicated in blue). Firstly, a decentralized distribution structure for both types of format can be noticed. Secondly, it becomes apparent that the supermarket outlets are supplied by more than one distribution centre, whereas discounter outlets are only supplied by a single DC. The distribution centres are located outside the cities close to suburbs. Furthermore, a clear regional responsibility of all PoS is noticeable. The number of discounters' distribution centres is higher in rural areas. Due to the denser DC network, the distances between discounters' DC and PoS are the shortest. These findings can be considered as representative for all other German supermarket and discounter chains. As far as relations of locations are concerned, consumer markets and other large-scale food retailers show the longest distance between their warehouses and DC and their outlets. Moreover, there are several overlaps so that one outlet tends to have several supplying DC. DC tend to be located in the middle of the PoS they deliver to, whereas non-company owned, third-party owned warehouses complement the supply chain structure for supermarkets, hypermarkets and a few discounters. Furthermore, Figure 16 seems to indicate that discounter-distribution centres deliver to less PoS than a supermarket-distribution centre. Looking at all forms of discounters and supermarkets, though, this

conclusion has to be reneged. In this case, it is not sufficient to look at the number of outlets which are supplied on average by one DC only. It is important to take into consideration the numbers and ranges of assortment offered at a PoS, in addition to its spatial presence. Discounters with a small number of articles (800–1,000 articles) and hard discounters such as Aldi or Lidl, have the smallest territories per DC, with an average of 50–120 PoS per DC, whereas there is no difference between the service PoS per DC for discounters with a large assortment and supermarkets. Difference between the latter two categories can be related to the number of total stores and their regional presence, though. Furthermore, it can be noticed that the discounters with a bigger assortment belong to retail groups that operate several differently branded chains with various types of retail formats. Depending on the size of their outlet network, a DC serves up to 250 PoS. In terms of consumer markets and hypermarkets, the number of outlets that are served by a single internal distribution centre can range from 50 to 150, supplemented by several external DC. These usually supply goods such as beverages or pastry and bakery products. The comparison shows that, in general, differences in retail logistics are closely linked to the retail format as well as to the assortment breadth and depth. This is even applicable within retail holdings: retailers who own different retail formats operate different logistics strategies and also different logistics sites for each of their chains. Assessing the number of DC that serve one single grocery site, this number ranges from 1 to 5 DC. 96% of all discounters are served by such a dedicated DC, whereas the other formats are served on average by more than one. Smaller supermarkets are served by 1.4 distribution centres. For grocery stores with more than 400 m² the number of related DC rises to 1.6 DC per supermarket, whereas we have 1.9 DC per consumer market and 2.2 DC per department store. According to these numbers, it can be concluded that the number of DC and warehouses supplying an outlet rises with the size of the outlet's sales area. The average distances between PoS and the company's own DC range from 25 km to 125 km and is closely related to the density of the DCs in an area: the higher the density of the DC network, the smaller the distance between DC and PoS. To allow a comparison of similar retailers and their distribution structures, Figure 17 shows the spatial distribution of one French supermarket chain and one German discounter chain (same chain used as in Figure 16). The figure reflects the more centralized distribution structure in France compared to the structure in Germany. Against the background of the interviews and the data analysed, it seems that logistics developments follow two spatial patterns:

- Polarization: logistics facilities are increasingly concentrated in very large metropolitan areas at the (relative) expense of medium sized cities and rural areas.
- Logistics sprawl: warehouses are moved from core urban areas to suburban and exurban areas.

There are some further particularities of French food retailing which need to be pointed out: Even though retailers have regional DC in France, much of the distribution is made by at least one DC which is located near Paris so that in total each PoS – no matter if discounter, supermarket or hypermarket – has at least two supplying DC.

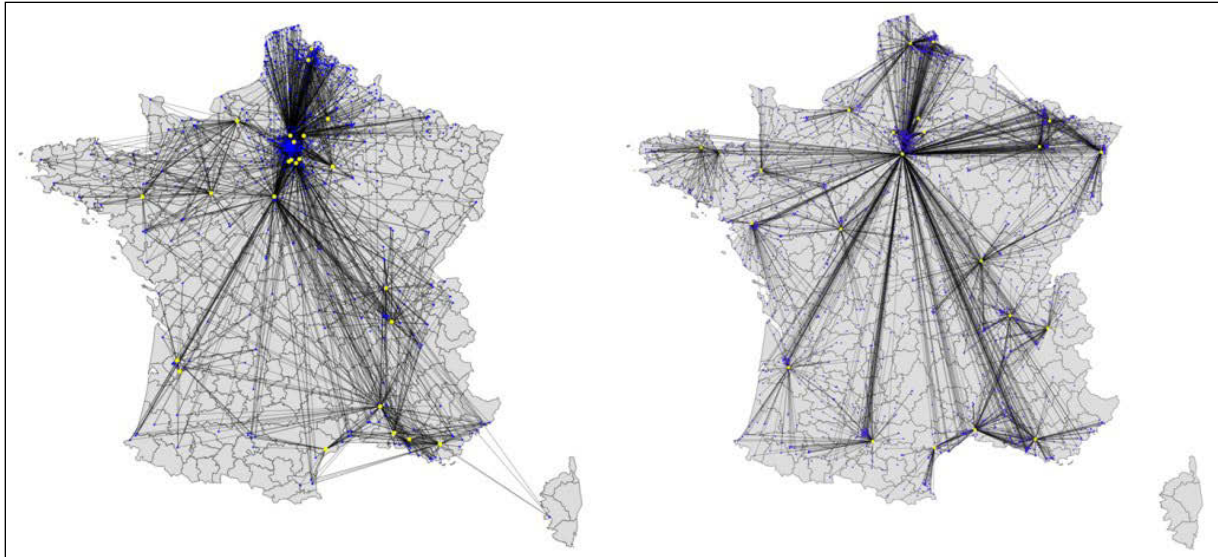


Figure 17: Spatial distribution of a French supermarket (left) and a discounter with their related distribution centres (right); Data source: TradeDimensions 2012

The logistics organization for large retailers is based on the geographical breakdown of the country in a few logistics regions (e.g., five for Auchan and nine for Intermarché). The number of logistics regions is the result of the arbitration between the transport costs and the costs of such logistics hubs. On average, DCs dedicated to food deliver to PoS within a range of 300 km. Regarding the TradeDimensions (2012) data for France, the median of the PoS numbers delivered by each DC is 79, the average is 143 (Bahoken *et al.* 2014). Further to the described concentration phenomenon for supermarkets, this is also applicable for discounters. Besides the central DC, Figure 17 demonstrates that, even though we find regional distribution centres in France, the DC structure of French supermarket-retailers is much more decentralized than that of German discounters.

A 5. Summary and impact of findings on freight modelling

The above analysis has revealed that for the same market in adjacent countries, in this case food retailing in France and Germany, differences as well as similarities can be found in distribution patterns and supply structures. In both markets a trend towards an expansion of the total sales area and an increase in the total of food stores can be observed. Also, both food markets are dominated by a small number of retail groups in the food sector which generate about three quarter of all food sales. There are some noticeable differences, though. The network of retail outlets is denser in Germany than in France, and the successful retail formats in each market are different, too: whereas in Germany discounters make the most turnover, in France the format of hypermarkets is more popular. By considering the features of the PoS together with the spatial patterns of their DC, the present analysis of distribution structures was deepened. The research investigated the link between the characteristics of food retail systems (formats, size of PoS) and the geography of their DC in France and Germany. The analysis of the distribution structures indicated that distribution centres are located nearby agglomerations of PoS in both markets. The detailed comparison of food retailers in Germany and France shows, however, that the spatial distribution of DC is not only related to the availability of resources (infrastructures etc.). The spatial pattern also depends on the specific retail system's characteristics. In fact, the geography of DC is strongly related to the format and to the size of stores. Nevertheless, a more regionally oriented catchment area of DC in Germany became evident during the analyses, which is reflected by a decentralized structure of DC. The analysed data and interviews for France and Germany also confirm the conclusions of Andreoli *et al.* (2010) that the recent trend in the geography of retailers' warehousing

has also been driven by industry consolidations and the microeconomics of big-box retailing, where advantage is gained from economies of scale in production, sourcing, and distribution (Bonacich & Wilson 2011). Furthermore, there are still national specificities behind the macro forces of globalization. In addition to these complex systems of country, location, format and size-specific differentiation, food-retailers develop specific logistics' organisations by type of product: grocery, household and personal care, beverages, perishables, frozen food or general goods.

What are the implications of these findings on transport modelling? The identified structural and spatial differences have an impact on freight transport with respect to (driven) distances but also in regards to characteristics of routes. As stated above, the reasons for such different spatial patterns are multiple and not always easy to assess: historical developments, influences of regulations by law, as well as geographical and demographical structures are some of them. It became clear that framework data such as turnover is not by itself sufficient information when it comes to modelling freight transport. Also, information about the number of outlets, types of retail format, assortment and sales area help to increase precision. In a comparison of freight transport structures, it can be noted that, despite their geographical and structural vicinity, even two adjacent countries such as France and Germany have very different spatial patterns for their food retail related distribution transport. As different national structures affect transport demand and transport flows, a future challenge will be to find a way how national differences, which effect transport demand, can be reflected in transport models. In this context another challenge for international transport modelling, which also impacted the research works for this paper, is the availability of data. The data available for different national markets varies significantly: definitions for classes of goods differ as do periods for which data is collected, for example. Even comparable data that one would assume easily accessible, such as turnover or number of outlets can be difficult to find due to differences in definitions. In the case of food retail, for example, this means that in terms of food turnover it is not always clear whether statistics include sales of specialized stores, drugstores or others. We experienced that even the figures for the total number of outlets for one country differ significantly from one source to another. As a consequence, direct comparisons of markets are difficult, and conclusions drawn for one market cannot necessarily be transferred to another market. Even data which seems to be similar at first sight is not automatically transferable. Only when it is established that markets contain comparable structures and are characterized by the same parameters are analogies feasible. Friedrich (2010) addresses another data restriction which occurs when it comes to data needs for freight transport modelling: statistics concentrate on traffic or number of vehicles but often lack in considering logistic systems. Therefore, as far as international freight transport modelling is concerned, the analyses of structures of one country do not necessarily allow the modelling of structures of another country. Data needs to be sourced, its compatibility needs to be ensured and structures have to be compared in detail for each country separately. Trans-border traffic analysis also needs thorough investigation in regards to the comparability of information available. This complexity is further enhanced by the fact that time periods of data collections by official statistics bodies often differ between countries as well as by the fact that classes of goods are not yet defined on an internationally applicable level. Standardization of data would therefore be one of the essential steps needed in order to facilitate successful international freight transport modelling. Such international data standards would allow for easier comparison of markets to analyse their structures and modelling of international freight transport interfaces. Such international data standards become even more important in the context of big data. If such standards are put in place, big data can contribute to building the basis of international freight transport models. This could enable the simulation of more efficient global transport chains, helping to find approaches for reducing supply chain emissions and ensuring that transport infrastructure can be used in an optimized way. If not, big data will remain an accumulation of numbers.

B. One goal, one approach? A comparative analysis of online grocery strategies in France and Germany

Saskia Seidel

Seidel, S (2021) One goal, one approach? A comparative analysis of online grocery strategies in France and Germany, *Case Studies on Transport Policy (in press)*, Elsevier.⁹ DOI: [10.1016/j.cstp.2021.10.013](https://doi.org/10.1016/j.cstp.2021.10.013)

B 1. Introduction

The supply of food is a basic need. In order to satisfy the diverse needs of consumers, food retailers offer a wide range of formats, from convenience stores where consumers can make everyday purchases, to hypermarkets or supermarkets that combine low prices with a wide variety of product choices and which focus more on weekly purchases. Multi-channel distribution is playing an increasingly important role in this context. For retailers, the satisfaction of the needs and requirements of customers are at the heart of their efforts. Today, most food is still sold via physical stores, which are often characterised as “bricks and mortar” stores. The range of products on offer and the size of the sales area are generally used to differentiate the various types of bricks-and-mortar store (Seidel et al. 2016a). Thus, different formats of store concepts and channels (namely, online marketplaces) have been set up and adapted to demand, especially from the local or surrounding clientele.

As well as within physical stores, which still represent by far the largest proportion of food retail, groceries are also offered online. E-commerce is already well established for most product groups but online groceries – especially fresh food – is still bottom of the league in terms of the total share of product groups sold online. Nonetheless, the online turnover of groceries is showing continuous growth and it is expected to comprise up to 2.5% of the European food market by 2023 (IGD 2019). Given the increasing sales during the Covid-19 pandemic where online grocery sales have nearly doubled, this growth could even be much higher.

Despite rising sales figures, the online division of bricks-and-mortar groceries is still mostly in deficit. Online distributors have developed different approaches and strategies that try to address this problem, with the aim of enabling profits in the sale of online grocery. It is noteworthy that these strategies vary between different countries and include all elements of the supply chain, including the type of online provision. A first obvious distinction is that of the transfer of online-ordered groceries. The delivery of online grocery sales can be carried out in different ways. We can distinguish delivery to the customers' home, to a pick-up point, or at an outlet of the grocery retailer.

In contrast to physical shopping, customers can make purchases regardless of their location during the ordering process and independently of shop opening times. E-commerce is therefore also defined as distance selling. According to Yrjölä et al. (2000), online shopping can be described as electronic order processing by households, combined with the ensured delivery of the packaged order. The type of order and whether it is submitted online, by telephone or in any other format, is not actually relevant, but rather how and where the goods are assembled and delivered to the customer. The key difference from physical shopping is that both the compilation and delivery of the finished shopping basket of e-grocery are the task and responsibility of the retailer, not the customer. For companies this is relevant as it has an impact on their total cost structure, logistical operations and staffing needs. Achieving a last-mile delivery becomes the key success factor for grocery sales once they enter the online market (Punakivi & Saranen 2001).

⁹ A revised version of the paper

The various aspects of online groceries have been analysed in great detail: for example, Gevaers *et al.* (2014) and Seidel *et al.* (2016b) have looked at innovations in last-mile logistics, Agatz *et al.* (2008) address logistical challenges of internet fulfilment in a multi-channel context, while Boyer *et al.* (2009) focus on challenges that occur at the last mile. Changes in supply chains are considered by Yriölä *et al.* (2000), Fernie & Sparks (2018), and Boyer & Hult (2005) among others, in whose work e-grocery provision is mostly viewed as an extension of the supply chain whereas the upstream supply chain is often left out. Wollenburg *et al.* (2018) conducted a comprehensive study on changes of supply chains for online grocery retail and gives first hints on structural differences between countries and companies. They could figure out three, considering the subgroups, six different concepts. 1) holding on original distribution structures 1.1) deliveries originate from stationary network (PoS) 1.2) Additional solo pick-up points are set up for online orders 2) Independent online DC that only focus on online orders DC 3) setting up channel-integrated DC. The authors see further research need in addressing differences of cost structures and the analysis of cost-benefits ratio. A first schematisation of distribution strategies with the result that operations planning can be structured according to fulfilment and delivery concepts depending on the development stage, market, growth and efficiency has been developed by Hübner *et al.* (2016b). The extent to which approaches differ between countries and whether they are linked to specific forms of supply is not considered. But the offers of online groceries may differ from country to country and also between neighbouring countries like Germany and France. The question arises as to the effects that differing forms of supply have on logistics and transport and whether a scheme can be drawn up that can be applied to different markets.

Building on previous research studies, this paper presents results from an empirical analysis of retailers offering online groceries. The focus is on the following questions: 1) What are the characteristics of the online grocery market? 2) Which challenges do retailers face in the online market? And what strategies, in particular which logistics and distribution strategies, do they use to meet these challenges and with what success? Against the background of the various offers of online food that exist, the question also arises: Are logistics solutions tied to specific types of e-grocery?

The following analysis will consider the neighbouring countries Germany and France. These are among the European nations with the highest turnover in food retailing. Both food markets are highly competitive, making entry into online business therefore difficult for many ‘bricks and mortar’ retailers. Whereas in Germany home delivery is the first choice for online groceries, the *drive through* (hereafter called *drive*) to pick up previously online ordered and prepared baskets of groceries is the dominant delivery format in France¹⁰. The results of these analyses will enable academics and practitioners to gain a better systematic understanding of online food practices.

The analysis focuses on e-grocery as retail food products and other household supplies. These can also be classified as fast-moving consumer goods (FMCG) as these kinds of consumer goods are usually purchased in short repurchase cycles as they are products of daily use. The paper is structured as follows: in section 2 the materials and methods are introduced. The research results are presented in section 3, and follow the subsequent logic: based on the results of the interviews and the literature analysis, first the characteristics are described, followed by a presentation and evaluation of the resulting challenges and strategies. The paper closes with a discussion and conclusion in section 4.

B 2. Material and methods

This paper aims to provide insight into the background to the introduction of online grocery and to understand what changes have taken place in retailers’ distribution and procurement of goods. Based on

¹⁰ According to Nielsen (2019) 81% of all food online sales was generated via *Drives*.

the assumption that this may differ between countries, the two chosen for the analysis are Germany and France, which despite their proximity appear to take varying approaches to implementation.

Building on an in-depth literature analysis, the core method applied in this study is extensive qualitative and empirical research in the form of expert interviews.

The author has monitored the grocery market and its developments since 2013, and the first short interviews for gathering insights into food retailers' online efforts were conducted in 2015. The main guided qualitative interviews were conducted from 2017 to early 2020 with a variety of experts from the field of online retail in France and Germany. The interviewees held different positions; among others, they were responsible specifically for organising online grocery transport and logistics, or they held positions as managers of location strategy, distribution organisation, of warehouses, or of e-commerce operations. Some interviews had to be conducted up to three times – to obtain specific 'strategic information' or to add company data to the questionnaire. A total of six interviews were held in Germany and France (three for each country) in 2017, 2019, and 2020.

The interviews were semi-structured and comprised the following parts: general characteristics of the e-distributor, the e-grocery business model, procurement and inbound logistics, logistics organisation, consumer/ordering behaviour, last-mile strategies and challenges from the retailers' perspective. The interviews were transcribed and the responses categorised by systematically summarising. Subgroups were also formed. This procedure enabled a better comparability between the interviews and a derivation of a typology of online logistics strategies and distribution organisations.

The results in section 3 are chiefly based on findings from the expert interviews carried out, and partly complemented with literature review. The results are presented in the following order:

- 1) Customers and products
- 2) Delivery formats
 - a. Drive through (hereafter called *drives*)
 - b. Home deliveries (HD)
- 3) Supply and transport chain organisation
- 4) Organisational structure.

The presentation of each aspect is followed by a derivation of the challenges and strategies to meet them. Results are then systematically summarised to form a typology of strategic organisations.

B 3. Results

B 3.1 Customers and types of product

Customers and their (shopping) needs are the focus of retailers' efforts. The following analyses therefore look first at the customer side of e-commerce.

Customers

According to Nielsen (2019a), 22.1% of French households now buy everyday products over the internet and have them delivered to their homes. The *drives* concept (see Section II, subsection B 3) has a customer base of about 26.7% of French households, but with a higher average shopping basket, at €68, than HD (home delivery) with €42 and a higher frequency of purchases (eleven versus five purchases per year).

The French interview partners gave an insight into their customers' profiles. In their experience, half of their customers visit the *drive* on their way home from work and around 50% of customers use the *drive* service once a week, often also for weekly shopping. The starting point for their pick-up drive are the workplace and the home in equal parts. Regarding the age of customers, around two-thirds are below 40 years old and slightly more women use the service, especially women with children living in the household. Looking at the job situation, one third are in leadership positions. The interviews confirm market observations. The *drive*'s customers remain more family-oriented and generate more purchases in comparison to home deliveries.

In the German interviews it was not possible to obtain profiles for the collecting customers, but this was possible for home delivery. The current target group for online sales can be summed up as families, dual-income households with no children, and working people with limited time for grocery shopping. Retirees and pensioners are a customer group that has a lot of potential, but is currently under-represented. Reasons for this can be attributed to the fact that only a small proportion shop regularly online¹¹.

Unlike in France, German customers see little added value in collecting goods. They prefer home delivery (Morganti *et al.* 2014). According to a study by McKinsey & Co., collecting goods only becomes attractive with a delivery fee of at least €3 (Joress *et al.* 2016). The retailers are aware of that fact and choose their offers accordingly.

Shopping basket

Customers often distinguish between products for which they want to make a choice on their own and products which are standardised and where the choice can be left to third parties (milk, butter, noodles, canned food, beverages, and hygiene articles, for example). This is reflected in the shopping baskets. Hygiene articles such as nappies or toothbrushes but also coffee are the bestsellers whereas frozen products are the least likely to be found in the *Drive* shopping cart. In recent years there has also been an increase in the number of bio-products. Also, home delivery shopping baskets contain only a few frozen articles. The bestsellers of the *drive* include fresh dairy products. The share of fresh food online is mostly below 10%, but with a higher proportion at *drive*. The German online shopping cart is similar, with frozen and fresh products making up less than 10% of the shopping cart.

Shopping basket sizes are often larger than in a retail store. Considering the country specificities, this is especially true for Germany. The average number of items purchased is up to 1.7 times higher than that

¹¹ Internet usage for reason of shopping decreases with increasing age. If 22.5% of all persons between 20 to 29 years order at least once a month online, only 3.1% of the people 70+ surveyed buy their goods online at least once a month. The shopping basket was not considered in the survey Poleshova (2020).

of customers who buy in a traditional hypermarket. This trend has also been noted by market experts in France (Dauvers 2020).

Challenges and Strategies

The dense and extensive store structure of German food retail outlets does not encourage customers to shop online. One big challenge is therefore to attract new customers. Customers' expectations are high and the willingness to change the procedure of the usual purchase of physical shopping is low. It is not only that the customer often finds it difficult to leave the choice of products, especially for fresh foodstuffs, to others, but they also want to see added value for changing their existing behaviour – if possible without surcharge. But it has turned out that willingness increases once an order has been placed and the customer has had a positive experience. If a positive experience occurs, the hurdle to ordering from other e-grocers is also lower. Encouraging customers to place their *first* order is therefore the real challenge. In order to simplify the ordering process, retailers make every effort to ensure the layouts of their websites are as clear as possible. The development of apps has also been considered by almost all providers, and IT plays a prominent role in this. Many providers take the recording of frequently ordered products into account and in some cases also enable the storage of standard shopping carts.

Compared to the non-food shopping basket, grocery shopping carts contain a large variety of products, but their value is much lower. Because of this, a large number of goods is needed to obtain the same value as non-food items (around 40-50 versus three non-food articles). Therefore, the composition and delivery of goods involve increased requirements, but the profit margin is lower. By setting a minimum order value, retailers are trying to increase profitability. The minimum order value has the side-effect of reducing ad hoc orders and increasing the tendency to order weekly purchases. These are not only more lucrative, but also easier for both retailers and customers to plan for the procurement of goods.

B 3.2 Delivery formats

Successful delivery to the customer is crucial for overall success (Morganti *et al.* 2014). 'Successful' here means, besides a punctual delivery, a handover of the products in good condition both at pick-up and via home delivery. In the following, the different forms of delivery are considered.

B 3.2.1 Drive

The interviews showed that the concept of the *drive* plays an important role in the development strategy of French supermarket chains and is often used to expand their catchment area. Companies see an opportunity to gain market share in areas where they have no business. Another advantage compared to HD is that customers themselves assume responsibility for the 'last mile'. Meanwhile *drives* are located in all departments of France and are represented in larger numbers than hypermarkets. The latter are mostly located near urban areas, and often near motorway junctions.

An interviewed site manager stated that the *drives* are also located in competitive areas. The legal requirements and costs of opening a new point of sale (PoS) are in the end higher than for establishing a location for a *drive*. The goal of the opening is thereby often the acquisition of new customers.

The product assortment, depending on what kind of *drive* is considered, range from about 1,400 (rarely) to more commonly huge assortments with up to 39,000 references. Through an extensive assortment, *drives* often provide a greater offer than supermarkets and hypermarkets. The size of *drives* covers 200 to 400m² and with adjoining storage area of 3,000 to 5,000m². In view of the large assortment, total number and nationwide distribution of *drives*, the *drive* can be said to have become a hypermarket of proximity in all areas – urban, suburban, peripheral and rural.

However, apart from the breadth of the product range, research has shown that different types of *drive* can be distinguished. *drives* are almost exclusively used by bricks-and-mortar retailers to transfer the online ordered groceries to the consumer. There are some ‘click and *drive*’ outlets where the customer parks his or her car on a platform and a grocery store employee places the goods in the customer car’s trunk, while others have vending machines or others – in fact the majority of *drives* – feature a reception area similar to that of a shop. These *drives* can be divided into solo and connected *drives*. Furthermore, based on the investigation in France, a distinction directly related to the storage of the goods and the transport chain is possible. The following classifications can be made.

Drive at Store

This kind of *drive* is placed right next to a point of sale (PoS), a demarcated area in the car park. The *Drive* staff members place orders directly in the trunk of the customer’s car. Ordered food is picked by employees of the attached food store. All goods offered in-store are also available at the *drive*.

The model ‘*drive* at store’ is often attached to large stores like hypermarkets so that pickers have to cover an area of up to 10,000m². The picking rate is about 60 articles per hour.

Coherent Drive or Drive accolé

Although this type of *drive* is connected to an existing hypermarket, it has its own warehouse on site. The warehouse is smaller than the PoS. The online ordered products originate solely from the warehouse. In addition, there are employees who work exclusively for the *drive*. The warehouse is optimised for picking so that the picking rate is up to 200 articles per hour. The disadvantage compared to the *Drive* ‘pick in store’ is a smaller product range.

Isolated Drive with attached dark store or Drive isolé

For the isolated *drive* a new location without a supermarket next door is opened. There is a dedicated warehouse on-site for the *drive*. This kind of *drive* is usually located in the catchment area of a competing supermarket, and is often located near motorway intersections. The dark store is sometimes partly automated to reduce the number of employees at the site. The *drives* analysed in interviews were supplied every two days. The stock of fruits and vegetables is very low so that sometimes a supply more frequent than every two days is needed.

Some of the *Isolated drives* also function as marketplaces. Products that are not in the inventory of the retailer are directly delivered to the *drive*’s site and handed to the customer.

Isolated Drive without dark store

Among the newer forms are *drives* without an attached warehouse, which open at new locations without being connected to a PoS or dark store. These *drives* can also look like collection stations with refrigerated compartments. The ‘isolated *drives* without dark store’ are delivered directly from the online warehouse. The completed and picked orders are distributed from the online warehouse to the different isolated *Drive* sites according to a ‘hub and spoke’ system.

Piéton

The pick-in concept of inner-city supermarkets is actually not a *drive* but a concept for pedestrians. In 2019 there were 76 Piétons in France, most of them in Paris. The pick-up by car is not possible due to limited (and sometimes non-existent) parking space. This model has a counter within the supermarket. The assortment is, with around 10,000 articles, much larger than in the usual local inner-city stores. Therefore, this concept is especially attractive for customers without a car that enables driving to a hypermarket on the outskirts. The online ordered groceries are delivered from a dedicated online

distribution centre. A delivery is available within 16 hours if required. There is often a minimum order value of €30.

Click and Collect/Collection Service/'Abholstation'

This is a concept for collection in the stores from lockers, at a special counter at the PoS itself or in an extra isolated area with separate entrance. The picking takes place in the store. Only in some cases are the ordered groceries also delivered separately from an online distribution centre (mostly in connection with lockers). The place of picking varies depending on the provider. These models have more than 20,000 references (even those with about 80,000, including non-food, have been found) in France, so that their assortment can be compared to the assortment of hypermarkets. In Germany, this model of collection service is currently the only offered type of *drive* service. Picking takes solely place at the PoS.

So, there are diverse ways to organise the storage and picking for getting orders ready for collection at the various types of *drive*. There are three different places of origin and storage of the online offered products: at the point of sale, in a local warehouse at the pick-up point (dark store) and in a distribution centre specialising in online orders. The latter can be regional or national.

In France, all three storage and picking concepts can be found, whereas in Germany, with its current focus mainly on home delivery, picking for *Collection Service* takes place exclusively in stores.

Challenges and Strategies

With the attached *drives*, the shop area corresponds to the warehouse. The warehousing and picking for the online ordered products take place in the attached PoS. The advantage of this kind of *drive* is that there is no need to develop a new area for the opening. It is often assumed that this model has the advantage that its organisation allows synergies and economies of scale – not least through standardised logistics organisation, joint stock management, and reduction of storage costs – but, as the interviews revealed, this is often a false assumption. The model seems inefficient; there are increased costs due to greater complexity. In many cases there are conflicts in the inventory as the inventory management system is reaching its limits. The shelves at the PoS serve as an online warehouse with the result that there is a risk of running out of stock, with consequences for shop costumers but also for online shoppers. The availability of the products can fluctuate – for instance, products may still be available at the time of ordering but no longer during the picking process, so that the replacement of goods or the need for smaller shopping baskets can be the result. If this occurs it may be necessary that higher levels of stock are needed at the PoS and, depending on the order volume, an adaption of the store infrastructure (arrangement of shelves, for example) may be required. Also, the picking costs are very high as the products are not arranged for efficient picking, but arranged to attract customers in-store.

From experience and in order to increase efficiency, some retailers have adapted the arrangement of their shop products to online environments. This can include establishing so-called buffer zones where specific products that are in high demand, or which may be very heavy or bulky, are placed. Others connect small warehouses, dark stores, to the *drives*. Mostly these places act self-sufficiently, but there are also locations where the picking at dark stores can take place in combination with point-of-sale picking. In this case, products that are ordered particularly often are stored at the dark store and are only accessible to pickers. Products that are not in frequent demand are added from the PoS. The local storage of groceries at the point of pick-up make a quick response possible (up to two hours' lead time for click and collect service).

In recent years, and against the background of the establishment of *drives* as an existing sales channel, the first steps have been taken towards the introduction of warehouses that are exclusively responsible

for online business. In this case the finished commissioned goods are brought to the pick-up point. The advantage is a more efficient and cost-effective picking, but the lead time for the order is higher so that the response to customer orders is less spontaneous. Also, the cost of opening such a warehouse is only worthwhile when companies offer online services on a larger scale.

Table 7 lays out the strengths and weaknesses of the various concepts.

Table 7: Strengths and weaknesses of different organisation of storage and picking for drive concepts from retailers' perspective (author's own elaboration)

	Online Distribution Centre (DC) for <i>Drive</i> or <i>Piéton</i>	Store picking	Dark store at <i>Drive</i> site
Strengths	<ul style="list-style-type: none"> • Inventory • High in labour efficiency • Two-stage order-picking possible • Semi or fully automated • Choice of location adapted/optimised to online grocery (catchment area) 	<ul style="list-style-type: none"> • Use of existing supply chains • Use of existing sites • Small initial investments • Use of a (wide) range of shops • No further land development necessary • No duplicate stock-keeping • Capital investment low • Expansion into 'new regions' is easier at first because there is no need to build an expensive warehouse beforehand 	<ul style="list-style-type: none"> • Arrangement of products enables fast picking • Requires only small areas in contrast to large online warehouses; can also be located in urban areas • Customer proximity
Weaknesses	<ul style="list-style-type: none"> • New development of areas/territorial coverage is necessary • High investment costs at the beginning 	<ul style="list-style-type: none"> • Assortment limited to PoS stock • Challenging data synchronisation • Assortment and stock levels vary from store to store • Low in labour efficiency • Single-step picking • Arrangement of products not ideal for fast picking • Low storage capacity • Faster out of stock/risk of stock-outs • Competitive to sales-in-store influences shopping experience for customers; orders ready for pick-up can block paths in the store • High incoming orders can lead to refilling during operation even at high frequency times 	<ul style="list-style-type: none"> • Smaller assortment than online DC or hypermarket • Small warehouse structure (hardly any economies of scale) • Higher initial investment compared to store picking • If connected to a PoS, it will require a sufficiently large area for implementation (usually only available at hypermarket locations)

B 3.2.2 Home delivery

Besides the *drives* there is also the possibility of having the picked groceries delivered to customers' homes. This method of delivery is the most widespread across the world. In France, home delivery for groceries is most common for urban areas where Paris is the biggest region. Preparations are currently underway to extend the offer to cities with over 10,000 inhabitants throughout France. This development has been accelerated by the Covid-19 pandemic.

Also, in Germany, home delivery is especially offered in cities. Often the whole assortment is offered by the retailer and can be ordered, whereas hardly any offers exist for rural areas. The offers in rural areas are often limited to durable foodstuffs. The interviewees stated that an expansion of the service for rural areas would be possible and there are considerations regarding how this could also be implemented. The main obstacle is high logistics costs, not least due to the wide distribution of customers. The legitimate question arises as to what surcharge the customer is, or would be, willing to pay. Since the willingness of customers to pay is low, there have been no attempts to extend this service to all types of food. According to the interviewees there is consequently a limitation to non-fresh products. The range of non-perishable products is sometimes larger than in local shops. In some cases, the range is also being

expanded – for example, test products (with a possible takeover later in the shop), special offers or pet food.

In rural areas and smaller towns, where a comprehensive range of products is not yet being offered online (mainly no provision of fresh groceries), food is delivered by a conventional transport service provider. On the other hand, the areas already developed for the online offer of the entire range of food products are covered with the companies' own logistics operations.

According to the offered assortment, in cities home deliveries are offered for the whole assortment which is also available in store. Sometimes, depending on the trader, additional products are also offered. These additional product offers rarely feature fresh food but rather non- and near-food articles as well as promotional products.

While the volume of orders is highest at the weekend, deliveries take place between 6 a.m. and 10 p.m. from Monday to Saturday, depending on the supplier. Agreeing to the interviewees, early morning times and slots after 6 p.m. see the greatest demand. To complete the ordering process, customers usually have to reach a minimum amount of the shopping cart value. Delivery in Germany is seldom free of charge. The amount of the surcharge depends on various factors: shopping cart value, time of day and size of the time window, delivery area, number of customers ordering nearby and other factors.

In Germany, delivery is carried out by the retailer itself, whereas in France the interviews revealed that for delivery some retailers have partnerships with companies that have a lot of experience in delivery, like Ocado or Amazon. In France, home deliveries are made almost exclusively with a service provider, although one specialising in food and fresh products. During the pandemic, where many people have been unable to go out shopping, some retailers have also started co-operation with logistics companies like Uber Eats or Deliveroo to offer (extended) HD services. These services are mostly limited to smaller orders as many deliveries are made by bicycle. This offer is mainly limited to the Paris region, however.

As with the *drives*, the origin and storage of products for online dispatch and the starting points of delivery differ. The delivered groceries can originate from a PoS or from a warehouse or distribution centre. The latter can be distinguished between original warehouse location/distribution centres (already used for delivery from PoS), with a separate area for goods intended solely for online orders, and a new location for exclusive storage and order picking for online food. Home delivery is mainly offered in cities. Here the model of in-store picking often remains in place, above all in thinly populated areas. In big cities like Paris (where most retailers have their main focus) or conurbations like Lyon or Marseille, some retailers have set up new warehouses specifically for online groceries. Nevertheless, the French online department stores still have their focus on the *drives*. In France, picking in the stores is often handled by service providers. In Germany, on the other hand, the picking is done by retailers' own staff at the PoS as well as at the warehouse.

In contrast to the supply undertaken by conventional supermarkets, home delivery is primarily carried out with sprinters. Since the onset of Covid-19, smaller orders are also possible, and these are delivered by bicycle or cargo bikes. In the overall picture, though, this is a relative exception.

Challenges and Strategies

The main challenges reported by interviewees are the place of storage, picking costs and last mile.

Once the decision has been made to offer goods online, test markets are first established. In these test markets, customers are supplied from a supermarket. The disadvantage is that the area of stores is limited so that in areas with a high order volume, pickers and customers compete with each other. Furthermore, interviewees stated that a store-based pick up often leads to problems in merchandise management so that as soon as the online offer moves beyond its test phase and the online customer base expands,

deliveries are only made from purely online warehouses in Germany. In France, fewer retailers use dedicated online warehouses as the starting point for their deliveries. The problems with home delivery, especially during its introduction, are often a lack of logistical know-how, coupled with long preparation/commissioning times, low productivity, and high logistics costs. This is then reflected in higher product prices and up to two days' lead time for deliveries. Both these factors make it unattractive for customers. To counteract this, many retailers have entered into co-operation with logistics service providers, both for warehousing and the last mile, and have started to establish new locations for exclusive online distribution.

The interviews revealed that different types of warehouse are used for online groceries. Some retailers dedicate a specific area for online orders in existing warehouses, others are establishing new locations. These new sites are usually strategically chosen to ensure optimal supply to the entire area. They are therefore often located on the outskirts of cities, sometimes even within the urban area. The new warehouse locations are partially or fully automated to speed up the picking process. The design is strongly related to the budget that is planned and made available for the online business.

The interviews confirmed that intralogistics is often decisive in order to be able to act in a cost-neutral way. The highest possible efficiency is necessary in order to be in the black. Picking constitutes a large proportion of costs; in consequence, the costs per order should be kept as low as possible. According to the interviewees, the costs per order are between 60 and 75 cents. The aim is to reduce the total time spent on ordering by (partially) automating the process. In fully automated warehouses the minutes per order can be limited at up to five minutes. The downside of this model is the high initial investment costs. Furthermore, this model is only profitable if a certain order size is reached. The interviews confirmed that it takes a certain time to reach full capacity. The initial investments can only be generated through profits from bricks-and-mortar stores. Through automation, saving of staff costs can be made as only about 60% of the employees are still needed. In non-automated warehouses the pickers walk up to 15 km per day. These 'footpaths' are completely eliminated in fully automated warehouses, as the goods arrive fully automated at the picker.

The biggest challenge is the last mile, regarding a successful delivery and optimisation of routes. For an optimisation of routes some interviewed retailers started to establish and use micro hubs between their online warehouses and their customers. These micro hubs can be of various types, and in mobile or fixed locations. Rare but in use are larger transport vehicles which can be used as mobile hubs, while other retailers use containers. The local hubs can be differentiated between newly developed small sites or micro fulfilment centres with a similar surface area compared to smaller shops. Existing shops are also sometimes used as hubs. The micro hub model is often chosen when an online warehouse is responsible for a large catchment area.

The efficiency of a tour is strongly dependent on the length of the tour and the number of customers. The latter is not only dependent on the volume of orders and the number of available vehicles. As a rule, up to 25 orders would fit into one delivery vehicle, but the length of the stops rarely allows more than 10 to 15 customers per tour. The stop length depends heavily on the order quantity (weight and volume), and accessibility of the building and parking situation (flat, floor, house, with/without lift). Besides parking, traffic jams and entering the delivery address are factors that cost valuable time. The traffic flow cannot be influenced, but attempts are being made to shift delivery windows to less busy hours. To reduce the time for entering customer addresses, one of the interviewed retailers has implemented an IT system where the various processes of ordering, customer address and routing do not have to be keyed in multiple times. This system integrates all delivery information in a single application. Therefore, time savings during the tour can also be gained through smart IT.

Home delivery usually requires the presence of one person from the household at home. To avoid missed deliveries and to guarantee the presence of the customer, a time window for delivery is agreed in advance. This is done either by the customer actively booking time slots during the ordering process itself or by offering fixed time slots for delivery in certain (postal code) regions. For a successful delivery, IT extends to communication with the end customer. Customers receive a notification as soon as the goods are in delivery. Some providers inform customers that the goods will arrive in 30 minutes, others offer live tracking or a notification regarding the distance of the deliverer to the place of delivery, for instance the number of stops remaining. Due to the perishability of some products, among other factors, usually only one delivery attempt is made.

The fact that relatively few customers are willing to pay for convenience of delivery, and who find it easy to receive their purchases in an allocated time window, brings further complexity into the economic model of online grocery service. Agreeing a time window for delivery increases the first-time hit rate, but adds complexity to route planning (which is a challenge in itself). With conventional deliveries to PoS, not only are the delivery points well known, but also the delivery frequency and quantities are already highly optimised. Unlike the shop network, the points of contact change daily due to customers' irregular ordering behaviour (Figure 18). There are no fixed contact points, so present routes cannot be firmly established.

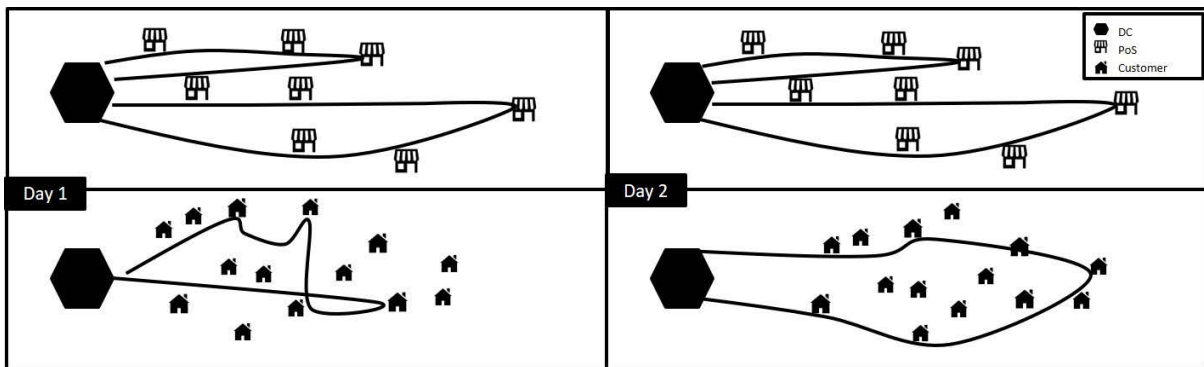


Figure 18: Simplified display of tours for the delivery from PoS (above) and home delivery (below)

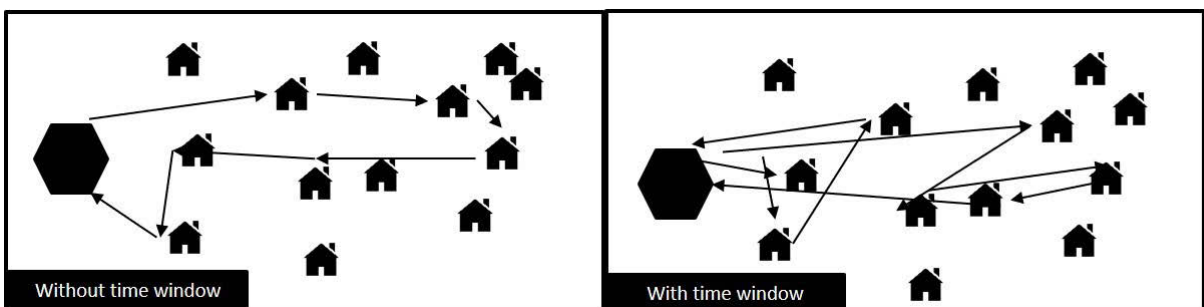


Figure 19: Delivery without and with time window (author's own graphic based on interviews and on the results of Boyer & Hult 2005)

To generate better predictability, retailers try to encourage regular orders from customers. This can be done in different ways, and incentive systems such as discounts are usually chosen. By marking time windows in which deliveries within a radius have already been agreed upon, customers are encouraged to choose their delivery windows in a similar time window. If this is successful, orders can be better bundled in one area and tours can be optimised. Nevertheless, the offer of time windows often implies that the shortest routes are not taken, which therefore leads to a significant rise in kilometres driven and

in costs (Figure 19). Gevaers *et al.* (2011) calls this the ping-pong effect. The offer of defined time windows for the handover to the customer makes real-time planning necessary.

Furthermore, consumer density is mostly not high enough to operate at a tolerable level of costs. Same-day delivery presents a major logistical challenge in terms of costs and planning complexity. With more lead time, routes can be better optimised. Therefore, delivery offers are rarely for the same day but normally have a lead time of between 24 and 72 hours.

Most retailers' concepts are based on the hub and spoke system, but it should be considered whether in many cases a point-to-point delivery would not be more appropriate. Another approach is that of the 'milkman' principle. The aim is to use fixed routes to reduce drop costs and achieve better capacity utilisation per tour. However, this has an effect on the supply offer, as no individual delivery times can be selected by the customer. This model has not so far been used by the interviewed retailers.

The main differences in the offered delivery service is that France relies mostly on *drives* where the last mile is left to consumers. With regard to home delivery, most French retailers rely on transport service providers, specialising in food, for delivery to customers whereas German bricks-and-mortar stores make deliveries to their customers themselves.

From the results, the existing forms of offer can be represented as follows (Table 8):

Table 8: Existing types of e-grocery design, on a modular principle (author's own elaboration)

	Design forms					
Assortment	Full assortment	Partial assortment including fresh food up to full assortment 1,400 – 39,000 references			Full assortment	
		Dry food + non-food				
Type of offer	Drive & HD	Drive	Drive & HD	HD	Drive & HD	
Storage & picking	At PoS	At dark-store	At local distribution centre/Separated area at existing warehouse/DC	At central distribution centre/Separated area at existing warehouse/DC	Specialised distribution centre only for e-commerce	
Degree of automation	Manual		Partly automated		Partly automated	Fully automated
Last Mile HD						
Delivery area	Delivery within the city limits		Delivery within a certain region		Nationwide	International
Lead time	2 hours	12 hours	24 hours	48 hours	72 hours	2 weeks
Delivery time window	Within 1, 2, or 4 hours		2 hours	2 hours	no	no
Delivery	Own service (G)	Service provider (F)	Own service (G) Service provider (F)		Service provider (G, F)	
Price model	Minimum order value and service fee	Minimum order value and service fee	Minimum order value without service fee	Only service fee	Service charge	
Payment methods	Cash on delivery	Credit card	PayPal	Invoice	Instant bank transfer/ direct debit	Prepayment
Type of collection point						
Goods transfer	Click and collect at counter in store	Click and collect at parcel locker in store	Click and collect at parcel locker	Drive	Piéton	
Opening	Monday – Saturday		Monday – Saturday (rarely Sunday)			Monday – Saturday
			7 days a week			

B 3.2.3 Supply and transport chain organisation

We can distinguish supply chains according to how they appear in different standard transport chains. Distribution structures can be classified according to various parameters. The classic approach distinguishes three distribution structures: decentralised, centralised, and direct. Another approach is that of Gudehus (2010), who argues that the tiered nature of a supply chain arises from the number of intermediate stations through which goods pass from point of delivery to point of receipt. Gudehus (2010) distinguishes five steps from direct running up to four levels of supply chain. Taking both approaches into account, we can see that the food sector in France is characterised by centralised and in Germany by decentralised distribution structures (Seidel *et al.* 2016a). These structures go along with three to four steps from supplier to points of sale (see figure 3). However, in both countries there are rather decentralised structures in the online grocery retail landscape. By applying the approach governing numbers of intermediates, the following picture emerges:

At first, with the introduction of online commerce, the upstream supply chain as such is not changed (Figure 20 (1)). Mainly changes in the front-end logistics occur, at least with regard to home delivery. When the first *drives* were opened and connected to existing shops, the supply chain did not initially change. The number of intermediates remained the same. But the picture is different when considering the establishment of a stand-alone ‘*Drive* with dark store’. Even though dark stores are often delivered from distribution centres like points of sale, this means an extension of the supply chain as it entails a new delivery location. With the establishment of online-dedicated warehouses, an extension by means of a further intermediate level of the supply chain has occurred (Figure 20).

As long as the goods for home delivery have been assembled at the PoS, the upstream supply chain also remains the same. In the latter case, however, the supply chain has been extended, as the retailer is responsible for delivery to customers’ homes. With the expansion of the online offer and the development of new locations for dedicated online warehousing and also with the use of micro hubs, the original supply chain has changed. This modification can take the form of an additional trans-shipment location or a change in the destination location (Figure 20).

The various types of online offer as well as the different storage and picking locations were examined in the previous section (B3.2.2).

Challenges and Strategies

The already existing optimised supply structures and supply chains of retailers represent both an advantage and a disadvantage. Bricks-and-mortar retailers have the edge over start-ups, for example, as they already enjoy an established supply chain. Their distribution structure is already optimised for the cost-efficient distribution to points of sale. However, the distribution of online food presents different challenges than the previous structures can meet. The quantities to be picked at the warehouse are much smaller than those for stores. Customer proximity is also very important for quickly meeting demand and providing good product quality. Central distribution structures are therefore not particularly suitable.

Depending on the company, logistics costs account for 15-20% of sales prices. A modification is therefore equivalent to savings potential. As a consequence of the duration of, and retailers’ varying levels of experience in, the online business, most providers have adapted their supply chains. In order to be able to better guarantee the response time to orders, proximity to the customer is a great advantage. The author’s analyses revealed that e-commerce alters the original chain, not only on the last mile, but also in the preceding stages (see Figure 20 and section B6.4.3). New locations close to the customer are developed. Depending on the size of the catchment area and customer density, several small online warehouses or a large one are set up, which are then supplemented by small (micro and mobile) hubs. These hubs are delivered like PoS from online warehouses. Smaller vans then take over for last-mile

delivery to customers' homes. There are also approaches for using the existing shop network as a distribution centre, both for collection and as a hub, which therefore represents a starting point for home delivery (section B4.3.2).

All new (micro-)fulfilment locations, which are more scattered than the original warehouses for the delivery to PoS, are as close to the customer as possible, and are optimised for efficient picking for smaller quantities than those DC for the PoS. These micro-fulfilment locations can take on different forms, with some connected to existing points of sale while others are opened in the outskirts of cities or in the surrounding area with a good connection to the catchment areas. There are also hybrid models, where already existing warehouses are extended by means of an area reserved exclusively for online business.

When picking in the store takes place (store-based picking system), the process chain of stationary retail is only extended by the process elements of delivery logistics. This is the case in France and in some testing areas in Germany. Few companies retain this model later in an advanced stage as the picking costs are too high. In addition, store picking can lead to competition between picker and customer but, more often reported and far more relevant, to problems with store inventory management (see Section B 3.2).

In the case of advanced companies, the upstream transport chain is also evolving (Figure 20). When *drives* function as marketplaces, this opens an additional supply chain from the supplier directly to the *drive*. Figure 20 illustrates the different transport chains and highlights the changes that take place when online grocery is additionally offered by retailers.

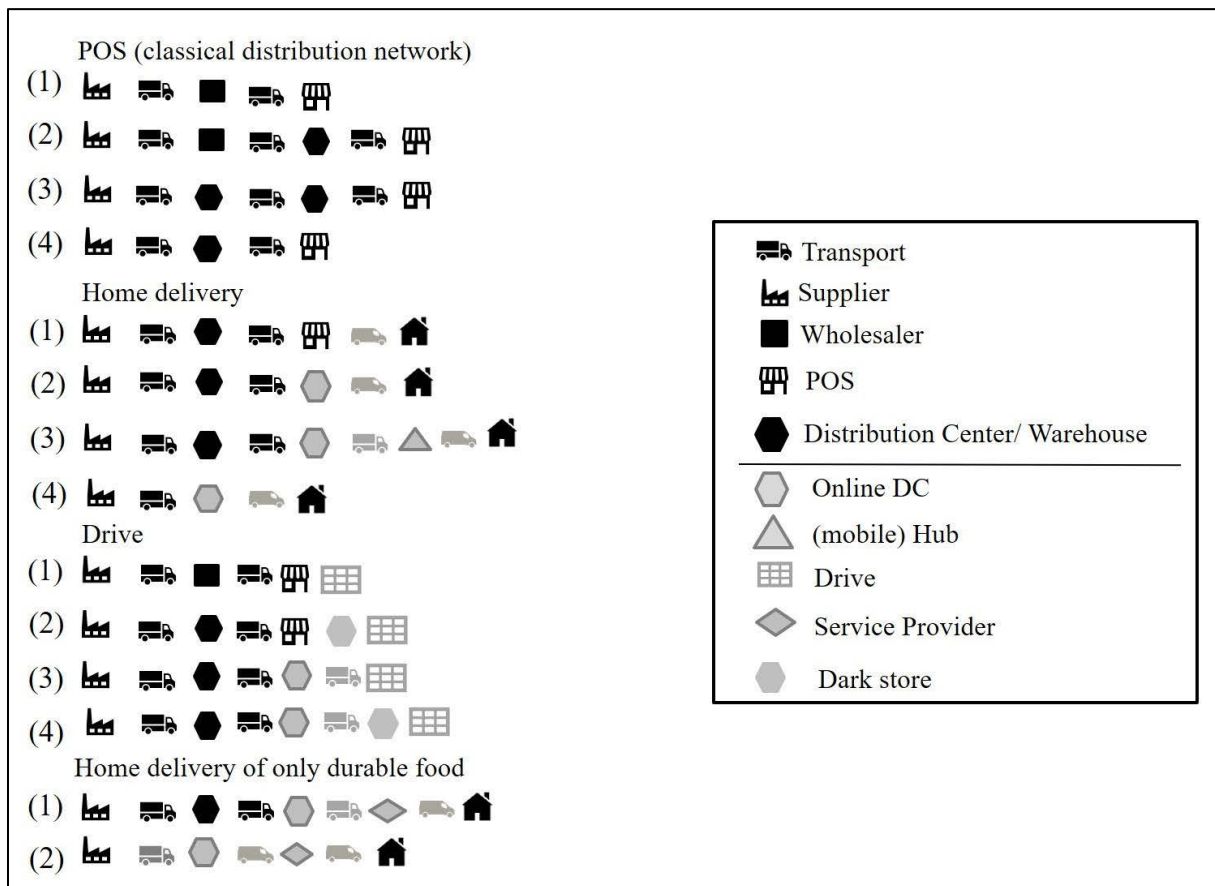


Figure 20: Transport chains in online grocery: existing bricks-and-mortar structures coloured in black, changing and new structures coloured in grey (author's own elaboration)

New places of origin of goods – that is, new suppliers – appear in connection with online food, when a new assortment is established. This is the case when, for example, shipment regions act as test markets for new products, the online shop also functions as a marketplace (for the sale of products not yet listed in the range) or if products are offered which can only be purchased online (not listed in the range).

The main differences between France and Germany are, on the one hand, the online offer and, on the other, the fact that French retailers use specialised transport services for delivery. In Germany, transport services are only used by retailers for the delivery of durable food. In addition to the development of new areas for the storage, handling and picking of goods, new areas are being developed in France for the collection of goods, the *drives*. In Germany, instead, the new site development focuses on the distribution centres.

B 4. Organisational structure

Before introducing e-commerce, it is first considered which model is suitable, where it is often not clear whether the chosen model can be applied in inner city, urban and rural areas. Since online business is loss-making, especially in the beginning, and the number of customers is a major factor, most retailers focus on large urban areas first.

The interviews revealed insights into the different steps taken when bricks-and-mortar retailers decide to offer a new distribution channel. Highly simplified, three main steps have an effect on the shape of the online grocery model. The analyses have enabled an identification of factors that are decisive for the various forms of online food supply and logistics. These are summarised in Table 9:

Table 9: Decisions to be taken by retailers (author's own elaboration based on interviews)

Steps	Relevant Factors	Examples	Necessity
1. Decision for new distribution channel	Product-related factors	Storage and transportability of the products Range of products	Adaption and expansion of information technology (IT)
	Company-related factors	Existing network of points of sale experience	
	Customer-related factors	Open-mindedness towards new offers Purchasing habits of the target group	
	Competitive factors	Number of competitors Market position of competitors Competitors' offers	
	Legal factors	Regulations governing the handling of foodstuffs Guidelines and regulations for the opening of sites	
2. Decision from where to start delivery	Customer & area offer	Density of customers	
	Existing network (PoS + DC)	Already established network	
	Available budget for expansion and redesign	Turnover and market power of the company	
	Infrastructure	Own assets Road network	
	Law/legal factors	Guidelines and regulations for the registration obligation for opening sites, food hygiene requirements, etc.	
3. Design of the last mile	Assortment	Dry food – service provider can be used (Germany) Whole assortment → delivery by the retailer on its own (Germany), service provider (France)	
	Type/offer profile	Drive or HD	
	Customer (as new participant in the distribution system)	Location Expectation	
	Legal requirements	Food hygiene and transport requirements	
	Network of the retailer	(Online) warehouses, PoS and hubs	

To increase customer loyalty to the retailer, a name similar to the stationary banner is often chosen for online sales.

Challenges and Strategies

For many retailers, the introduction of online sales first represents new territory. In order to gain initial experience, many bricks-and-mortar outlets start by offering easily transportable products such as dry goods and non-food. Until sufficient experience has been gained, some retailers also enter into co-operation with experienced partners. This has happened in the field of storage and distribution as well as in the realm of delivery.

For retailers, cost optimisation and the satisfaction of customer needs have always been the focus of retailers. Now with online commerce, the customer is at the centre of all efforts to first of all satisfy the customer and to achieve a certain market penetration. Cost optimisation is of secondary importance, even if it is essential for survival in the long term. Nonetheless, the challenge is to optimise costs in order to achieve purchasing profits. The customer represents a planning uncertainty due to his or her irregular purchasing behaviour. Due to the mostly irregular receipt of orders, it is difficult to plan routes

in advance and these are usually only planned on a daily basis. Customer locations change compared to store locations, which remain the same. Retailers therefore provide incentives for customers to order regularly (see Section B 3.2).

Besides logistical challenges, discussed in detail in Sections B 3.2 and B 3.3, the challenges also include technical ones. IT plays a major role, not only the part that is visible to the customer such as the structure of web pages and how simple the websites are to navigate, but especially the adaptation of internal processes. With the offer of online shopping, retailers need to shift their category management processes away from a product-centric approach and more towards a consumer-centric one, in order to align themselves with shoppers' preferences and preferred paths to purchase. Retailers use machine learning to enable demand-driven inventory placement. The goal is to have a product database of good data quality across all channels, regardless of whether they are operated separately (multi-channel) or as part of a network (omni-channel). If systems succeed in being intelligently networked so that procedures do not have to be keyed in multiple times, large processes can be optimised and high costs saved. This also applies to logistics.

B 5. Discussion and Conclusion

This paper has looked at restructuring in the field of logistics in stationary food retailing by offering food products online. On the basis of expert interviews with online food retailers, combined with in-depth desk research the paper compared the strengths and weaknesses of different patterns of storage and picking, and the various forms of offers were assigned to a modular scheme. The analysis has also shown that different offering models require the implementation of varying storage and picking processes, resulting in different challenges to the supply chain organisation. The implementation is primarily linked to the strategy of the retailers. Nevertheless, the steps and their main influencing factors could be systematised. Overall, it could be determined that the supply chain is influenced by the design and type of service offer as well as by the selection of the type of storage location at the storage site. Customers act as new participants in the distribution system and IT plays a paramount role in taking this into account as efficiently as possible.

Looking at the grocery markets in France and Germany, there are diverse solutions in different markets. In France, online groceries are mainly processed via the *Drive*, whereas in Germany home delivery is preferred. The approach and concepts in both countries are very different, but have the same goal: to keep customers, be competitive, increase sales and attract new customers. The evaluations showed that the main challenges for the online sales of groceries are of an operational nature. Low profit margins in particular present a challenge so that efficient order fulfilment and delivery are essential for e-grocers.

In both markets a highly competitive intensity in food retail makes low logistics costs an essential competitive factor: this is why retail companies rely on sophisticated and automated procurement procedures. But logistics are of strategic importance when linking the online and stationary sales channels. However, logistics are often determined by inefficiency and historically evolved processes instead of being aligned with the new sales channels. Thus, one could say online grocery is still in its infancy in terms of logistics. But with the growing customer base and the experiences gained since the beginning, these structures are gradually improving and there are more and more efforts by retailers to reorganise their distribution. In contrast to offline distribution, where procurement and warehousing structures have been centralised over years, decentralisation is now occurring in some areas. Smaller online warehouses are being opened close to customers or, if central structures remain, larger central online warehouses are being opened, supplemented by regional transshipment points/(mobile) hubs close to customers and conveniently located. Due to the new interlinking of locations, this results in an increased volume of traffic on the retailers' side.

Furthermore, the claim to be able to respond flexibly or even spontaneously to customer wishes/orders is associated with high costs. However, due to the related increase in costs, food retailers are very interested in optimising the last mile. As a consequence, they have developed a variety of tools (see sections B 3.2 and B 3.3) to smooth routes and orders and to make better forecasts. In the future, further options have to be created to reduce logistics costs. Co-operation between retailers on the last mile could be one option for further reducing costs for retailers, whilst at the same time contributing to the reduction of distribution-related emissions. Establishing these will be difficult due to the competitive situation, but enormous cost savings, which could be gained by bundling and by improving the efficiency of last-mile transport, are attractive. Growing pressure to cut back on transport-related emissions, particularly in urban areas, where inner-city driving is more and more restricted, could be a further incentive. It is important to investigate the user expectations of both retailers and final customers towards such bundling on the one side. On the other, research into potential traffic and emission reductions related to such consolidation needs to be undertaken.

What do these developments mean for (passenger) transport? *Drives* have so far had little direct impact on passenger transport. Their indirect impact is not to be underestimated though. Particularly in peripheral, semi-urban areas the replacement of local shops by centralised *drives* makes it impossible for customers to shift from a private car to more sustainable forms of traffic, as food shopping requires the use of a car. Whether the supply chain for the retailer remains the same depends on the location of the *Drive*. If it is adjacent to an outlet, not much changes. If it is drive-only and centrally located in an industrial area, major simplifications may be realised by the retailer: cheaper locations, fewer staff for the sales floor, easier storage of goods. Locations that are additionally developed as a *drive*, and that are not connected to existing locations and do not replace existing outlets, mean new supply points and partly also new supply chains as additional, purely online warehouses are set up for delivery.

As far as home deliveries are concerned, we are currently seeing a continuing increase in the number of shipments, further accelerated by the Covid-19 crisis which has brought online grocery to the fore (as of November 2020). The mixture of confinement, avoidance of public spaces and even the limiting to small gatherings of people have all contributed to making local shopping more difficult or even impossible, and may even have had a favourable effect. Next year this development will probably be statistically apparent and will show whether there has been sustained growth in online grocery sales.

Compared to store deliveries, distribution is far less optimised; on the one hand, the transported units are much smaller and, on the other, the ‘uncontrolled’ order behaviour leaves little room for optimising delivery tours and routings. This also results in more traffic as the existing shops continue to be supplied as usual and the tours driven for home deliveries are added. As regards customers, the question arises as to whether online grocery shopping at least changes their mobility behaviour positively. This is not easy to answer since it is unclear to what extent online purchases actually substitute journeys taken for individual shopping trips or whether they are made rather as a supplement. If the latter is the case, then an increased traffic flow is to be expected. Additional research in this area is needed to shed light on the question of whether online grocery shopping means supplementing or replacing physical shopping. And beyond that, what customers do with their newly acquired free time. Do they make other trips?

The development of e-grocery also raises issues about the future design of supermarkets. Will there be a change in the physical retail landscape? Since there are few fresh products in the shopping cart, especially with HD, it could also be conceivable that the PoS could focus on freshness and reduce the amount of shelf-stable food and non-food products and thus also the amount of retail space in future. The interviews also revealed that once online grocery becomes firmly established, this provides an opportunity to reduce the number of physical stores. This could be attractive for retailers as maintenance costs as well as personnel costs in the warehouse are less expensive than those that have to be spent for

a full-service grocery store. But what does that mean for the local supply and for employment? The effects of e-grocery on transport and urban development are therefore a particularly fruitful area for further study.

C. Innovations in e-grocery and logistics solutions for cities

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C 1. Introduction

Today we have widespread internet access in most countries, 76% in Europe (ITU - International Telecommunications Union 2014), which makes it possible to contact each other easily. That also applies for communication between companies and people. The accessibility of reaching people via the internet is further advantaged with growing smartphone penetration. The internet offers the possibility for retailers to get in closer contact with consumers. Furthermore, it offers not only the opportunity of sharing information, but also of adding another distribution channel. Many retailers make use of it and, by adding another distribution channel, become cross-channel¹² retailers. But also, other ‘filière players’ use the internet to sell their products. Consequently, these days there is almost nothing which cannot be ordered online. Even groceries are making their debut and can be ordered online.

Table 10: Current turnover and forecast in online food retailing for selected countries (Source: IGD 2013)

Country	2012 (€ bn)	2016 (€ bn)
UK	7.1	13.7
France	5.0	10.6
Germany	1.1	2.5
Netherlands	0.6	1.6
Switzerland	0.7	1.1

A short look at e-grocery development

Besides the United Kingdom (UK), France and Germany are the largest European distance selling markets, worth respectively €63.4 billion and €51.1 billion, of which about 54% refer to goods and 46% to services (Ecommerce Europe 2014). These countries are also the three biggest European food markets with €183bn for France (2013), €175bn for Germany (2013) and £175.5bn for the UK (IGD 2014). Food online sales compared to total sales are relatively small but are expected to double by 2016 (see Table 10). While in 2011 only 4.5 million people in Europe stated that they have ordered food online at least once, about 15 million stated that in 2014.

The sustainable online grocery development in France and Germany started later than in the UK, where an offer of e-grocery by ‘traditional supermarkets’ started at the beginning of the year 2000 (Linder & Rennhak 2012). At this time Ocado and Tesco introduced e-groceries in the UK, and all major UK grocers followed around 2006 (O’Farrel 2014). Therefore, the UK can be seen as the European pioneer in e-grocery. At the beginning of the year 2000 online shopping for food was also marketed heavily in other European countries. But companies had more start up difficulties there. Many companies were quite optimistic and invested in e-groceries, e.g. Otto in Germany or Telemarket in France. But after only a short time, most e-groceries stores closed down (including Telemarket and Otto). As it turned out, these companies were ahead of their times. Besides slow internet connections which probably made the internet ordering/shopping inconvenient and time-consuming, the high logistics costs were likely another reason for the lack of success. As reasons for their failure, failed companies claimed their

¹² also known as multichannel (sales channels are independent) or omnichannel retail (all sales channels are integrated)

problems were mainly high storage costs, picking and logistics costs, and the complex delivery requirements for fresh food, especially for the last mile segment. Another reason for the developmental disruptions could be that internet access was not as dense as today and people only began little by little to shop online. Then, only a few years later, when the internet had found its way into everyday life, some companies restarted their efforts.

As the different size of turnover shows (see Table 10), e-grocery plays out in every country differently. We also find different e-grocery concepts favoured in different countries. Accordingly, there is no one-size-fits-all approach for online food retailing. 'Click and collect' (CC) and 'home deliveries' (HD) are the two main possibilities which can be distinguished. But within these two possibilities, retailers try to find more innovative solutions to differentiate themselves from other e-retailers.

Aim of the present paper

In this article, we want to compare France and Germany, where e-grocery was introduced almost at the same time but varies in its form and speed of development. The two neighbouring countries have different commercial and sales structures for food. Looking at grocery shops, differences in size of stores, selling concepts, and offered assortment (e.g. frozen food stores, popular in France and scarce in Germany) are to be found (Seidel *et al.* 2014). Furthermore, the types of retail formats are dissimilar: discounters dominate the German food market in the number of points of sale (PoS). With a total turnover of €62.1bn, which represents a 44% share of the grocery market, discounters have also the highest turnover of all formats (USDA Foreign Agriculture Service 2012). In contrast, discounters in France hold a market share of only around 10% (Bosshammer 2011) and the highest share of food turnover is generated by large hyper and supermarkets. A difference in consumer behaviour can also be seen: German households spend around 11% of their total consumer spending on food and non-alcoholic drinks whereas French people spent around 13.5% (Bundesvereinigung der deutschen Ernährungsindustrie 2012). Differences occur also regarding food e-commerce. As mentioned above, all major food retailers in France and the UK offer e-groceries via at least one way (CC or HD) whereas in Germany only a few food retailers offer e-groceries.

In France, where e-groceries are mainly offered in combination with 'Drives' (a 'click and collect' form of online shopping with access primarily by car, also known as 'Click & Drive'), e-grocery was introduced around 2004 with the opening of Auchan's Chronodrives. The greatest success of the Drive concept was in 2012, when the number of Drives exploded from 1,000 in 2011 to 1,700 in 2012. Today all French major actors of the food retail sector have entered the e-grocery market, mostly in combination with Drives (Mareš *et al.* 2016). This development is also reflected by the number of Drives (see Table 11). In 2014, with about 2,110 more *drive* sites than hypermarkets (2,022) can be found in France (2014).

Table 11: Drive characteristics in France (Source: DGE, 2014)

Type of Drive	Number	Number of customers (in thousands)
‘Picking’ (<i>Drive</i> next to supermarkets, no storage)	1,446	332
‘Déporté’ (<i>Drive</i> with dark store, with storage)	421	989
‘Accolé’ (<i>Drive</i> next to supermarkets with storage at site)	223	722
Total	2,110	2,042

In Germany, a revival of e-grocery started around 2009 when Rewe set up a drive-through concept in Cologne. A new impetus to the German online food market was then added when Amazon announced they would soon enter the food market by selling groceries online. Many companies hope by offering e-grocery before Amazon, and thereby being part of the early movers, they will succeed to stay in the market or to be at least one step ahead of Amazon. This strategy was successful in the US, where US retailers who moved early won market share in the longer term. In the US, Amazon, with about 22,000 customers, is the biggest provider of e-fresh food (Rudarakanchana 2014).

To be successful in the new market of e-grocery, dealers try a lot of innovative concepts, on which we shall focus our attention. As an additional step of the technological innovation process, we consider, as suggested by (Green & Hy 2002), use of the internet a powerful component in redefining supplier-retailer relationships. In this context the following questions arise: **Who actually offers e-groceries? Why are these actors interested in e-grocery? What are the constraints and what are the opportunities for e-grocers? Is logistics a constraint or a driver for the success of online fresh food? And are there consequences for cities?**

Most literature spotlights consumer preferences and/or behaviour, whereas comparably few consider logistics, e.g. (Hübner *et al.* 2016b)¹³. Others like (Vanelander *et al.* 2013) consider the most commonly used supply chain (SC) and analyse these in terms of optimising logistics costs. We consider that the logistics issue is essential and, following the work of Hesse (2002), Paché (2002) and Kessous (2001), we think that e-grocery will sustain and extend market shares by controlling logistics.

By analysing innovative e-grocery concepts which stand out from other food online offers, we want to explore how logistics requirements are considered. The term ‘innovative’ involves two dimensions for us here. First, we shall examine new players that are trying to enter the food market and who have not been in contact with consumers before, known as ‘filière players’, or providers that have not handled food before. Second, we shall look at marketing concepts that stand out from other e-grocers’ concepts. The present research begins by reviewing different solutions for fresh food and analysing them in the context of the following five points: institutional context (including law), economic context (level of competition), actors involved in e-grocery, spatial context, and consumer patterns. The review is based on recent scientific publications and professional literature. Moreover, online press, press releases and homepages of several online grocery offers as well as annual reports have been gathered and analysed. Additionally, short interviews with different e-grocers in France and Germany were conducted. Building on this, the next section proposes an analysis of the framework conditions, as well as of the drivers and constraints, particularly regarding the role of logistics, of the e-grocer concepts. The last section discusses the results in light of current territorial factors underlying the observed evolutions with a focus

¹³ Original citation: Huebner, Alexander, Heinrich Kuhn and Johannes Wollenburg. 2014. Last Mile Fulfillment and Distribution in Omni-Channel Grocery Retailing: A Strategic Planning Framework. Working paper. This paper was published in the meantime.

on cities and the potential impact up on them. Particular attention is also given here to changes in goods flows and mobility of consumers.

C 2. Innovative solutions in e-grocery in France and Germany

In our research we identified eight innovative concepts in France and Germany. The concepts are analysed in view of socio-economic and spatial contexts which explain the significant differences in the development of e-grocery in each country.

C 2.1 Different contexts for the development of e-grocery

Institutional Context

The institutional framework conditions of e-grocery are mainly the same as for “normal” supermarkets. From a general point of view, there are no special laws, subsidy legislation or support from cities or municipalities that promote the establishment of e-grocers in Germany. However, France introduced a specific law to regulate commercial activities. Since the law of modernisation of the economy (LME) was introduced in 2008, retail trade projects with a sales area reached at least 1,000m² (from creation or extension) requiring an authorisation of commercial exploitation (AEC). Since March 28th, 2014 this obligation applies also for Drives (ALUR Law). Still in France, we can find forms of sponsors when the Chambers of Agriculture encourages farmers to develop Drives with the label “bienvenue à la ferme”. There are 54 farmer *drives* with this label in France.

A general law which applies for all type of groceries but gains a special importance in the context of business to consumer (B2C) food deliveries is the regulation regarding cold supply chains. Small shipments therefore need complex treatment for different kind of products, e.g. splitting the consignment into separate boxes. The EU regulations on food hygiene (EC) no. 852/2004 and no. 853/2005, including the management system HACCP (Hazard Analysis and Critical Control Points), define the framework for the organisation of transport for fresh products.

Economic context

With respect to the competitive food market and their high market share, the “bricks and mortar” stores form the main competitors for all e-grocers. Besides these stores, other e-grocers form the competitive framework for all e-grocers.

There are different reasons for companies to invest in e-groceries. In regards to the stagnation of hypermarkets in France, the internet offers the possibility of reigniting growth in sales (Picot-Coupey *et al.* 2009). The aim of strengthening consumer loyalty may be another reason why an online sales channel is offered by retailers (Schramm-Klein 2003). For ‘filière players’ e-grocery offers the possibility of extending their activity, i.e. to interact directly with consumers. Other actors such as start-ups use the internet to enter the food market without setting up a branch network.

But it has to be noted that framework conditions such as small margins and high logistics requirements, e.g. for products which are sensitive in handling, complicate a market entry. As a result, e-grocery often turns out to be unprofitable. The early years in e-grocery development are therefore very dynamic, with changing players, as not all providers manage to make profits. One example is Ocado, one of the most successful British e-grocers, who took 15 years before being able to record figures in the black (LZ.net - Lebensmittelzeitung 2015).

Actors involved

Besides traditional (bricks and mortar) food retailers, the internet offers new opportunities for other stakeholders within the food supply chain (producers, wholesalers, service providers) to enter the grocery market by getting in direct contact with consumers. But also, pure internet players and new start-ups try to enter the food market by offering food online.

Through our desktop research we found more than 90 providers each in France and Germany who offer groceries via the internet. As mentioned above, *drives* are especially successful in France, although home deliveries (HD) are also frequently offered and used primarily in cities. The providers who offer *drives* are mainly multichannel-retailers. By the implementation of *drives* they mostly fall back on their existing branch network. But they also invest in the opening of new sites which are then only dedicated to pick up services (Drive “Déporté”, Table 2).

In a comparative analysis of French and German e-grocery providers, it is conspicuous that in France, mainly the ‘filière players’ use e-commerce to diversify their offer and sell their products directly to consumers. In Germany, beside the ‘filière players’, who often specialise in a specific assortment, we find many individual initiatives and start-ups outside the food industry which enter the online food market and are often supported by transport service providers. One German transport and logistics service provider, *DHL*, even offers e-grocery.

Small and medium-sized food retailers rarely offer their products via the internet. In cases where they offer e-groceries, they are supported by actors specialised in e-marketing and online selling as well as by transport service providers.

Generally, it can be stated that besides new players on the B2C food market, new relationships between ‘filière players’ are also evolving. As a consequence, relations in supply chain are also changing (see C4.3.2).

Spatial context

Most online offers for food are accessible in cities, with big urban areas which present a large catchment area being clearly favoured (e.g. Paris, Lyon, Ruhr area, Berlin). The locations of *drives* are mainly

located in the outskirts of cities close to working places or traffic nodes. They are often affiliated to already existing stores but are also placed at new sites, e.g. a dark store. These dark stores are retail outlets or distribution centres that provide food exclusively for online shopping. It is noteworthy that French retailers offer e-groceries nationwide, with home deliveries mainly offered in city centres, and Drives mainly in rural areas and outskirts.

Besides home deliveries, the 'filière players' entering the e-grocery market use more and more urban pick up points named 'point-relais' to offer their products close to the consumers. The usage of 'point-relais' for food ordered online can be seen as a witness to the success of click and collect in France.

In Germany retailers are still experimenting with different offers, searching for the right offer to address customers via the internet. The small number of *drives* (< 20) offered in a few (sub) urban areas are more reminiscent of a test phase and witnesses that the 'click and collect' concept is not really viable as yet. The HD concept, apparently more attractive for German consumers, is therefore the most offered e-grocery delivery form. As long as home deliveries are offered close to locations of multichannel retailers, deliveries are often done by retailers' own distributors, whereas in remote areas deliveries are made via postal services such as *DHL* or *UPS*. Pure internet players mainly rely on service providers for B2C deliveries.

Consumer Patterns

According to (Bovensiepen *et al.* 2014), 87% of German consumers buy groceries solely in shops. The reasons why and when consumers shop for groceries online has been considered in many papers (e.g. (Farag *et al.* 2003; Farag 2006; Picot-Coupey *et al.* 2009; Plachetta & Röttig 2012) *etc.*) and it is clear that changes in consumer shopping is a material factor in redefining supply (Filser *et al.* 2001; Moati 2009). Widespread internet access, which is increasing with growing smartphone penetration, facilitates the access of retailers' online concepts for consumers. In 2012, smartphone penetration of more than 50% in France and Germany was documented (Schindler 2013). Since then a further increase has been recorded. Initial studies show that continued growth in smartphone penetration involves a shift in internet user behaviour. As a result, changes in the way consumers' access internet services have been recorded. Users are able to be always connected and have instant access to different kind of services (Ericsson 2014). Besides searching for information and checking emails, buying online has become one of the most significant online activities.

A great number of people are looking for opportunities to save time in everyday routines; grocery shopping can be one of them. Online grocers and multichannel retailers try to adapt themselves to this development. Aiming, for example, at employed parents, e-grocers place their *drives* in business areas to attract customers during the journey between their working places and homes.

When the question is posed as to what percentage of consumers shop for food online, different answers and figures can be found. But it is sure that consumers in the UK and France shop more regularly for food online than Germans. Whether this is more related to the wider offer of online grocery in UK and France or to consumer behaviour, or is rather a result of both is not clear yet. But experience to date shows that food shopping via the internet does not replace but often complements traditional shopping. An interesting aspect in e-grocery shopping which cropped up in our interviews is that purchase baskets of online groceries tend to be bigger than the purchase baskets bought in shop. This might be an indication that customer expectations are different from one shopping channel to another.

C 2.2 Identified innovative concepts

During our research we identified eight innovative concepts which differentiated themselves from other e-grocers, in terms of concept offer or actors involved. The analysed concepts are illustrated in Table 12.

Table 12: Innovative solutions compared (own elaboration)

Name	Location	Special characteristics
Bonduelle Bienvenue (since 2012)	Villeneuve d'Ascq (Lille region)	Send a food brand without supermarket intermediary
Diadiscout.com (2014-2015)	4 stores in Paris	Discounter Use of chilled lockers
Monmarché.fr (since 2007)	Paris region first and all over France	Direct selling wholesaler-consumer
Arcimbo (since 2013)	Villeparisis (Paris region)	Fresh-produce Drive associated with a standard Drive
Venteprivée Miam Miam (since 2012)	All over France	A general pure player that tests the sale of fresh products
allyouneed.de (since 2012)	No stores only HD delivery German wide,	Initially transport and logistics service provider More products than many POS
Kochhaus.de (since 2010)	11 stores HD German wide	Recipes with delegated products
Emmas Enkel (since 2011)	Stores and HD in 4 urban areas:	Corner shop culture combined with ICT

The e-grocers in Germany presented here are mainly start-ups, whereby *allyouneed.de* has a special status as this concept is strongly supported by the transport and logistics service provider *DHL*, who is also the main shareholder of this concept. In France no service provider has so far been involved in online food retailing; all have been 'filière players'.

Auchan, one of the leading food retailers in France, is one of the early movers in French e-grocery with its *Chronodrive*. In February 2013, *Auchan* decided to start a new concept named *Acrimbo*, to compensate for weak sales in fresh food of the Drive format. *Acrimbo* is a store dedicated to fresh products, primarily organic and labelled products, which is geographically associated with a Drive. *Acrimbo* offers click and collect and direct sales. Home delivery, which was originally proposed, was discontinued. Another innovative concept for fresh products is provided by *Dia*, a European hard-discounter. The company, which is mainly located in the inner cities rather than on greenfield locations and therefore has difficulties to attach drives to its stores, introduced an e-grocery service via chilled lockers. The lockers are offered at four POS in Paris. Products ordered online can be collected in store. The French pure player *Vente-privée* has also engaged in the sale of fresh products with its concept *Vente-Privée Miam Miam* and attributes itself to short food supply chains. Two other innovations attract our attention because they constitute a real change of organisational model: *Bonduelle Bienvenue* and *Monmarché.fr*, which respectively show how industrial agribusiness and wholesalers are trying to get into the e-grocery market.

Bonduelle is a French company producing processed vegetables. *Bonduelle* products are sold through traditional distribution channels (supermarkets, mini-markets) and through catering circuits (restaurants, institutional food service). With *Bonduelle Bienvenue* and e-commerce, the company can sell directly to the end consumers without any intermediary. The store is designed like a showroom for the entire product range. The aim of the company is to develop this type of store close to *Bonduelle* factories all over France. Another example that shows that e-commerce is a way to remove intermediaries is *Monmarché.fr*, e-grocery offered directly by the *Rungis* wholesalers. The *Rungis* International Market

is the principal market of Paris, and it is the largest wholesale food market in the world. Through the new sales channel via the internet, this market, initially dedicated for professionals, is also opened to end-consumers.

All analysed German innovative concepts offer a fresh food assortment; moreover, two of them offer a full assortment. The one who limits its offer to fresh and dry food is *Kochhaus*. This multichannel retailer has assessed the competitive German food market by selling food via a special concept. Food is only offered in combination with recipes. When recipes are chosen, all required ingredients are provided. The intended target group consists of gourmets, curious hobby cooks and employed persons with limited time who have a desire for healthy or balanced meals and are interested in new cooking recipes. The concept of selling food on the basis of a recipe was initially offered via stores but is now also available online. In the meanwhile, seven German online start-ups have followed suit and also offer this concept. The concepts of the eight providers differ in the ordering process, with or without subscriptions. But the biggest distinctive feature is if the delivery service is a national or regional offer. The concepts of all recipe-food players are quite similar but differ in one point: the origin of products. Whereas some receive their products mainly from (local) producers, others source their products also from supermarket chains. One may have thought that these differences can be attributed to their spatial presence, so that in case of a nationwide offer it is easier to rely on a German-wide supermarket chain rather than to build up a nationwide network with producers. But as our researches showed in these cases, the reverse is true.

The entrepreneurs of *Emmas Enkel* developed an e-food-retailing concept where the corner shop culture ('Tante Emma Laden') is connected with all advantages of an online shop. The primary focus of this concept is to put the service aspect for consumers in the foreground. Customers have different options to buy their food: in a store at the counter or to order via a tablet in the store, to order at home, via telephone or via smart phone on the move. Beside the different ordering proposition, different ways of how the customer can gain his products are also offered. The orders may be packed ready to collect at the store or delivered to the customer's home. To make this service possible, the store differs from normal retailers' points of sale (POS) by having a bigger storage site than the sales area at the POS. The company currently works without its own warehouses, all products are directly delivered to the shop. The enterprise, which is currently in an expanding phase, was recently joined by *Metro Group*. It is remarkable that last mile deliveries are recognised in-house as an important part of the selling concept. The founders therefore prefer to make their deliveries to consumers with their own staff rather than to outsource the service¹⁴.

The last innovative concept which should be introduced here is the concept of *Allyouneed.com*. This start-up, which was founded in 2012, is 90% owned by *DHL*. *DHL*, which already had a lot of experience in shipping food products from countries of production to major clients in Europe, also decided to position itself in food deliveries in the last mile segment. Therefore, *DHL* is the first transport and logistics service providers who ventures to the sale of food. In addition to selling of products also all deliveries to consumers are made by *DHL*. The therefore enterprise widened its logistics concept to make an end-to-end supply chain for food possible. As the assortment of about 20,000 products includes also fruits and vegetables, the vehicle fleet was extended with refrigerated vehicles.

Our studies showed that the marketing concept to reach customers was usually prioritised. Accordingly, logistics implementations were considered only as a second thought.

¹⁴ Interview with founder of *Emmas Enkel*, carried out in January 2015

C 3. Consequences for transport and logistics

As explained above, most online offers for food are mainly accessible in cities. There is, however, an important difference between France and Germany. The success of French retailers' *drives* allows the majority of the French population to have access to e-grocery. Home deliveries are more developed in Germany, which may explain the importance of *DHL*'s role in the development of e-groceries offers. The constraints and the investments in the last mile vary from one option to the other; this also applies for the organisation of the supply chain.

C 3.1 Home delivery or Drive?

After the decision has been taken to offer groceries online, the next decision to be taken is how to get the products to the consumer. Even though there is much space for diversity there are mainly two options, HD or *drive* (cf. Table 13).

With HD, providers have to decide if they make the deliveries themselves or if they work with a service provider. As doing HD themselves means a lot of personnel, acquisition, and maintenance costs, many e-grocers decide to cooperate with logistics service providers (SP). But also, logistics SPs are not only confronted with pre-packed and palletised food but often with the requirement to take care of and/or to package food by themselves. Therefore buildings, vehicles, cargo agents and employees must comply with the requirements of food law, which is especially of importance for cold chains (food safety).

Even if food is already packed for transport, requirements differ for other non-food products. The various products must be treated differently on their way to the end consumer, regarding sensitive handling for some products or cooling where necessary; goods therefore have to be packed in separate boxes. Furthermore, all fresh products need special storage, and rapid handling and transport. The shift from day to hour deliveries offered by most e-grocers constitutes an increase of logistics complexity. Moreover, the volume of freight flows changes compared to supplying a POS: smaller 'packages' and smaller vehicles are needed for last mile deliveries to customers. This change is also accompanied by additional costs.

In summary, HD causes a lot of efforts and costs. As it is frequently unprofitable, some retailers stopped deliveries after a short time, as did, for example, *Arcimbo*. Others like *Ooshop* (Carrefour) abandoned their HD service throughout France and limited HD only to big cities where a high consumer density and consequently a critical mass of volume orders can be found¹⁵. There are also grocers who would like to offer their assortment online but cannot even find logistics service providers for HD. These grocers are forced to switch to another delivery concept. *Diadiscout* is one example of a retailer who did not find a service provider for HD and had no equipment for doing HD themselves. As a result, chilled boxes for picking orders up at retail branches were developed and offered as an alternative concept¹⁶. This case shows that even if logistics are not prioritised when it is planned to introduce e-grocery, it can have a big effect on the implementation.

More attractive for HD are delivery solutions with only minor effects on logistics (see Table 13). As long as not the entire range but just one type of product or a partial range (not fresh and dry food mixed) is offered, it is possible to use transport service providers such as *UPS* or *Chronopost*. More and more French e-grocers (offering just one type of product) use chilled packages which can be transported with uncooled packages to also facilitate deliveries for fresh food such as cheese or other delicatessen products with "classical" transport service providers. In general, it can be stated that, as long as the same type of product is given, transport is easier to implement, even for hand-sensitive food. An example of

¹⁵ Interview with Performance Process Manager of *Ooshop*, carried out in May 2015

¹⁶ Interview with Assistant responsible for e-grocery in Paris of *Diadiscout*, carried out in January 2015

the assembling of the same kind of products is the concept of the delivery of boxes with only fruits and vegetables. A fortiori, when different types of products are offered, the fulfilment and logistics requirements increase. At the moment where one provider offers fresh and non-fresh products or even the entire range of products, a transport with “classical” transport service provider is no longer manageable, as specific vehicle assets (such as cooling) are required. Thus, transport and logistics must be specifically organised.

A concept where food safety does not affect the delivery is the store-based "click-and-collect" service, such as Drive. This way of providing products to consumers is interesting as it only means additional costs for picking up goods in store or warehouse (dark store), high delivery costs are avoided as they remain to consumers. This may explain the success of *drives* and all forms of pick up points (farmer *drives*, meeting points,) and why especially French e-grocers rely on this delivery possibility when offering products online.

Table 13: Sales and logistics strategies for e-grocery (own elaboration)

Sales Strategy	Delicatessen	One product	Market place	Partial range	Partial range	Entire Range	Entire range
Examples	Gourmondo.de Comtessedubarry.com	My muesli.de Fromages.com	Oekokiste.de Laruchequiditoui.fr	Edeka24.de	Chronodrive.com	Rewe.de Auchandrive.fr	Allyouneed.com Super-u.fr Ooshop.fr
Concept	Generally dry products not available in supermarket	personalised / local products	Same type of products of different producers or sellers offered via one platform	Dry products ordered online and delivered to consumers' home	Supermarket offers a selection of their products online	Products ordered online are ready for pick-up by customer (full assortment)	Products ordered online and delivered to consumers' home (full assortment)
Outbound logistics	HD or pick-up points (PP)	HD	HD or PP	HD	Drive	Drive	HD
logistics requirements	Few technical requirements for fulfilment and transport	Few technical requirements for fulfilment and transport	Few technical requirements for transport or in terms of PP pick-up by consumers	Few technical requirements for fulfilment and transport	pick-up in POS or dark store	High fulfilment requirements	High fulfilment requirements

Increase of fulfilment and logistics requirements →

C 3.2 Changes in supply chain

The direct selling of food from producers to consumers is not a new development. The possibility of buying food via regional markets, via catalogues (e.g. *bofrost*) or direct at the farm existed before. But the internet enhances the direct access to the consumer. For the deliveries (last mile) to consumers, new stakeholders, mainly SPs, have to be involved. In this case, the direct deliveries to consumers mean two changes in supply chains: new actors involved (SPs) and a rise of additional supply chains (not only conventional SC from producer to wholesaler or to retailer but also from producers to consumers, see Figure 21). Furthermore, e-commerce offers other actors involved in food supply chains the opportunity to offer food directly to consumers. This causes changes in relations between suppliers, distributors and consumers (Figure 21), so that the changes in supply chains are about two main things: new actors are directly involved in the food B2C market (producer or wholesaler) and, directly related to this, intermediaries are skipped. In cases where pure online players offer food to consumers, it means that new intermediaries enter the food SC.

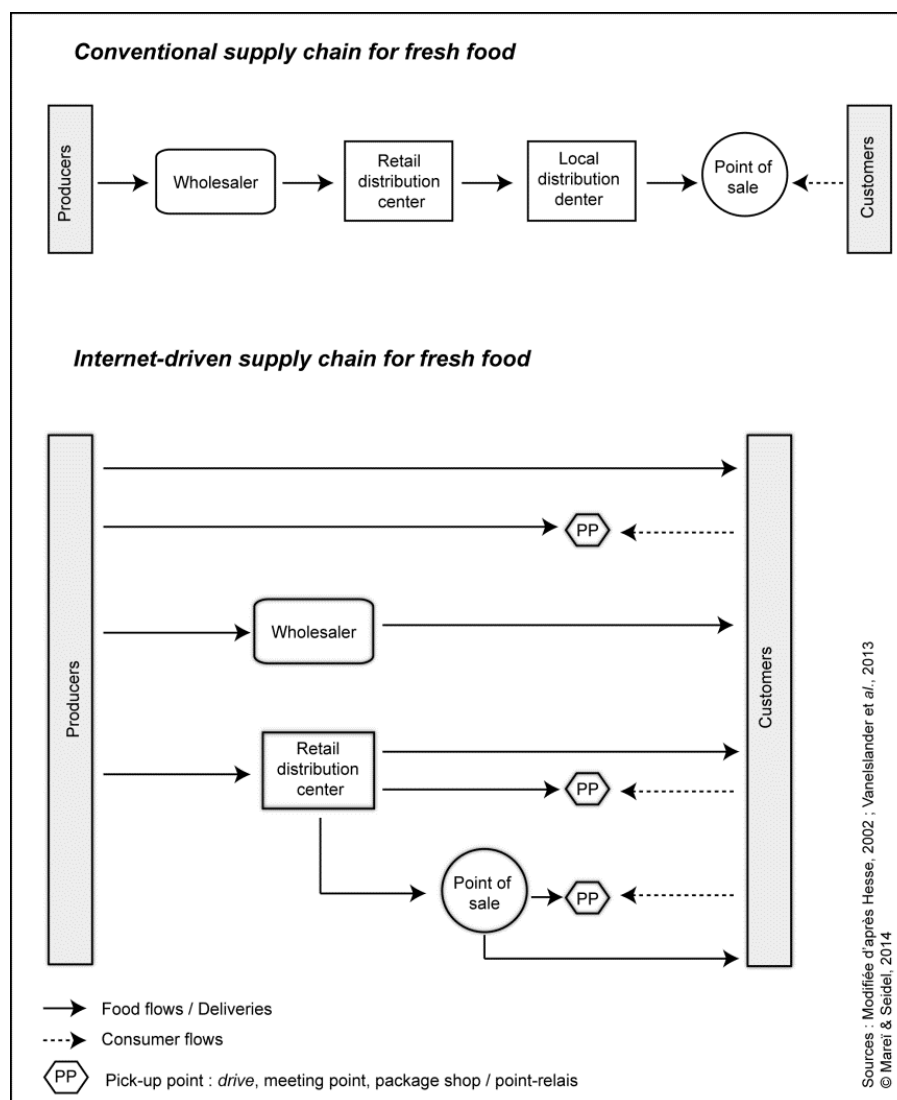


Figure 21: Simplified presentation from conventional supply chain to internet-driven supply chain for fresh food

Cross-channel retailers have different opportunities from where the delivery to the consumers starts. As long as the amount of orders is manageable via their stores, most retailers' deliveries start from their POS. Another opportunity is delivery from warehouses which are suited for the pick-up process for small shipments. The warehouses suited for pick-up process can be affiliated to already existing

warehouses or be located near the catchment area. Supply chains of cross channel retailers change mainly in the last mile segment. Therefore, the additional sales channel often means an additional supply channel. As long as the last mile is done by a service provider and not by the retailer itself, a new stakeholder is involved in this last mile segment.

It can be concluded that the development of e-grocery leads to a behavioural change of food providers and to changes in the last mile segment. The described changes in supply chains have an effect on cities and can entail different consequences. On the one hand, more commercial traffic flows can be registered due to deliveries to consumers; on the other, obstruction of traffic can be frequently observed as home deliveries often end up in second row parking. In this context, e-commerce increases the visibility of logistics issues for cities.

Furthermore, new locations are emerging (pick up points, new inner-city shops but also new locations of distribution centres close to cities) which represent attraction points for commercial transport.

C 4. Conclusion and discussion

More and more companies are offering e-groceries, for various reasons. For one, it offers the possibility of a market entry, some (producers, wholesalers) see the possibility of widening their sales by adding additional customer groups, other companies want to secure their leading market position or see the possibility of enlarging their market share. Our interviews showed that the growth of e-grocery is currently more about strengthening customers' loyalty and gaining market share rather than a question of economic gains. This can also be seen in the French market where e-grocers do not make much profit with *drives* and managers explain that making a profit is in this context not of utmost priority. However, we can see that *drives* are the main tool for French e-grocers in their B2C relationship as they crisscross the country.

Which form of e-grocery is offered can be mainly related to the type of e-grocers, the type of existing branch networks and the areas where the e-grocery service is offered. The main objective and biggest challenge for e-grocers is still – as regards the question as how to get the groceries to consumers – the logistics and transport issue. Thereby, home deliveries are problematic due to the last mile and are the most challenging part of e-grocery. One opportunity, at least for German e-grocers, could be the development of a service provider specialised in last mile food deliveries. Being able to refer to an already existing logistics network would facilitate delivery to consumers. Above all, a great deal of extra work for deliveries is the moving from days to hours, and that is particularly true for fresh food, which requires close attention for storage and transport. As a result, it is still to be assumed that logistics will decide the future of food online sale. Regarding effects on supply chains, three different kinds of changes were recorded in internet-driven supply chains: new actors get involved, new relations between actors occur, and additional supply methods are registered. The last mile delivery, which was beforehand part of the consumer daily routine, is now the responsibility of food providers who want to develop their activities in big cities. As a consequence, the challenge consists of organising the last mile.

One effect on cities in France and, partly, in Germany is the higher visibility of delivery services: daily, more and more delivery vehicles branded can be seen with the name of online grocers or the big service providers for food, such as Star's service in France or Rewe delivery vehicles in Germany. As a consequence, the issue of freight transport is made more visible by e-grocers in large cities. With regard to a further increase of home deliveries, the question of managing flows and road sharing become more essential in urban planning. In some French municipalities the increase in e-commerce and the resultant problems in last mile delivery recently led to a set-up of working groups focussing on the discussion of urban freight transport challenges. Furthermore, an increase in e-grocery could be reflected in grocers' resettlement location policy and so become interesting for urban development policy. More broadly, e-

commerce confronts cities with storage questions, with poor availability of land next to cities, and also with the daily management of e-commerce flows with logistics issues.

Looking at the consumer side, the adoption is currently in an initial stage, whereby a bigger utilisation of e-groceries by French consumers can be recorded. The authors expect that, with a further manifestation of daily internet use and a further incorporation in daily routines, the willingness to buy food online could increase. A prerequisite is that e-grocers manage to take consumer demands into account by offering simple ordering processes and guarantee speed and reliability of deliveries. Nevertheless, buying products online may remain complementary to physical food purchase.

In France it already turns out that online grocery is not requested for all type of products, perishables with short use-by dates remain part of to “traditional local shopping” most of the time. This development confirms the hypotheses of Alain Rallet (2001) about the development towards a hybrid shopping behaviour. Although the German e-grocery market not as developed and has yet to be sufficiently analysed as to draw generalised conclusions, a similar development does seem possible. The consequences of e-grocery shopping for consumer mobility are difficult to answer, as they are not been extensively analysed to date. Some case study analyses already exist for changing mobility behaviour in combination with online shopping for other product groups such as clothing or electronics (Cao 2009; Rotem-Mindali 2014) but these cannot be easily transferred to e-grocery as the shopping behaviour differs. It could be interesting in future research to analyse the consequences of e-grocery shopping on consumers’ mobility behaviour. However, the question of if and when a substitution of mobility behaviour takes place in such circumstances is of special interest. Is it likely that shopping which was initially done on feet, bicycle or public transport is now substituted via commercial vehicle trips? Are individual car trips also likely to be substituted?

Consequently, to fully understand the (future) challenges for cities that go along with increasing e-commerce, a joint consideration of urban freight and consumer mobility behaviour is needed.

III. Summary, Discussion and Conclusion

1. Summary of the main findings

This cumulative thesis examines and analyses whether and how online grocery offers change the flow of goods and thus the organisation of transport and logistics. Furthermore, it seeks to explain the phenomena by looking at the context in which these offers occur. The articles build on each other by systematically working through the structure of food retail trade.

A. Paper I: The **first study**, which focused on stationary food retailers and their distribution structures, revealed that there are national differences in distribution structures and also company-specific differences. One thing both markets have in common is that distribution centres are located close to agglomerations of PoS. The locations are thus chosen to reach as many branches as possible from each site. The retailers' strategy also plays a role, and that strategy depends on whether they are nationally or regionally positioned. The most significant difference between the countries is that the French food distribution structures are centrally organised, whereas those in Germany are mostly decentralised and organised via regional distribution structures. Nevertheless, specific retail characteristics such as the type of stationary retail and the size of the stores play a significant role. Promotional goods that are not subject to perishability are usually organised nationally. The location and structure of warehouses are influenced by industry consolidation and the microeconomics of retail companies. These can gain advantages from economies of scale in production, procurement and distribution.

B. Paper II: The **second study** looked at the restructuring of logistics in stationary food retailing when food products are offered online. When answering the research questions about changes taking place, the challenges and strategies of retailers were the focus. The analysis included French and German online food markets, which differ in their offerings and implementation, despite their geographical proximity. The evaluations reveal that the main challenges for online sales of groceries are operational. Low profit margins present a significant challenge, making efficient order fulfilment and delivery essential for e-grocers. Unlike other product groups, online groceries are not delivered by conventional CEP service providers. Deliveries in Germany are organised and executed exclusively by retailers. In France, the system relies on cooperation and subcontracts with transport service providers who specialise in food deliveries. The paper compared the strengths and weaknesses of different patterns of storage and picking, and the various forms of offers were assigned to a modular scheme. The analysis shows that different offering models require the implementation of various storage and picking processes, resulting in different challenges for the supply chain organisation. The implementation is primarily linked to the strategy of the retailers. Nevertheless, the steps and their main influencing factors could be systematised. Overall, it could be determined that the supply chain is influenced by the design and type of service offered and the selection of the type of storage location at the storage site. Customers act as new participants in the distribution system, and IT plays a crucial role in handling this as efficiently as possible.

Against the background of the knowledge of the first study, the results show that e-grocery offers change the distribution structures.

C. Paper III: The **third study** revealed that logistics and transport are central elements in implementation for the other e-grocery actors. With regard to the supply chain, entering into direct exchange with customers means that intermediate trade stages – that is, intermediaries or middlemen – are skipped. The new players depend on establishing relationships with food suppliers. These usually develop regionally. This is not surprising, as the offers are mainly offered regionally at first. The offers focus primarily on cities, and only a few actors dare to expand nationally. The national offers refer to

products that are not subject to a short perishability period or are offered in combination with uniform baskets of goods for many customers (e.g., linked to recipes). To be secure in the procurement of goods and, above all, to experience support, some new suppliers seek contact with traditional retailers. In this case, new relationships emerge. For deliveries, couriers are used for day-specific time windows, and conventional transport service providers are used for day-unspecific deliveries. Producers who offer regional products usually organise and execute the transport themselves.

The three studies together provide a comprehensive picture of the changes taking place. They highlight the challenges faced by companies in terms of the economic efficiency of the concepts as a whole, and those faced by cities due to the small consignments and the space requirements for logistics in urban areas.

In the following chapter, the results and methodology are discussed in relation to the research questions.

2. Discussion and implications

The aim of this thesis was to explore how food commodity flows are changing as a result of the availability and configuration of online groceries. It also sought to determine whether the different forms of supply in Germany and France are reflected in a different organisation of transport and logistics.

To reach these goals, the following steps were conducted:

- 1) The initial distribution structures in stationary food retail were analysed. This work provided a baseline knowledge for further work.
- 2) The online business models of brick-and-mortar retailers that transformed into multichannel grocery retailers through the introduction of online offers were analysed. This involved studying the various offers and challenges the e-grocery providers face – that is, the different specifications of each offer, which also determine the measures the companies take and the impact on logistics and transport organisation.
- 3) The new players (e.g., start-ups) in this market providing innovative e-grocery concepts were analysed. These providers had not been in the market previously or had not been in direct contact with customers.

The work has shown that the online supply of food changes commodity flows. How and to what extent these commodity flows have been changed or adapted is discussed in the following paragraphs along with the sub research questions. The latter are systematically addressed in regards to how they fit into the existing body of knowledge.

2.1 Discussion of the results and the research questions

2.1.1 *What is the initial situation of brick-and-mortar retailers' supply of goods?*

The analyses of the initial situation show that the consolidation processes shown in sections 2.3 and 2.4 and analysed by Fernie et al. (2000), JLL (2013), Rodrigue & Dablane (2020), among others, have taken place in the companies studied. Nevertheless, there are some differences in terms of countries and retail formats. Consolidations can take place centrally or at a regional level. Even if there are regional distribution centres, companies in France are mainly centrally organised. Many locations are clustered near Paris and the surrounding area. In Germany, most retail formats involve consolidations on a regional level. The country is divided into different regional clusters, which do not necessarily correspond to the federal states. The regional locations often have a historical basis. However, new, strategically located sites are also being developed to enable proximity to as many PoS as possible. In addition, as shown by Thonemann *et al.* (2005), direct deliveries are also made to PoS. Direct deliveries mainly involve bread and convenience products. Some retailers also deliver fruit and vegetables directly to the shops, and most handle this through their distribution structures.

2.1.2 How is the fulfilment and delivery of online orders implemented?

Overall, the following fulfilment types can be distinguished:

- store picking, (F, G)
- dark store (manual or semi-automated picking) (F)
- micro-fulfilment centres (F)
- non-automated DC (F, G)
- semi-automated fulfilment (F, G)
- full scale automated DCs (G).

The delivery of online orders is implemented differently in France and Germany. For collection, it is logical that the customer takes care of the last mile. Different approaches to HD can be observed in Germany and France.

The analyses have shown that most retailers first rely on their existing structures and offer an online service using those. Wollenburg *et al.* (2018) concluded that many retailers use this system. In France, where many supermarkets have large sales areas and correspondingly large car parks compared to Germany, the focus was initially on the final part of the sales process – the collection of the goods by the customer. For this purpose, dedicated pick-up areas were established. The goods ready for collection came from the supermarket. With the expansion of the offer and increasing experience, some small fulfilment centres were set up attached to PoS. These small fulfilment centres are also referred to as ‘micro-fulfilment centres’ (automated picking) or ‘dark stores’ (mainly manual picking). Only later, when the model proved successful, did the offer expand to the establishment of *drives* independently of the PoS. These newly developed *drives* can also have micro-fulfilment centres or dark stores attached. HD is still partly managed from the PoS. Furthermore, entirely new structures such as online distribution centres were created to serve the online offer.

In Germany, the picture is similar in terms of the early days of the business model, with online goods initially picked in the shops. *Drives* were scaled down following initial test runs, as they did not prove to be successful. Instead, retailers focused on HD. Specific online-related structures were only developed later. Today, almost all goods for HD originate from dedicated online distribution centres. At these dedicated online DCs, automation plays an important role, enabling efficient picking of the much smaller units compared to the units for the PoS. Automation is associated with high acquisition costs, especially if the fulfilment centre is a large site, and not every company has the necessary budget. Consequently, other systems can be found. Semi-automated fulfilment centres are a frequently used alternative. These focus primarily on automating dry products in combination with manual handling of, for example, fruits or products from the service counter (cheese, meat, exact weight as required). In non-automated online warehouses, system-based picking occurs. In this case, the advantage over the supermarket is that the goods are stored according to efficient picking and not for display.

Groceries for pick-up at stores (i.e., ‘Abholstation’) are predominantly picked manually by staff at supermarkets.

2.1.3 What influence does the retailers' 'initial situation' have on the design of the new distribution channel?

In my work I identified the following points as the 'initial situation' characteristics:

- size and market power of the retailer
- size of the distribution area
- existing own network of PoS and DCs
- branch size
- set-up of the distribution structures
- location of the sites.

In Paper II, the process followed by a retailer of going online of retailers could be divided into a total of three steps:

- (1) decision for the new distribution channel
- (2) decision of where to start delivery
- (3) design of the last mile.

The initial situation of the retailer, especially the existing network of PoS and DCs, played a major role in all three steps. For example, pick-up points were established when the necessary spaces were available at the already existing locations of PoS. Similarly, home deliveries are usually managed from the existing network of PoS and DC in the beginning. An expansion to meet the new needs only occurs later (see 2.1.1). However, this paper shows that external factors play a role in addition to the company's prerequisite. These include customer-related factors such as customer density, the retailers' competitive situation or legal issues. The findings that different elements play a role in the design of e-grocery offers are consistent with those of Hübner *et al.* (2018). The authors attributed the factors to the categories: country, customer and retailer specifics. Future research could systematically analyse the factors to learn about their relevance for the chosen offer.

This thesis provided a detailed exploration of the influence of the characteristics and design of the offer which, to my knowledge, the first of its kind relating to e-commerce. However, Blanquart *et al.* (2012) identified similar influencing factors when analysing the distribution structures for brick and mortar retailers. Based on the findings, the scheme developed by Blanquart *et al.* (2012) could also be applied to e-commerce offers.

2.1.4 What impact does the offer of e-grocery services have on transport and logistics organisation?

Last mile

The most apparent change at the outset concerns the last mile. Whereas the transport of purchased goods was originally the responsibility of the customer, it is now the retailer who is responsible for this part of the supply chain when it comes to HD. This entails an extension of retailers' responsibility and costs in terms of logistics and transport. Since this is complex and presents challenges in optimisation, many scholars have given attention to this area – for example, the optimisation of doorstep delivery was researched by Kämäräinen *et al.* (2001b), Punakivi & Saranen (2001), and Boyer *et al.* (2009). My research has shown that a successful delivery, whether via *drive* or HD, is where food distributors focus their attention. In doing so, they hope the positive order relationship promotes satisfaction and positive customer experiences that increase customers' loyalty, which itself has a positive effect on predictability and enables food distributors to reduce their costs and increase their profitability. This confirms work by Xing *et al.* (2010) and Rao *et al.* (2011). However, achieving such customer loyalty is difficult in online sales. However, as the orders are mostly irregular, customers' ordering behaviour remains

uncertain in online distribution logistics compared to stationary sales. Demand changes constantly, and most orders are irregular. Due to this unpredictable ordering behaviour, delivery locations change daily, and forward planning becomes difficult. Therefore, companies try to reduce volatility, smooth out order volumes and encourage regularity. This is achieved by differentiation of pricing, delivery days or time windows, and IT solutions that optimise online distribution. By integrating all delivery information in a single application, these tools support the transport planning optimisation for online deliveries. The tools often include a customer service element, which informs customers about the exact time of delivery or potential delays, offering alternative solutions and further increasing the positive customer experience for which the food retailer aims.

Furthermore, companies' vehicles, which were not designed for small units and last-mile logistics, have to be adapted.

Some companies decide to outsource the last mile or the entire online channel. Outsourcing or cooperating with companies that have a lot of experience in the last mile with fresh products is more of a French phenomenon among brick-and-mortar retailers.

Warehouses

Stationary retailers initially used the existing structures for deliveries. The fact that initial structures such as the PoS network are used is consistent with the insights of Agatz *et al.* (2008) and Wollenburg *et al.* (2018). However, not all brick-and-mortar retailers have built their online offering 'on top' of their traditional grocery PoS network (Yrjölä 2001), and new locations are also being built and used. However, this is more likely to be the case for companies that have already established such a large online customer base that they can afford the risk, or they have sufficient financial reserves to do so. In any case, all companies first used test markets before rolling out the online offer further. In the test markets, the existing structures are used, or elements such as picking or last mile are outsourced. Only following expansion do the organisational structures and flows of goods change. There is a link between the chosen offer of online selling and origin of goods. If the goods are offered for collection and picked in the supermarket, the online offers correspond to those of the supermarket and are also covered by the originally existing SC. In cases where pick-up is covered by micro-fulfilment centres or dark stores, the range available online is usually smaller than that offered by the supermarket. In these cases, goods are usually covered by the existing distribution structures, or there is an intermediate step with an online DC. This online DC is supplied like PoS by the central warehouse.

An online warehouse, and thus a significant adaptation, is essential, because the requirements for offline warehouses or supermarkets do not correspond to those of online operations. This applies to the design of the warehouse locations, storage (e.g., groceries for PoS are kept in large storage units, boxes or pallets, whereas the online part requires individual grocery items) and the picking processes. With the changed requirements for warehouse logistics, the inventory software is also adapted.

The online warehouses are primarily operated manually or are partially automated (see above). Only a few suppliers can afford the high investment costs for fully automated online warehouses. Fully automated sites are more likely to be found at the micro-fulfilment level due to the high costs involved. Online warehouses are located as close as possible to the sales areas. When opening up new customer territories, before expanding the warehouse structures, it needs to be examined whether the territories can be supplied from the existing online DC and supplemented by hubs. These hubs, which can be integrated as line-hauls, enable fine distribution to other smaller vehicles.

Inbound logistics

In addition to the last mile and the distribution SC, this thesis also considered transportation and logistics from when groceries first enter the company, summarised as inbound logistics. Hence, it also includes inventory management and aspects of procurement. The results reveal that these processes, which are part of logistics, also change once a retailer enters the online market. Here, the focus is more on planning

than on the storage and pathways within the companies, which were discussed in the previous section on warehouses.

Stocks management in the online warehouses is often planned traditionally, which means that customers can only order items available from the stock. If products are still available during the ordering process but no longer available when the shopping basket is being put together, replacement products are used. Inventory management plays a vital role in this context (Hesse 2002; Fernie & Sparks 2009). Typically, the criteria according to which this is organised are:

- ensuring a constant ability to deliver
- low stock levels so that only a small amount of capital is tied up
- flexible delivery times.

The inventory management includes three steps: demand planning, inventory planning and procurement planning. For demand planning, a distinction is made between programme-based and consumption-based demand planning. Most online distributors interviewed used consumption-based planning, which involves using forecasting methods based on the quantity of items demanded in the past. In inventory planning, like for DC responsible for PoS, a buffer stock and order level are always used. To enable a smooth process, the synchronisation of processes is mainly supported by technology. As a result of offering online shopping, retailers need to shift their category management processes away from a product-centric approach towards a consumer-centric one (section B.4). This is to align the processes with shoppers' preferences and preferred paths to purchase. To implement demand-driven inventory placement, retailers use machine learning. They aim to have a product database of good data quality across all channels. The synchronisation of processes often results in a highly flexible supply chain, and communication and transparent processes through digitalisation play a central role. Warehouse management, distribution order management or execution systems are coupled.

The analysis also reveals that procurement differs according to product groups. It is fulfilled from existing central warehouses and directly from suppliers (e.g., beverages) to the online warehouse. The extent to which the ordering behaviour affects the upstream supply structures could not be fully analysed and described. This is an area that requires further investigation.

2.1.5 What changes can be observed following the introduction of an additional distribution channel in terms of cooperation with other actors, supply chains and logistics?

Many French companies outsource their online sales and related logistics and cooperate with logistics transport service providers who have advanced knowledge in last-mile deliveries of fresh food. In my surveys, these were mainly companies who exclusively focus on such distribution, such as Star Service. Several of these cooperative efforts have expanded to include food or restaurant delivery services – for example, Uber Eats and Deliveroo. In the latter case, deliveries can also be made by bicycle. However, this only happens with smaller shopping carts. This development is mainly due to the COVID-19 pandemic, in which companies have faced ever-increasing demand and limited resources (e.g., drivers and delivery vehicles). However, it is often impossible for suppliers' stocks to be adjusted quickly, and a lead time from order to delivery of up to a week is not uncommon. Nevertheless, cooperation seems to be very successful and allows for models that can be scaled to demand. This suggests that such partnerships could also be successful in other countries such as Germany.

In addition to the last mile, picking and warehousing are also outsourced in France. In Germany, few brick-and-mortar food retailers could be found that outsourced warehousing or transport to the customer. These are mainly found with providers that only operate as online sellers (pure players). Parcel service providers are only used exclusively on a national level for delivering goods that customers have bought online. On a regional level in Germany, last-mile deliveries are usually made by the online food seller

themselves. Companies can be supplemented by external staff at peak times, although this solution is not very common. During the COVID-19 pandemic, logistics staff were taken over from other sectors, sometimes on a temporary, subcontracted basis.

As mentioned, when the downstream processes in grocery retail are modified, there are implications for the distribution supply chain (see 2.1.4). As providers' strategies vary between different countries, the type of online provision and the consequences for the various elements of the supply chain vary accordingly. Thus, in addition to the two main last-mile delivery solutions – HD and click-and-collect from a pickup point, which were also analysed, for example, by Hübner *et al.* (2016b) – there are also subforms, such as different types of pick up points (e.g., Piéton). In total, six different types of collection point were identified in this work. This insight is significant because the different types of last mile also result in diverse organisation in the supply chain. Furthermore, for doorstep deliveries, different types of organisation were identified (see also Table 8). Whereas many French retailers still focus on *drives* and stick to the fulfilment via their PoS network in regards to HD, the majority of German companies use online DC. The initial situation of the retailer is central to the overall implementation, as the initial network and the available budget inevitably play a role. Table 14 summarises the different types of delivery and their organisation.

Table 14: Different type of deliveries and their organisation

Origin	Online DC	PoS	Online DC	PoS	Dark store or micro fulfilment centre		PoS	Online DC
Type of offer	Piéton (F)	Counter at PoS/ 'Abholstation' (F, G)	Locker at PoS (F)	Drive/Click and collect (F)	Coherent drive (F)	Isolated drive (F)	HD (F, G)	
Level	Regional offer							National
Last mile	By customer by foot (F)	By customer, by foot or car (F, G)		By customer by car (F)			Service provider (F)	Own logistics (G) Service provider (F, G)

The challenge of delivering food lies primarily in the freshness and shelf life of the products, which means that the place of dispatch needs to be close to the customers. Proximity to the customer is therefore a vital factor in the choice of location for the online DC, especially for HD. Existing structures such as branch networks can be used (Agatz *et al.* 2008) or intermediate warehouses or transshipment points near the delivery areas can be developed. Existing distribution centres are rarely used as a starting point for deliveries to customers. The structures within these locations are seldom suitable for small-scale picking for households, as they are designed for branch dimensions (see 2.1.4). If sufficient space is available, existing DCs are expanded to create areas for small-scale picking. Generally, however, new locations tend to be developed exclusively for online distribution. These locations are strategically sought in the vicinity of the customers, and decentralised distribution centres are favoured. If an online DC location is opened for several regions, it is supplemented by regional mobile hubs. The new DCs are supplied by the original distribution centres. However, some products are delivered directly from the manufacturer to the online DC – for example, beverages, bread products and items that are not in the offline portfolio or those new to the seller's portfolio and tested online for demand. These direct deliveries represent new transport and commodity chains.

The finding that existing delivery structures evolve is consistent with Wollenburg *et al.* (2018), who looked at the upstream structures of omnichannel retailers and distinguished between three or – including the subcategories – six different strands. While Wollenburg *et al.* (2018) distinguished between two types of pick-up points, independent and affiliated, my work has identified two additional forms:

- solo pick-up, already pre-commissioned and with its own warehouse at the site
- a new version called 'Piéton' which is located in the inner-city area.

The latter are supplied directly by online distribution centres. This finer distinction of pick-up points is important in that respect, as it affects the supply chain and significantly impacts the resulting transport demand. In addition to the existing delivery structures, there are additional transport elements. The extent to which the demand for transport increases could be explored in future studies.

2.1.6 Who, besides brick-and-mortar retailers, are the other market participants? How do they organise transport and logistics? What is changing in the supply chain?

The consideration of pure online retailers and other actors has received little attention in the literature. This study has shown that there are non-brick-and-mortar actors – companies that exclusively distribute goods online. Start-ups and new companies are called ‘newbies’. There are already different types of provider here: full-range providers, which are relatively rare; providers that specialise in individual product groups; and providers linking food to services – for example, offering meals packages where food is sold jointly with recipes. Then there are the marketplaces. These providers do not usually sell any food themselves but offer their website as a platform. Additionally, there are ‘filière players’, producers or niche product sellers who use the internet to cut out any further intermediary sales and distribute directly to the end-customer. Three actors can be distinguished among the producers: farmers, manufacturers of individual product groups and manufactories of niche products. The latter uses online services to reach a large market that would not be accessible without the internet. Transport service providers were originally in business, but they have since disappeared from this market.

Furthermore, the food sector includes established suppliers originally from the catalogue business. For these providers, it is only the communication medium that has changed, not the sales channel. The underlying structures have remained largely unaltered.

In the context of non-brick-and-mortar providers, it becomes apparent that supply chains are in a state of upheaval. An extension of supply chains is indispensable. Middlemen are omitted and, in some cases, new cooperative ventures arise regionally. The last mile, in particular, is organised differently here than in large retail chains. For deliveries, couriers are used for day-precise time windows, whereas unspecific deliveries are made with conventional transport service providers. In contrast, own delivery vehicles tend to be used for vegetables and fruit boxes. The vehicles often fail to meet the latest standards, and the delivery staff do not usually have a logistics background. This method of organisation and its impact could be the subject of future research, which could further investigate the potential of cooperation and ascertain whether transport could be made more efficient in this way.

This thesis also delivers some pertinent conclusions, discussed in the paragraphs below.

1. A high customer density is required

Analysing the framework conditions regarding e-grocery offers revealed that the most significant challenge for the successful implementation of a new distribution channel (*drive* or HD) is the need for high customer density. Aiming at a minimum order volume and customer density, cities or sparsely populated areas that resemble urban areas tend to be chosen, at least for the initial phase of e-grocery services. However, for a long time after the initial rollout, the vast majority of online grocery services remain in urban areas. National supply is only partially offered and mostly limited to dry products when considering HD. The focus on urban regions also facilitates economies of scale, as a certain level of demand is required for planning efficient delivery routes. Nevertheless, the total costs of the last mile are high and pose challenges for the analysed companies. These findings are in line with those of Boyer *et al.* (2009), among others. The approach in France to ensure an online offer via *drives* occurs mainly in the urban hinterland. This system is the result of addressing car-driving customers primarily. The locations are connected to existing large supermarkets or are located on easily accessible arterial roads.

2. *The initial contact with the customer is a challenge*

The analysis has shown that the biggest challenge is the initial contact with customers. The effort to convince customers to change their routines and buy groceries online has been identified as a major challenge. Besides establishing the first contact with customers, motivating them to use the service again was identified as the second biggest challenge for the providers. Therefore, the added value of online offers such as ‘convenience’ and ‘time-saving’ needs to be addressed by e-grocery providers.

Retaining customers in the long term relies on their initial experience. If this goes well, customers can be won over. However, negative experiences such as bottlenecks in the availability of goods, poor product quality or limited delivery windows can deter potential long-term customers.

The added value that an online offer can generate differs in respect to customer expectations. Hence, the offer designs can vary accordingly. The comparison between Germany and France showed that French customers initially saw the biggest added value in time savings. The retailers’ pick-up points were a good response to this need. In Germany, added value and services are often associated with HD, and the response to pick-up points was correspondingly restrained. Only in the last two years has the pickup model experienced a slight upswing, but it still lags far behind doorstep delivery in Germany.

It is assumed that COVID-19 facilitated the first approach. Although there were supply bottlenecks at the beginning of the crisis, consultants such as Kantar & Detail Online (2020) assert that the pandemic will increase the shift from brick-and-mortar retail to online channels faster than expected by consulting companies or market research institutions.

Across all results, it is evident that food retail has many interrelated areas. Transport is not done for its own sake but always serves a purpose by satisfying the needs of consumers and companies alike (Blanquart *et al.* 2012). The analysis of these needs and an understanding of them is central to understanding food retail’s transport and logistics. Accordingly, transport should also be considered in the overall context, always against the background of specific requirements.

This work focuses on what e-grocery providers need to do and the resulting changes. It looks at the companies’ internal changes and the new players and the effects on the commodity flow of goods, which are influenced and shaped by logistics and transport organisation. The work reveals that external factors are also worth examining. A structured view would have the added value of facilitating a comparison between countries or companies. Therefore, a frame of reference should be developed that breaks down the external influencing factors and needs of the companies. When looking at why retailers choose different strategies, this work has shown that the situation is complex. Various factors such as initial infrastructure, legal framework conditions, customer needs and their willingness to accept certain offers, market position and relationships with other retailers need to be considered. The work has revealed a framework. The initial approaches developed in the context of the work, meaning an extensive systematisation of influencing factors leading to a shaping of the respective design, also across countries could be further developed. There is already work on this for the stationary retail trade.

Blanquart *et al.* (2012) described a systemic approach that considers that retailers’ transport and logistics strategies depend on a non-transport-related environment. The authors developed a conceptual framework that systematically investigates key drivers for retailers’ transport demands and adapted it for food retail (Blanquart *et al.* 2012; Seidel *et al.* 2013; Blanquart *et al.* 2014). The determinants of logistics organisations cover the micro-, meso- and macro-levels. The micro-economic context takes the individual retailers’ strategies into account. The meso-economic context refers to the organisation of the retail sector and retailers’ sector dynamics. It includes aspects such as the vertical integration of wholesale or new relationships with suppliers. The macro-economic contexts represent retailers’

external framework conditions and include consumers' consumption habits and the political control and regulatory framework. This scheme could also be applied to the online grocery market.

2.2 Implications

Like other e-commerce sectors, the growing online food market impacts urban structures and has various impacts on land requirements.

On the one hand, there are the effects of the *drives*. French companies specifically used these to offer customers a cross-channel offer and, primarily, to open up new sales areas quickly and expand the distribution network. As no special authorisation for an opening was needed, the *drives* were located in residential areas or the sales area of the companies' competitors (see Section II, B 3.2 Delivery formats). The uncontrolled growth made urban commercial planning difficult. The government has already acted to slow the excessive growth and prevent the consequences of this development on urban structures with the implementation of the ALUR Act in 2014. The law demands that authorisation is required from the Commission Départementale d'Aménagement Commercial to open a *drive*. In addition to deceleration, an article of the law also stipulates that deconstruction must take place if the site is closed (Carrelet & Cruzet 2014).

As in France, compatibility assessments are required in Germany before retail outlets (with >800m²) can be opened. These are based on the sales area. As far as I am aware, such specifications are not necessary if logistics areas are developed. The situation in France has shown that there could be a need for readjustment here, if German retailers choose to take up this option. Market observations are necessary to be able to react to the development with regulations if needed.

Parallel to this is the development of HD, which predominates in Germany and is also growing in France. Here, too, various effects can be observed on real estate and land requirements. Two development options have emerged. In densely populated areas with a relatively large catchment area, such as the Ruhr region, warehouses dedicated to online sales are being built, incorporating extensive logistics areas. For distribution, these are supplemented mainly by micro hubs requiring smaller logistics areas in urban locations. Alternatively, in contrast to the large logistics areas, small online department stores are being built nearby or in cities to be as close to the customer as possible. Overall, the results show that a quasi-regionalisation of supply chains is occurring. This has policy implications, as locations close to the city are increasingly chosen for storage, picking and starting point for deliveries.

With the continued growth of e-commerce, inner-city logistics areas or areas close to the city will experience further demand. This development offers the opportunity to reutilise fallow logistics areas or areas that are no longer in use. In many urban locations, the available logistics space is already scarce or non-existent. However, since there is a need on the part of the retailers, they could convert existing structures. This could be true, for example, if sales locations reduce their sales area according to a limited product offer. Here, for example, the reduced sales areas could just offer the exclusive sale of basic products that experience ad hoc demand and convenience products would be possible. The remaining original sales area could be used for the establishment of micro-consolidation – that is, converted. The interviews showed that this is already being considered. It is even conceivable that some supermarkets will make way for micro fulfilment centres. In this case, even smaller areas would be sufficient compared to PoS, as the area used for displaying goods and the checkout area would be omitted. Overall, the primary concern is the implication of this development for the future cityscape. Policy tools will be needed to control the development. It also needs to be asked what the possibilities are for being active not only in a reactionary way but also in a formative way.

Other impacts that are partly emerging involve the labour market. Currently, in many companies, the number of sales outlets (i.e. local presence) means more turnover. With increasing online sales, this is no longer necessarily true. In the long run, supermarkets could be replaced by, for example, micro fulfilment centres or hubs. This would impact the labour force, as jobs in the logistics sector are less well paid than those in retail. Furthermore, depending on the degree of automation and size, fewer staff are needed at logistics locations than PoS. On the other hand, the demand for delivery staff increases.

This leads to another crucial point: a growing online business naturally increases the number of delivery vehicles serving the end customer (i.e. for HD). As many cities are already congested, measures should be developed to counteract this. Low-emission delivery vehicles should be employed. However, not all vehicles – for example, cargo bikes – are suitable due to their low load capacities. If they are currently used sporadically, it is primarily for marketing purposes and for small purchases. Electric vehicles, in contrast, have larger capacities, and incentives could continue to be created for their use. Because of the high volume of traffic, incentives to bundle shipments would be practical. For German providers, it is probably more challenging to motivate companies to do this, as German firms typically handle the last mile for HD themselves. However, in France, where many deliveries are already made with service providers, this could be more easily implemented. Nevertheless, most companies prioritise standing out from their competitors, and this usually obstructs sensible bundling.

2.3 Limitations

This work succeeds in systematically recording and describing the adaptation mechanisms (logistical practices) and revealing the differences in supply chain structures between e-grocery services and the stationary food trade. Based on the study's structured analysis of two neighbouring but contrasting markets, further insights relevant for research and practice could be generated. The results of the analyses contribute to a better systematic understanding of online food practices among researchers and practitioners.

This work has limitations that may affect the generalisability of the findings. The focus was primarily on the company perspective to understand the motivations that lead to offering and organising online trade. However, the insights relate primarily to e-grocery services in France and Germany. Future research should consider other countries for expanded comparability. Furthermore, the work focuses mainly on brick-and-mortar retailers. While this might be considered a limitation, it should be emphasised that this group represents the biggest market segment. Furthermore, all groups of actors were included in the work, although they could not be analysed to the same extent within the framework of this study. It would therefore be helpful to investigate their structures further and take a closer look at the different groups, analysing companies from each group to draw valid conclusions. An expansion of the analyses to other countries would be practical.

In the discussions with e-grocery providers, changes in the upstream supply chain (i.e. in the procurement of goods) were also considered. However, as not all actors in the supply chain were addressed, these are not sufficient for describing the relationships in a differentiated way. To fully describe the changes in the upstream SC, it seems necessary to address the suppliers and their relationships with multichannel e-grocers.

During the analyses, it was found that an adjustment of the companies' network structures affects other areas, such as social impacts (e.g., reduced use of employees in retail and a shift to logistics), environmental impacts and the impact on land requirements. These results raise further questions regarding the social, ecological and urban structure-related effects, which could be addressed by further research.

Regarding the methods used for the analysis, because online groceries are a relatively new topic with little data available and subject to constant change, a qualitative approach was chosen, supplemented by quantitative data analysis. The mixed-method approach was particularly suitable for the analysis for various reasons. On the one hand, there are too few retailers to carry out quantitative analyses alone. An aggravating factor is that data sources (e.g., total sales and turnover, locations of branches, consumer spending, vehicles used) are difficult to obtain, especially for international comparison. Company data is also difficult to acquire as competition is fierce, and companies want to make sure that no strategically important information goes to their competitors. It was also not possible to use all answers and company names, and certain company characteristics could not be mentioned. All of this makes an all-encompassing discussion of the answers difficult.

Concerning the selection of interviewees, there are only a handful of providers in each of the markets that dominate the sector. All these leading providers were approached for interviews, but their willingness to talk varied. However, it was possible to converse with half of the brick-and-mortar online grocery providers, and Guest *et al.* (2006) asserted that six to 12 interviews are sufficient to research a homogeneous group. The research is therefore representative of the multichannel retailers.

The same guiding questionnaire was applied for each expert interview. It was not possible to obtain in-depth answers to all questions in every interview, though. While this allowed for outstanding insights in some interviews, it limited the direct comparability of the answers in some cases. Information on logistical structures and data are highly sensitive due to their strategic relevance. In many cases, they embody the success or failure of an entire business model, which is why some organisations are unwilling to share information. For these reasons, the names of the companies are not mentioned in the study to prevent conclusions being drawn about individual companies. Personal contact and building trust were therefore of core relevance for the success of the research, which is why the personal interview approach was a major advantage. It made discussions with the companies possible and allowed the questions to be adapted to the interviewees. It also generated a deeper understanding through follow-up questions, which would not have been possible with an online questionnaire, for example.

Despite these limitations, the thesis contributes to a clearer understanding of online grocery retail. It provides added value because it does not only look at the effects at the large retailers but considers all stakeholders.

3. Conclusion and outlook

The main topics this work addressed were how commodity flows change through the introduction of online grocery sales and whether different online offerings have different effects on the flow of goods. The underlying thesis for the research was that structures, developments and impacts may differ between countries. Therefore, the study included an international comparison using the examples of France and Germany – two countries with different characteristics. The order-processing, last-mile delivery and other details in France and Germany differ, showing that analysis results from one country are not necessarily transferable to customers and retailers in other countries. By comparing the two countries and analysing the different market players in detail, the work provides comprehensive insights into the different logistics and transport structures and offers a comparative reflection on online food retail development.

The study shows that the online distribution of food changes commodity flows. It is not only front-end logistics that change, but the overall structures in the supply chain too. By focusing on the downstream side of the supply chain, this work reveals how new locations are being opened and new delivery structures are emerging, whether the goods are transhipped via several distribution centres until they reach the customer or the producers supply customers directly. The different forms of sales impact the design of distribution chains, and the various distribution formats require different adjustments to existing structures.

Through my work, I have identified the following relevant parameters for the design of online distribution for formerly brick-and-mortar retailers:

- product-related factors
- network-related factors
- customer-related factors
- competitive factors
- legal factors.

The network structure, available budget, customer catchment area, infrastructure and legal factors are relevant for the organisation of the supply chain. As new partnerships emerge, logistics and transport organisation are subject to constant change.

Whereas brick-and-mortar retailers have to amend existing distribution structures to adjust to online sales, providers newly entering the market can optimise their structures to the specific requirements of the online food sales market from the outset. I have shown that in addition to these different starting positions, other, country-specific aspects play an important role when online food retail distribution structures are implemented.

Overall, it became apparent during the research that retail is increasingly consumer-oriented and highly dynamic. The online distribution of groceries poses a challenge for many companies, as the product quantities for the end consumer require a different logistical treatment to the quantities required by the branches. In addition to an efficient design of the last mile, the underlying processes need to be adapted so that the products can be delivered to the consumer in time, with the requested quality and quantity and in a specific time window. Hence, proximity to the customer is increasingly important when choosing the location for the final storage or deposit of goods prior to their supply to the end consumer. To guarantee this, the entire supply chain must be adapted in terms of the flow of goods.

Outlook

Against the background of the results, various questions and topics can be derived that should be investigated in future research.

First, the results show that different distribution strategies require different supply chain structures to reach a high level of efficiency, which is essential in the grocery business. In addition to large restructuring processes such as establishing new locations, smaller restructuring occurs, such as intralogistics at the DC location. Intralogistics is primarily relevant for practice (i.e., retailers and logisticians) and already receives a lot of attention from this side. However, it should also receive greater attention from a scientific perspective, as changing intralogistics can impact retailers' ordering processes and thus the upstream supply chain. To understand the changes in upstream SC, however – particularly the interrelation between the upstream and the downstream – it is necessary to consider the design of grocery supply chains. To analyse the changing structures of the upstream supply chain, the 'filière concept' could be applied. This concept, which French economists originally developed in the 1970s for the structured examination of economic processes, is suitable for depicting changes in traditional and modern chains for individual products or product groups (Lenz 1997). In doing so, it looks at the changing relationships of the actors in the supply chain, from the producer to the consumer.

Second, the factors influencing the design of the respective distribution systems seem an important theme for future research. The scheme developed by Blanquart *et al.* (2012), which analysed the framework conditions systematically and made it possible to identify the key drivers for the retailer's transport needs and demand, could be applied for online grocery as a starting point.

Third, while dealing with the topic of e-grocery services, I noticed that most approaches focus on the extent to which deliveries could be more efficient, while social and environmental impacts have received little attention in research. In view of social impacts, there is a risk of eliminating better-paid jobs (retail clerk vs. logistics staff) in the long term. Regarding environmental effects, e-commerce is associated with increased packaging waste and increased traffic due to increasingly smaller, fragmented consignment sizes. This is true for deliveries to the end customer and also for pick-up points that handle much smaller units than PoS, receiving finished commissioned goods ready for pick-up by the customer at shorter intervals. One driver for the different design of the online offer is that e-grocers aim to address an increasing customer demand for convenience. Comfort and spontaneity – that is, the ad-hoc availability of deliveries – also play a role. The short intervals between ordering and delivery are a challenge, and there is a need for further research into how to avoid the further increase of individual deliveries. How growing demands for comfort and more sustainable supply structures fit together is a crucial issue. There is a need for research from different angles, including the consumer behaviour side, the logistics side, the urban planning side and the transport side.

Fourth, the COVID-19 pandemic saw the development of two trends: regional and sustainable products. These are experiencing an increase in demand and online purchases, and food has experienced significant growth in these areas recently. There has been an upsurge in regional eco-boxes with deliveries of vegetables and fruit from local farmers. This development regarding short-circle distribution needs investigation. The rising consumer demand for regional products could be an opportunity for regional producers. There is a need for research into how transport can be made more efficient – for example, through cooperation. Another research field in this context is the impact of e-grocery services on local supply, public places and urban infrastructure. A further push could present the opportunity to establish regional supply cycles, giving suppliers the chance to bypass the grocery store as an intermediate stage and offer goods directly. In addition, and with the rising demand for online orders, full-range retailers have experienced an upswing, enabling the purchase of groceries and still avoiding contact. Furthermore, offers such as recipe-based ingredients for dishes or deliveries of fresh

regional products have experienced a new demand, as more people than ever have been cooking and eating at home. It remains to be seen how these trends will persist and evolve beyond the pandemic.

Fifth, distribution in local areas is an issue. Even though rural areas can benefit from e-grocery services, they are mainly offered in urban areas. There are several reasons for this, linked primarily to the need for large numbers of potential customers to make the business more profitable, especially against the background of high delivery costs. Research is needed into models that could guarantee supply to rural areas. There is the possibility that establishing such structures would be viewed negatively, as they could further weaken the already weak stationary structure. One negative impact on local structures could be that a PoS becomes unprofitable – for example, a decline in sales could lead to closure. Above a certain turnover size, online business could be more profitable for retailers in some areas. The advantage that the online market could hold for the future lies in the comparatively low costs of an exclusively operated micro-consolidation centre compared to a supermarket, which requires a relatively large area for product display and checkouts and involves a large number of employees, who usually belong to a higher earning group at the PoS. Questions remain as to what the ‘channel shift’ to e-grocery services means in the long term and the consequences for local supply and urban landscapes.

Sixth, the growth of e-commerce provokes changes in inner-cities with new demands on space, especially in terms of real estate pricing and parking space. Logistics networks are already in the process of being converted, offering quotes for small and medium-sized online retailers, specializing in local markets, and possibly also global providers. The question here regards the consequences of e-grocery developments for cities. It is necessary to consider this from several different angles. In terms of sustainability, the 15-minute concept – the notion of reaching daily necessities within 15 minutes – is current once again. This concept contrasts with the offer of online products, as the extensive availability of the latter tends to make regional shops superfluous. Potentially affecting the cityscape and the range of shops on site, the question arises as to whether developing e-grocery models would be compatible with current concepts of sustainable city planning. However, constant ordering also harbours potential benefits such as improved predictability. Distribution structures could be optimised as needed.

To summarise, sustainability, social compatibility, ecological issues and economic impacts should be given greater consideration in future research.

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Appendix

Appendix A: List of related scientific contributions during the PhD and responsibility assignment

The following list contains all scientific contributions on the topic of retail distribution and e-commerce published during the official PhD phase. Those highlighted in grey are part of this work.

Journal papers

Year	Title	Journal	Role / Co-authors
2015	Same–same but different? A comparison of food retail and distribution structures in France and Germany	<i>Case Studies on Transport Policy</i>	First author, substantial contribution of study concept, data collection, analysis and writing of the paper
2021 (submitted)	One goal, one approach? A comparative analysis of online grocery strategies in France and Germany	<i>Case Studies on Transport Policy</i>	Single author
2016	Innovations in e-grocery and logistics solutions for cities	<i>Transportation Research Procedia</i>	First Author, study concept, data collection, analysis and writing of the paper Seidel, S, Mareï, N, Blanquart, C
2020	E-commerce in France and Germany a comparative analysis	<i>RTS - Recherche Transports Sécurité</i>	First Author, study concept, data collection, analysis and writing of the paper Seidel, S, Blanquart, C
2019	Challenges and perspectives for the use of electric vehicles for last mile logistics of grocery e-commerce – Findings from case studies in Germany	<i>Research in Transportation Economics</i>	Third author, including in writing of the paper Ehrler, V, Schöder, D, Seidel, S
2016	Pratiques et lieux du e-commerce alimentaire : nouvelles logistiques, nouvelles mobilités ?	<i>la revue NETCOM</i>	Fifth Author, including contribution to data collection Mareï, N, Aguiléra, A, Belton-Chevallier, L, Blanquart, C, Seidel, S
2014	A conceptual framework to understand retailers' logistics and transport organization-illustrated for groceries' goods	<i>Published in HAL-ouvertes; Presented at Annual Meeting Transportation Research Board - TRB, Jan 2014</i>	Second Author, including significant contribution to study concept, data collection, analysis and writing of the paper Blanquart, C, Seidel, S, Lenz, B
2014	Spatial patterns of food retailers and consequences for logistics. A comparison between France and Germany.	<i>Presented at TRA, Transport research arena, published in Proceedings. Paris</i>	First Author, substantial contribution of study concept, data collection, analysis and writing of the paper Seidel S, Blanquart C, Ehrler V, Müller N
2014	The impact of e-commerce on final deliveries: alternative parcel delivery services in France and Germany.	<i>Transportation Research Procedia</i>	Second Author, including significant contribution to study concept, data collection, analysis and writing of the paper Morganti, E, Seidel, S, Blanquart, C, Dablanc, L, Lenz, B

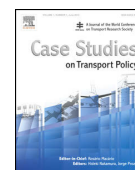
Appendix B: Printed versions of the three papers

- Paper I** **Seidel, S,** Blanquart, C, Ehrler, V (2015) Same–same but different? A comparison of food retail and distribution structures in France and Germany, *Case Studies on Transport Policy* 4 (1), p. 29-37 <http://dx.doi.org/10.1016/j.cstp.2015.09.001>
- Paper II** **Seidel, S** (2021) One goal, one approach? A comparative analysis of online grocery strategies in France and Germany, *Case Studies on Transport Policy* (in press),, <https://doi.org/10.1016/j.cstp.2021.10.013>
- Paper III** **Seidel, S,** Mareï, N, Blanquart, C (2016) Innovations in e-grocery and logistics solutions for cities, *Transportation Research Procedia* 12, p. 825 – 835, <https://doi.org/10.1016/j.trpro.2016.02.035>



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Same–same but different? A comparison of food retail and distribution structures in France and Germany

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ABSTRACT

When modeling international freight transport, it is tempting to assume logistical structures for national markets all over the world are almost identical, at least when it comes to specific market segments, e.g. food or fashion. This is not the case, though. Despite several parallels, there are some fundamental differences which are reflected in different logistics food distribution systems and which result in different freight transport demand.

The DLR Institute of Transport Research in cooperation with IFSTTAR France conducted a detailed empirical analysis of the food retail market in France and in Germany. Based on the data collected, the differences in transport demand structures for the same product are outlined. The implications of such differences for the requirements of international freight transport modeling are discussed in conclusion.

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1. Introduction

With the continuous spread of the same labels across high streets all over the world, one could expect to encounter similar logistical retail structures everywhere, at least for similar market segments, e.g. food or fashion. Therefore, when modeling international freight transport, it is tempting to assume almost identical logistical structures within national markets and for the same market segments all over the world. However, this is not the case. Despite a globalization of brands, distribution structures within industry still vary significantly from one country to the next and even on a regional level such as Europe. As a consequence, different logistics distribution systems with different freight transport demand can be found.

With its high number of selling points, its important revenue volumes and its relevance for every-day life, the food retail market lends itself as an interesting market for a closer analysis of the impact of retail structures on distribution logistics and transport demand. Therefore, and against the described background, this paper takes a closer look at the food retail industry's structures, using the example of two neighboring EU countries, France and Germany, as they are among the European countries with the highest revenue in food sales.

Like most other retail industries, the food sector is characterized by growing market competition and increasing cost pressure. At the same time, fostered also by online experiences, customers' expectations towards instant availability of an interesting and diverse product assortment are rising continuously. As a consequence, the necessity of optimizing the efficiency of processes and logistics structures is growing, with retailers having to cope with the complex mixture of supply chains of local, regional and global sourcing at the same time.

This complexity of today's retailers' businesses is often further increased by their geographical spread. Furthermore, growing awareness of environmental concerns, demand for sustainable products and the need to optimize the efficiency of processes in order to keep costs at a minimum add to the challenges that the retail sector faces. These are further enhanced by more transport-specific issues such as congestion, resulting difficulties to time deliveries and increasing energy prices, namely fuel.

These challenges and the competitive environment of the retail industries have resulted in distinctly different spatial patterns, both on an industrial as well as on a geographical level. This differentiation is due to the fact that retailers try to differentiate themselves from their competitors through their network structure, and that they try to optimize their logistics efficiency: "Retail and service networks are developing and as competition is increasing in the retail environment, the best location is one of the most critical criteria of network performance. This location criterion deals not only with the single store location but also with the global network location." (Cliquet 1998, 206).

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Based on an analysis of the structure of food retailers in France and Germany (Section 3), the present paper investigates their spatial distribution patterns, including logistics hubs, distribution centers and warehouses. These analyses build the basis for the following comparison of distribution structures of the French and German food retail industry. The paper closes with a summary of the findings and an outlook of the impact of the findings on international freight transport modeling and its related data sourcing.

2. Method

This research is based on empirical data, both existing (TradeDimensions) and the authors' own (empirical research in the format of structured interviews). In order to achieve a comparable data basis for the two markets Germany and France, TradeDimensions (2012) data was chosen as it is one data-source that contains data for both countries, covering about 92 percent of food points of sale (POSSs) and distribution centers (DCs) and wholesalers linked to food POSSs in Germany, as well as about 59 percent of POSSs in France. The 92 percent for Germany include about 36,000 food POSSs and 1163 related DCs and wholesalers. The 59 percent for France cover data of about 18,470 POSSs and 360 DCs and wholesalers. Whilst all locations of big retailers are captured, it is important to bear in mind that small-scale supermarkets or "superettes" are often independent and therefore can be missing in the TradeDimensions data.

The TradeDimensions data is organized in three excel-spreadsheets (for France and Germany each). One table lists the POSSs and describes them by using 39 different variables, including a variable for the type of format of the POS. A second excel file of the TradeDimensions data-set lists all DCs and wholesalers. The third table links the POSSs to the warehouses by using an individual ID per POS, DC and wholesaler. This way, it is possible to identify each DC and warehouse supplying an individual POS. Then, using the information of the three tables, an adjacency matrix has been created for France and Germany, to describe the link between the POSSs and the distribution centers in more detail (Bahoken et al., 2014).

Based on these data analysis, individual retail chains (rather than retail groups) and their spatial distributions were analyzed. In a next step, retailers' locations, relations between outlets and wholesalers, internal and external warehouses/distribution centers were investigated. For this purpose, locations of POSSs and their related DCs were geo-referenced and visualized by the means of ArcGIS. Subsequently, the impact of these structures on the related freight transportation structures were described for France and Germany separately, followed by a comparison of their characteristics. The TradeDimensions data analysis was complemented with empirical research in the form of interviews, which were conducted with food retailers in France and Germany. All major food retailers in both countries were requested for an interview. In total, 23 interviews were held, of which about 15 were conducted in France and eight in Germany. Most of the interviews, held in the period from January to April 2012, were conducted on the phone. Questionnaires for France and Germany were identical. The

interviews covered the full range of food retail formats, i.e. hypermarkets, supermarkets, discounters and others.

The following paper reflects this research work and compares the distribution systems in food retail in France and Germany. Differences of distribution structures and their impact on transport demand are discussed. The text closes with an analysis of the impact of such differences on the data sourcing for transport modeling and an outlook on what is needed in order to improve data sourcing for freight transport modeling.

3. The food retail systems in France and Germany

3.1. Characteristics of the food retail system in both countries

The increase in complexity of structures described in the introduction, combined with rising cost pressure and customer expectations in the food market, is a process that has been going on for a long time. The efforts to further improve distribution structures of food supply chains started about a hundred years ago: The first logistics initiatives took place early in the 1920s, when branch firms implemented a network of regional warehouses for the procurement of their stores. The first steps for creating these networks were taken by major food retailers (Paché and Crespo de Carvalho, 2002). With retailers usually being the last element prior to the end-consumer in an entire supply system, they are challenged with the need to align their logistics system to those of their suppliers and intermediaries in order to achieve efficient stock management and delivery systems. Consequently, big retailers began to build distribution centers where goods were bundled before their delivery to the points of sale and retailers' warehouses became the major node of the traffic and transport patterns. In the 1990s the organization of food distribution changed from mainly direct store deliveries to a just-in-time format (Fernie et al., 2000), enabled by the advancing developments and use of IT, forecasting and just-in-time deliveries. The downstream actors of the sector, retailers, progressively imposed the location, the volumes and the frequencies of the deliveries to rationalize and optimize the flows and to obtain a lasting competitive advantage (Blanquart et al., 2012). This centralization, combined with the outsourcing of services formerly provided in-house contributed to the creation of a market for third party logistics providers (Fernie et al., 2000). The establishment of delivery structures through retailers' central and regional distribution centers seems complete nowadays.

In theory, one would expect that food retail structures of France and Germany, two adjacent European countries, should be similar to each other. In reality though, several differences can be found instantly.

When comparing their food retail market structures, differences can be noticed already in their framework and basic characteristics (Table 1).

There are 21 percent more grocery shops in Germany than in France. In line with this, the number of employees is higher in Germany. It is noticeable that, despite these values, turnover in food retail is much higher in France.

Furthermore, there is a difference in the consumer habits between these two countries when it comes to the budget spent on

Table 1
Food retail – framework data 2012.

Country	Number of inhabitants in millions	Number of grocery shops/outlets	Number of employees in millions	Food turnover in billion €
France	65.43	31,970	0.5	183.7 ^b
Germany	81.8	38,866 ^a	1.2	161.7

^a Without drugstores and specified stores.

^b Without specified stores like bakeries or butchers. Source: HDE (2013), EHI Retail Institute (2013), Nielsen Company (2014), Eurostat (2013), INSEE (2012).

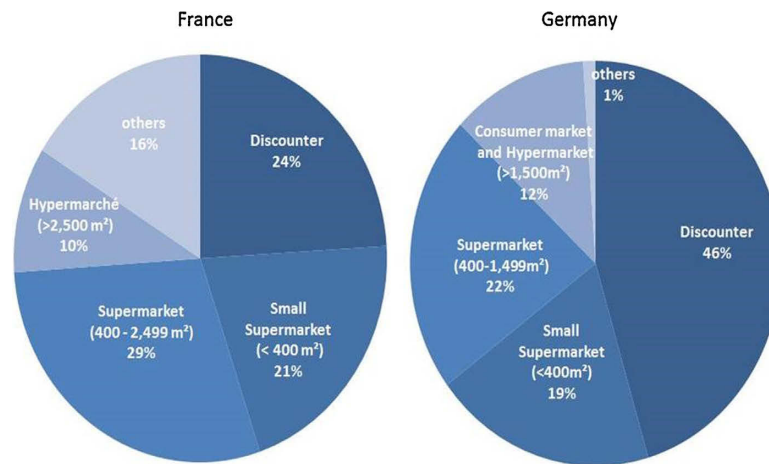


Fig. 1. Share of total number of POSs by type of format 2012 (specialist shops not included).
Source: TradeDimensions (2012).

food and non-alcoholic drinks: whereas German households spent around 11 percent of their total consumer spending on food and non-alcoholic drinks in 2010, French households spent around 13.5 percent (BVE, 2012).

Also, selling concepts vary between both countries, both concerning the size of stores as well as the sales concepts (e.g. click-and-drive is a successful concept in France but not in Germany) and the assortment (e.g. frozen food stores, popular in France and scarce in Germany). The following definition will be applied for the various concepts and formats:

- Small super market (<400 m²).
- Supermarkets (400–1499 m² Germany, 400–2499 m² France).
- Consumer markets & hypermarkets (≥1500 m² Germany, ≥2500 m² France).
- Discounters (low-price strategy; normally 300–900 m²).
- Others (click & drive, organic POS, freeze stores etc.).

Whereas in Germany discounters dominate the market, in France supermarkets have the highest share in terms of number of outlets. On the other hand, the share of small-scale supermarkets is nearly the same for both countries, as is the share of hypermarkets, which seems to be approximately identical in Germany and France (Fig. 1). But there is a noticeable difference when it comes to the size of these hypermarkets, though, with the French hypermarkets being considerably bigger with an average of 5416 m². The smaller sales areas in Germany and the high share of discounters can be explained to a large extent by regulations: in most urban areas shops are limited to a maximum sales area of 800 m². All food retailers who strive for bigger sales areas have to prove that their shops will not have negative effects on adjacent shops and central shopping areas. Discounters, whose sale areas normally fall below this, are favored by this law (Blanquart et al., 2013).

Looking at the turnover by type of format, a similar picture emerges for the spread of format shares: In Germany, with a total turnover of 62.1 billion euros, which represents 44 percent of the grocery market share, discounters have the highest turnover of all formats (USDA Foreign Agriculture Service, 2012). In contrast, discounters in France hold a market share of only around 10 percent (Bosshammer, 2011). There the highest share of food turnover is generated by the large scale supermarkets (Hypermarché). Comparing the percentage of sales per shop size in both

countries, it becomes apparent that discounters with a sales area of 400–999 m² are well established and dominate the food retailing market in Germany. They account for 52 percent of all food sales. In contrast, the small-scale supermarkets and discounters in France cover only 20 percent of all food sales. A general trend in both countries is a decrease in numbers of food outlets in the last years, but an expansion in the total sales area, which is in line with the concentration also observed in other industries.

Another interesting difference between both markets is related to the ownership of the retailers: the German market is characterized by independent small and medium-sized food retailers. Most of them are family owned and often they are organized in networks and cooperatives. On the French market, groups and corporate stores are dominant. Both countries have one thing in common: a small number of retail groups dominate the grocery market. In Germany the top five retail groups are responsible for three quarters of all food sales (TradeDimensions, 2012). In France, the picture is similar: 77 percent of food sales are generated by the top seven food retailers. In both countries the leading retailers operate several differently branded chains with various types of retail formats, such as small neighborhood stores, discounters, consumer markets or hypermarkets. Of particular interest is that, besides one Danish discounter we rarely find non-German supermarket chains on the German market, whereby German food retailers can be found in other European countries, e.g. in France. French retailers are present in most European countries but not in Germany.

Summarizing, it is to be said that, despite their geographical vicinity and the fact that both countries are part of the EU and its legislation, remarkable differences can be found between the markets of food retail in Germany and France. These differences are the result of various factors: historic developments, local legislation differences, different regulations, geographical constraints, varying consumer behavior and many more. The comparison reflects that, even for a small fragment of our overall economy – food retail – the market structures and sources of data available to describe these markets vary substantially. A comparison of the markets is feasible, but achieving full transparency is not possible, as quality of data, coverage of markets, data access, clustering of data and data definitions vary.

The following section analyzes how far the differences in market structures impact the spatial patterns of the retail system

and, subsequently, its transport demand. Based on this understanding the requirements towards improvement of data sourcing for freight transport modeling will be derived.

3.2. Spatial patterns of the retail systems

There are different ways to illustrate the spatial distribution of POSs. One possibility is to map them out, (Fig. 2), which instantly makes visible the higher number and concentration of POSs in Germany. As expected, most POSs and their highest density are to be found in urban areas. With more than 0.9 POSs per square kilometer, the highest food store density exists in these areas. Furthermore, more retailers can be found next to the sea and near the country border in France. In Germany, the highest density of POS can be found in Berlin and the western part of the country. These regions also have a higher number in population and a higher purchasing power per capita. In general, the eastern part of Germany has fewer big cities and more rural areas than the western part.

The high concentration of POSs in urban areas suggests that the number of outlets can be directly linked to the number of population. The relationship between commercial activity and urban space has long been discussed in the field of urban geography. Most theoretical models assume that retail establishments follow movements of households, rather than households being attracted by existing retail structures that match their needs. It seems that there is a better coverage of POSs in southern Germany than in the north. This is true for the total number of POSs, but when the total number of POSs is linked to the number of inhabitants of an area, it becomes obvious, that in total there is a higher offering per capita in the north (Fig. 3). In absolute numbers we find 2194 inhabitants/POS in the north and 2289 inhabitants/POS in the south of Germany.

Like in Germany, in the north of France more POSs per inhabitant can be found in the north of France than in the south. This higher offering per capita is further emphasized by the sales area per inhabitant. In total, there is more sales area per inhabitant in the north than in the south of both countries. On a country level, though, the average sales area per inhabitant in France (300–400 m²/1,000 inhabitant) is smaller than in Germany (400–600 m²/1,000 inhabitant), even though the shop sizes are much bigger (Metro Group, 2014). Comparing both countries, we find considerably more inhabitants per POS in Germany than in France,

as illustrated in Fig. 3. This confirms the observation made earlier: POSs are smaller in Germany, often located in centers of towns.

To further visualize the difference in spatial distribution of POSs in France and Germany, Thiessen-Polygons are used in the following. For the calculation of these polygons perpendicular bisectors of the POS are defined. The intersections of the lines form vertices which result in Thiessen-polygons. By this method the distance between all given POSs is considered, so that the potential catchment area can be illustrated. Fig. 4 illustrates this Thiessen-Polygon-Calculation for all POSs. As a result the high network density of POSs in Germany becomes obvious (the darker the colour the denser is the network of POSs).

There are only a few regions that have a catchment area bigger as 100 km². The density of inhabitants per POS, which is highest in urban areas, at the borders, and in coastal areas in France is in line with the above described absolute number of POSs. The overall network of POSs is not as dense as in Germany, which is not surprising as the population density is lower in France, too, so that such a dense network is not needed.

After analysing the spatial distribution of POSs, the locations of the retailers distribution centers will now be analysed. To have product-filled shelves and yet not to overstock, an efficient supply system is of utmost importance.

4. Consequences for the geography of retail warehousing and transport demand

4.1. Distribution structures in France and Germany

Retail companies continuously try to rationalize their distribution infrastructure and to make more efficient use of their resources. A core characteristic of the resulting logistics development in recent years is the continued tendency to centralized procurement by means of distribution centers. This leads to a reduction in the number and size of wholesalers' warehouses, and to the consolidation of stocks at a small number of very large regional distribution centers (RDCs). Warehouses and distribution centers play an important role as their location can be crucial for an optimized delivery structure for a retailer's supply chain. Despite their relevance, not all DCs are owned by retailers, though. DCs can be company internal, owned by the same owner as the POSs they supply to, or external, belonging to a third company, e.g. a wholesaler.

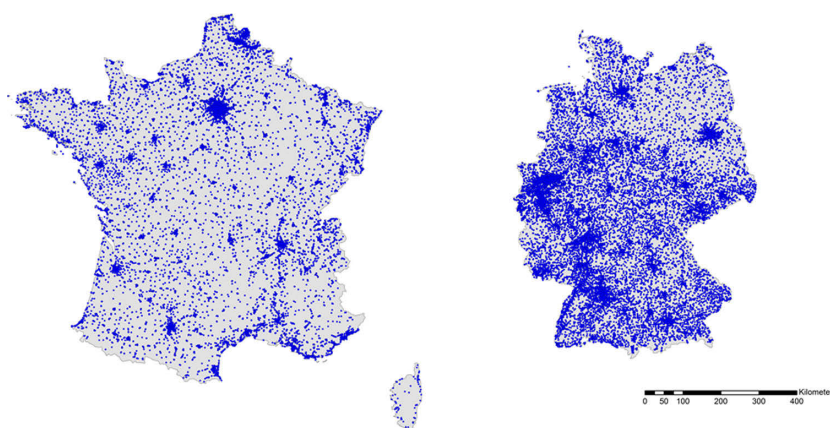


Fig. 2. Distribution of POS in France and Germany.

Source: TradeDimensions (2012).

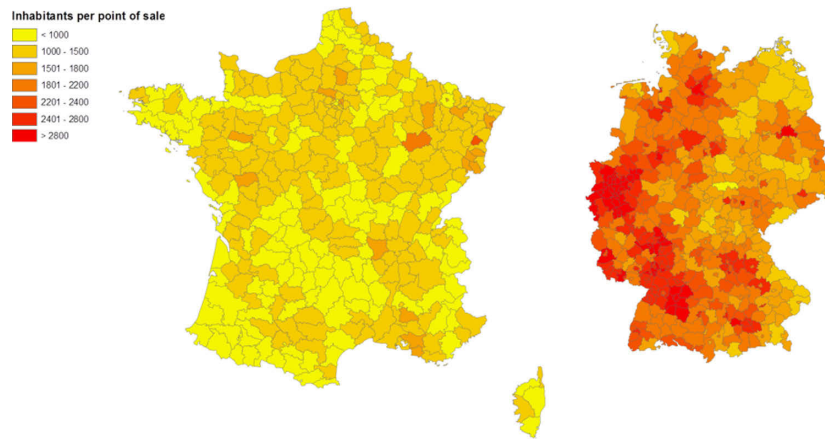


Fig. 3. Inhabitants per point of sales in France and Germany.

Source: TradeDimensions (2012), Statistisches Bundesamt, INSEE (2012).

Due to the fact that no information is available on whether the management of external warehouses is outsourced or not, the following analysis focuses on internal warehouses, as these can be indicative of retailers spatial strategies.

Looking at the TradeDimensions data in more detail, an initial dissimilarity between France and Germany is notable straight away: there are more distribution centers and warehouses in Germany (over 530 sites) used for deliveries to POSs than in France (around 360 warehouses in total). Around half of the 530 sites in Germany are owned by retailers, others belong to service providers and wholesalers which deliver their goods directly to the POSs.

In spatial terms, German DCs are relatively evenly distributed throughout the country, while in France they are concentrated around Paris and partly around Lyon (Fig. 5). Looking at transportation access, all German distribution centers have an average distance to motorways of two (up) to five kilometers. The

only exception is a discounter that is solely represented in a small northern part of Germany. Also in France, the sites of distribution centers are located near motorways. Furthermore, in both countries the distribution centers are located near to urban areas, close to the agglomerations of POSs.

As the total number of DCs on its own cannot explain differences in distribution structures, the differences between retail formats will be analyzed hereafter in order to understand the extent to which the choice of a logistical organization is influenced by the location of a retail shop and the retail format.

4.2. Distribution centers by retail formats

As the empirical research in the form of interviews revealed, there is a general difference between the DC network of supermarkets and discounters in Germany. This is also confirmed by the

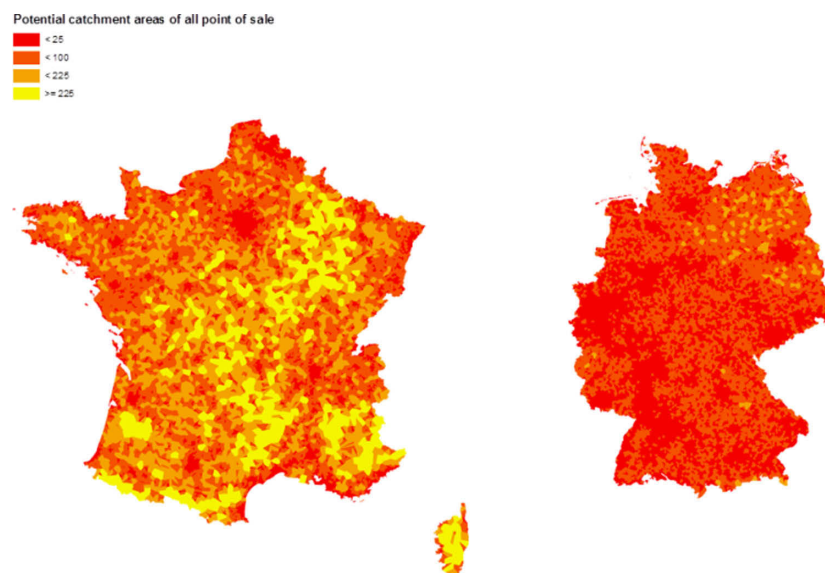


Fig. 4. Potential catchment areas of all POS in km².

Source: TradeDimensions (2012).

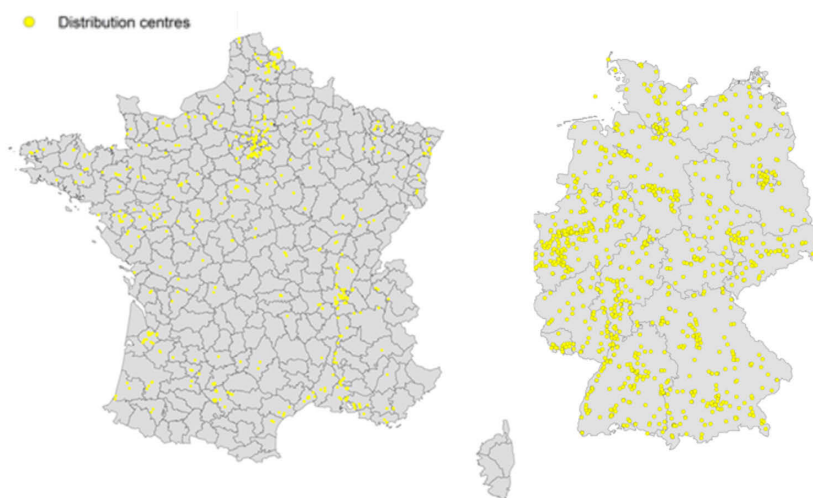


Fig. 5. Distribution centers in France and Germany.

Source: TradeDimensions (2012).

TradeDimensions data: supermarkets, consumer markets and department stores use a lot of third party warehouses and distribution centers, whereas discount retailers use primarily their own (internal) distribution centers. Exceptions are warehouses for fruits and vegetables. These are usually run by wholesalers who directly distribute the goods from their site to the discounters' POSs. All in all, supermarkets have the highest number of distribution centers, which can be related to their dense network all over Germany. Hypermarkets have only a few of their own warehouses and supplement their distribution network with several external warehouses. Furthermore, they use wholesalers' sites as distribution centers.

In Germany, discounters have the highest number of company-dedicated distribution centers, which can be explained by their big network structure of POSs and the fact that they do not use

external warehouses. For comparing retailers' internal warehouse structures, all company-owned warehouses and their related POSs were visualized in maps on the basis of the TradeDimensions data. Through the visualization of the affiliation of POSs to DCs, dissimilarities between different retail formats become apparent.

Fig. 6 compares exemplary spatial patterns of a supermarket chain's distribution centers with those of a discounter in Germany. The lines demonstrate the links between the distribution centers (indicated in yellow) and the POSs (indicated in blue). Firstly, a decentralized distribution structure for both types of format can be noticed. Secondly, it becomes apparent that the supermarket outlets are supplied by more than one distribution center, whereas discounter outlets are only supplied by a single DC. The distribution centers are located outside the cities close to suburbs. Furthermore, a clear regional responsibility of all POSs is

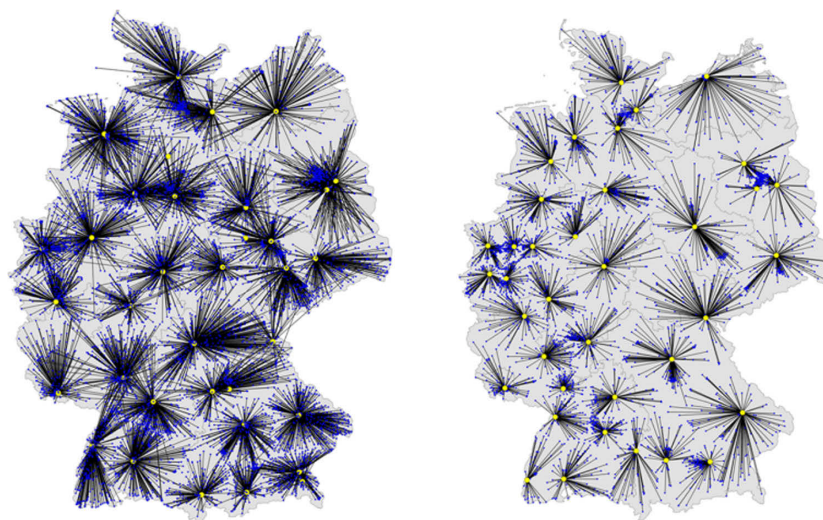


Fig. 6. Spatial distribution of a supermarket (left) and a discounter with their related distribution centers (right). (For interpretation of the references to color in the text, the reader is referred to the web version of this article.)

Source: TradeDimensions (2012).

noticeable. The number of discounters' distribution centers is higher in rural areas. Due to the denser DC network, the distances between discounters' DCs and POS are the shortest. These findings can be considered as representative for all other German supermarket and discounter chains.

As far as relations of locations are concerned, consumer markets and other large scale food retailers show the longest distance between their warehouses and DCs and their outlets. Moreover, there are several overlaps so that one outlet tends to have several supplying DCs. DCs tend to be located in the middle of the POSs they deliver to, whereas non-company owned, third-party owned warehouses complement the supply chain structure for supermarkets, hypermarkets and a few discounters.

Furthermore, Fig. 6 seems to indicate that discounter-distribution centers deliver to less POSs than a supermarket-distribution center. Looking at all forms of discounters and supermarkets, though, this conclusion has to be reneged. In this case, it is not sufficient to look at the number of outlets which are supplied on average by one DC only. It is important to take into consideration the numbers and ranges of assortment offered at a POS, in addition to its spatial presence. Discounters with a small number of articles (800–1000 articles) and hard discounters such as Aldi or Lidl, have the smallest territories per DC, with an average of 50–120 POSs per DC, whereas there is no difference between the service POSs per DC for discounters with a large assortment and supermarkets. Difference between the latter two categories can be related to the number of total stores and their regional presence, though. Furthermore, it can be noticed that the discounters with a bigger assortment belong to retail groups that operate several differently branded chains with various types of retail formats. Depending on the size of their outlet network, a DC serves up to 250 POSs. In terms of consumer markets and hypermarkets, the number of outlets that are served by a single internal distribution center can range from 50 to 150, supplemented by several external DCs. These usually supply goods such as beverages or pastry and bakery products. The comparison shows that, in general, differences in retail logistics are closely linked to the retail format as well as to the assortment breadth and depth. This is even applicable within retail holdings: retailers who own different retail formats operate different logistics strategies and also different logistics sites for each of their chains.

Assessing the number of DCs that serve one single grocery site, this number ranges from 1 to 5 DCs. 96 percent of all discounters are served by such a dedicated DC, whereas the other formats are served on average by more than one. Smaller supermarkets are served by 1.4 distribution centers. For grocery stores with more

than 400 m² the number of related DCs rises to 1.6 DCs per supermarket, whereas we have 1.9 DCs per consumer market and 2.2 DCs per department store. According to these numbers, it can be concluded that the number of DCs and warehouses supplying an outlet rises with the size of the outlet's sales area. The average distances between POSs and the company's own DCs range from 25 km to 125 km and is closely related to the density of the DCs in an area: the higher the density of the DC network, the smaller the distance between DC and POS.

To allow a comparison of similar retailers and their distribution structures, Fig. 7 shows the spatial distribution of one French supermarket chain and one German discounter chain (same chain used as in Fig. 6). The figure reflects the more centralized distribution structure in France compared to the structure in Germany. Against the background of the interviews and the data analyzed, it seems that logistics developments follow two spatial patterns:

- Polarization: logistics facilities are increasingly concentrated in very large metropolitan areas at the (relative) expense of medium sized cities and rural areas.
- Logistics sprawl: warehouses are moved from core urban areas to suburban and exurban areas.

There are some further particularities of French food retailing which need to be pointed out: Even though retailers have regional DCs in France, much of the distribution is made by at least one DC which is located near Paris so that in total each POS—no matter if discounter, supermarket or hypermarket—has at least two supplying DCs.

The logistics organization for large retailers is based on the geographical breakdown of the country in a few logistics regions (e.g., five for Auchan and nine for Intermarché). The number of logistics regions is the result of the arbitration between the transport costs and the costs of such logistics hubs. On average, DCs dedicated to food deliver to POSs within a range of 300 km. Regarding the TradeDimensions data for France, the median of the POS numbers delivered by each DC is 79, the average is 143 (Bahoken et al., 2014).

Further to the described concentration phenomenon for supermarkets, this is also applicable for discounters. Besides the central DCs, Fig. 7 demonstrates that, even though we find regional distribution centers in France, the DC structure of French supermarket-retailers is much more decentralized than that of German discounters.

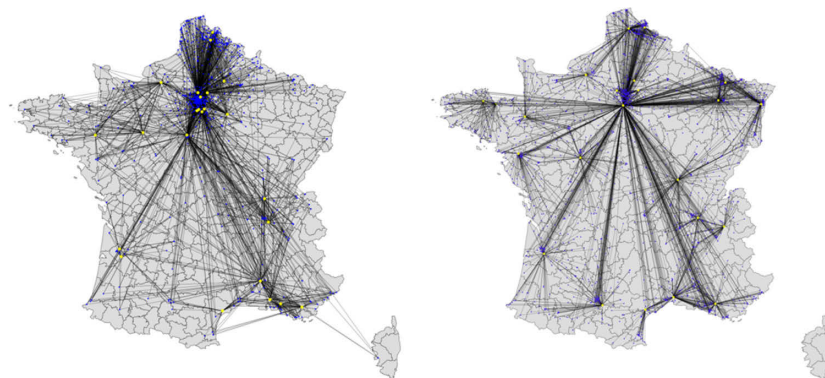


Fig. 7. Spatial distribution of a French supermarket (left) and a discounter with their related distribution centers (right). Source: TradeDimensions (2012).

5. Summary and impact of findings on freight modeling

The above analysis has revealed that for the same market in adjacent countries, in this case food retailing in France and Germany, differences as well as similarities can be found in distribution patterns and supply structures. In both markets a trend towards an expansion of the total sales area and an increase in the total of food stores can be observed. Also, both food markets are dominated by a small number of retail groups in the food sector which generate about three quarter of all food sales. There are some noticeable differences, though. The network of retail outlets is denser in Germany than in France, and the successful retail formats in each market are different, too: whereas in Germany discounters make the most turnover, in France the format of hypermarkets is more popular.

By considering the features of the POSs together with the spatial patterns of their DCs, the present analysis of distribution structures was deepened. The research investigated the link between the characteristics of food retail systems (formats, size of POS) and the geography of their DCs in France and Germany. The analysis of the distribution structures indicated that distribution centers are located nearby agglomerations of POSs in both markets. The detailed comparison of food retailers in Germany and France shows, however, that the spatial distribution of DCs is not only related to the availability of resources (infrastructures etc.). The spatial pattern also depends on the specific retail system's characteristics. In fact, the geography of DCs is strongly related to the format and to the size of stores. Nevertheless, a more regionally oriented catchment area of DCs in Germany became evident during the analyses, which is reflected by a decentralized structure of DCs. The analyzed data and interviews for France and Germany also confirm the conclusions of Andreoli et al. (2010) that the recent trend in the geography of retailers' warehousing has also been driven by industry consolidations and the microeconomics of big-box retailing, where advantage is gained from economies of scale in production, sourcing, and distribution (Bonacich and Wilson, 2008). Furthermore, there are still national specificities behind the macro forces of globalization. In addition to these complex systems of country, location, format and size-specific differentiation, food-retailers develop specific logistics' organizations by type of product: grocery, household and personal care, beverages, perishables, frozen food or general goods.

What are the implications of these findings on transport modeling? The identified structural and spatial differences have an impact on freight transport with respect to (driven) distances but also in regards to characteristics of routes. As stated above, the reasons for such different spatial patterns are multiple and not always easy to assess: historical developments, influences of regulations by law, as well as geographical and demographical structures are some of them. It became clear that framework data such as turnover is not by itself sufficient information when it comes to modeling freight transport. Also, information about the number of outlets, types of retail format, assortment and sales area help to increase precision. In a comparison of freight transport structures it can be noted that, despite their geographical and structural vicinity, even two adjacent countries such as France and Germany have very different spatial patterns for their food retail related distribution transport. As different national structures affect transport demand and transport flows, a future challenge will be to find a way how national differences, which effect transport demand, can be reflected in transport models.

In this context another challenge for international transport modeling, which also impacted the research works for this paper, is the availability of data. The data available for different national markets varies significantly: definitions for classes of goods differ as do periods for which data is collected, for example. Even

comparable data that one would assume easily accessible, such as turnover or number of outlets can be difficult to find due to differences in definitions. In the case of food retail, for example, this means that in terms of food turnover it is not always clear whether statistics include sales of specialized stores, drugstores or others. We experienced that even the figures for the total number of outlets for one country differ significantly from one source to another. As a consequence, direct comparisons of markets are difficult, and conclusions drawn for one market cannot necessarily be transferred to another market. Even data which seems to be similar at first sight is not automatically transferable. Only when it is established that markets contain comparable structures and are characterized by the same parameters are analogies feasible. Friedrich (2010) addresses another data restriction which occurs when it comes to data needs for freight transport modeling: statistics concentrate on traffic or number of vehicles but often lack in considering logistic systems.

Therefore, as far as international freight transport modeling is concerned, the analyses of structures of one country do not necessarily allow the modeling of structures of another country. Data needs to be sourced, its compatibility needs to be ensured and structures have to be compared in detail for each country separately. Trans-border traffic analysis also needs thorough investigation in regards to the comparability of information available. This complexity is further enhanced by the fact that time periods of data collections by official statistics bodies often differ between countries as well as by the fact that classes of goods are not yet defined on an internationally applicable level.

Standardization of data would therefore be one of the essential steps needed in order to facilitate successful international freight transport modeling. Such international data standards would allow for easier comparison of markets to analyze their structures and modeling of international freight transport interfaces. Such international data standards become even more important in the context of big data. If such standards are put in place, big data can contribute to building the basis of international freight transport models. This could enable the simulation of more efficient global transport chains, helping to find approaches for reducing supply-chain emissions and ensuring that transport infrastructure can be used in an optimized way. If not, big data will remain an accumulation of numbers.

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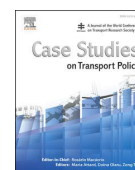
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One goal, one approach? A comparative analysis of online grocery strategies in France and Germany

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ABSTRACT

With an ever-growing variety of sales formats, food retailers are striving to cover all customers' needs. This includes setting up online sales, which involve adjustments in companies' logistics processes. This paper reveals which logistics processes are affected and what effects these changes have on the transport and logistics of groceries.

The paper examines the following questions: 1) What are the characteristics of the online grocery market? 2) Which challenges do retailers face in the online market? 3) And what strategies, in particular which logistics and distribution strategies, do they use to meet these challenges and with what success?

The research is based on expert interviews combined with in-depth desk research. The paper focuses on the German and French online grocery market, where the forms of supply differ greatly.

Applying a systematic research methodology, the paper first describes what types of online grocery services are currently available, mainly distinguishing between home delivery and collection options. The different patterns of storage and picking are compared in terms of their strengths and weaknesses and by assigning them to a modular scheme. The next step examines logistics processes and online sales-related distribution strategies, whereby most challenges are shown to be operational and optimisation is a challenge due to low margins. Consequently, existing location structures are often used, but new ones are also created. A typology of online logistics strategies and distribution organisations is derived with regard to the impact of online sales strategies on the logistics and transport structure. The paper concludes with a discussion of these impacts and an overview of future opportunities.

1. Introduction

The supply of food is a basic need. In order to satisfy the diverse needs of consumers, food retailers offer a wide range of formats, from convenience stores where consumers can make everyday purchases, to hypermarkets or supermarkets that combine low prices with a wide variety of product choices and which focus more on weekly purchases. Multi-channel distribution is playing an increasingly important role in this context. For retailers, the satisfaction of the needs and requirements of customers are at the heart of their efforts. Today, most food is still sold via physical stores, which are often characterised as “bricks and mortar” stores. The range of products on offer and the size of the sales area are generally used to differentiate the various types of bricks-and-mortar store (Seidel et al., 2016a). Thus, different formats of store concepts and channels (namely, online marketplaces) have been set up and

adapted to demand, especially from the local or surrounding clientele.

As well as within physical stores, which still represent by far the largest proportion of food retail, groceries are also offered online. E-commerce is already well established for most product groups but online groceries – especially fresh food – is still bottom of the league in terms of the total share of product groups sold online. Nonetheless, the online turnover of groceries is showing continuous growth and it is expected to comprise up to 2.5% of the European food market by 2023 (IGD, 2019). Given the increasing sales during the Covid-19 pandemic where online grocery sales have nearly doubled, this growth could even be much higher.

Despite rising sales figures, the online division of bricks-and-mortar groceries is still mostly in deficit. Online distributors have developed different approaches and strategies that try to address this problem, with the aim of enabling profits in the sale of online grocery. It is noteworthy

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that these strategies vary between different countries and include all elements of the supply chain, including the type of online provision. A first obvious distinction is that of the transfer of online-ordered groceries. The delivery of online grocery sales can be carried out in different ways. We can distinguish delivery to the customers' home, to a pick-up point, or at an outlet of the grocery retailer.

In contrast to physical shopping, customers can make purchases regardless of their location during the ordering process and independently of shop opening times. E-commerce is therefore also defined as distance selling. According to Yrjölä et al. (2000), online shopping can be described as electronic order processing by households, combined with the ensured delivery of the packaged order. The type of order and whether it is submitted online, by telephone or in any other format, is not actually relevant, but rather how and where the goods are assembled and delivered to the customer. The key difference from physical shopping is that both the compilation and delivery of the finished shopping basket of e-grocery are the task and responsibility of the retailer, not the customer. For companies this is relevant as it has an impact on their total cost structure, logistical operations and staffing needs. Achieving a last-mile delivery becomes the key success factor for grocery sales once they enter the online market (Punakivi and Saranen, 2001).

The various aspects of online groceries have been analysed in great detail. There are some studies dedicated to food purchasing behaviour such as Grunert and Ramus (2005) who focus on the determinants of consumer intention to purchase food online or more recent ones such as Mortimer et al. (2016) who focus in their study on the experiences of online shoppers in relation to the frequency of online shopping. In relation to the retailers' perspective and different approaches to the distribution of goods there are also works: for example, Gevaers et al. (2014) and Seidel et al. (2016b) have looked at innovations in last-mile logistics, Agatz et al. (2008) address logistical challenges of internet fulfilment in a multi-channel context, while Boyer et al. (2009) focus on challenges that occur at the last mile. In relation to deliveries, there are also recent works such as that of Wagner et al. (2021), which examine the impact of subscriptions on deliveries. Changes in supply chains are considered by Yrjölä et al. (2000), Fernie and Sparks (2018), and Boyer and Hult (2005) among others, in whose work e-groceries provision is mostly viewed as an extension of the supply chain whereas the upstream supply chain is often left out. Wollenburg et al. (2018) conducted a comprehensive study on changes of supply chains for online grocery retail and give first hints on structural differences between countries and companies. They could figure out three, or considering the subgroups six, different concepts. 1) holding on original distribution structures 1.1) deliveries originate from stationary network (POS) 1.2) additional solo pick-up points are set up for online orders 2) independent online DC that only focus on online orders DC 3) setting up channel-integrated DC. The authors see further research need in addressing differences of cost structures and the analysis of cost-benefits ratio. A first schematisation of distribution strategies with the result that operations planning can be structured according to fulfilment and delivery concepts depending on the development stage, market, growth and efficiency has been developed by Hübner et al. (2016). The extent to which approaches differ between countries and whether they are linked to specific forms of supply is not considered. But the offers of online groceries may differ from country to country and also between neighbouring countries like Germany and France. The question arises as to the effects that differing forms of supply have on logistics and transport and whether a scheme can be drawn up that can be applied to different markets.

Building on previous research studies, this paper presents results from an empirical analysis of retailers offering online groceries. The focus is on the following research questions (RQ): 1) What are the characteristics of the online grocery market? 2) Which challenges do retailers face in the online market? 3) And what strategies, in particular which logistics and distribution strategies, do they use to meet these challenges and with what success? Against the background of the various offers of online food that exist, the question also arises: Are

logistics solutions tied to specific types of e-grocery services?

The following analysis will consider the neighbouring countries Germany and France. These are among the European nations with the highest turnover in food retailing. Both food markets are highly competitive, making entry into online business therefore difficult for many "bricks and mortar" retailers. Whereas in Germany home delivery is the first choice for online groceries, the *drive through* (hereafter called *drive*) to pick up previously online ordered and prepared baskets of groceries is the dominant delivery format in France.¹ The results of these analyses will enable academics and practitioners to gain a better systematic understanding of online food practices.

The analysis focuses on e-grocery services as retail food products and other household supplies. These can also be classified as fast-moving consumer goods (FMCG) as these kinds of consumer goods are usually purchased in short repurchase cycles as they are products of daily use. The paper is structured as follows: in Section 2 the materials and methods are introduced. The research results are presented in Section 3, and follow the subsequent logic: based on the results of the interviews and the literature analysis, first the characteristics are described, followed by a presentation and evaluation of the resulting challenges and strategies. The paper closes with a discussion and conclusion in Section 4.

2. Material and methods

This paper aims to provide insight into the background to the introduction of online grocery and to understand what changes have taken place in retailers' distribution and procurement of goods. Based on the assumption that this may differ between countries, the two chosen for the analysis are Germany and France, which despite their proximity appear to take varying approaches to implementation.

Building on an in-depth literature analysis, the core method applied in this study is extensive qualitative and empirical research in the form of expert interviews.

The author has monitored the grocery market and its developments since 2013, and the first short interviews for gathering insights into food retailers' online efforts were conducted in 2015. The results of these interviews were published in Seidel et al. (2016b) and formed an important basis for the design of the underlying questionnaire for the interviews considered in this article. However, the guided qualitative interviews which build the basis for this paper were conducted from 2017 to early 2020 with a variety of experts from the field of online retail in France and Germany. The interviewees held different positions; among others, they were responsible specifically for organising online grocery transport and logistics, or they held positions as managers of location strategy, distribution organisation, of warehouses, or of e-commerce operations. Some interviews had to be conducted up to three times – to obtain specific "strategic information" or to add company data to the questionnaire. A total of eleven interviews were held with six companies in Germany and France (three for each country) in 2017, 2019, and 2020.

The interviews were semi-structured and comprised the following parts: general characteristics of the e-distributor, the e-grocery business model, procurement and inbound logistics, logistics organisation, consumer/ordering behaviour, last-mile strategies and challenges from the retailers' perspective. The interviews were transcribed and the responses categorised by systematically summarising. Subgroups were also formed. The following Table 1 shows an example of how the sub-categories were formed.

This procedure enabled a better comparability between the interviews and a derivation of a typology of online logistics strategies and distribution organisations.

¹ According to Nielsen (2019) 81% of all food online sales was generated via *drives*.

Table 1
Example for setting the subcategories.

Quote from a retailer	Main category	Subcategory	Subcategory	Details
'It varies, so we are supplied daily by the central warehouse and sometimes only once a week by the direct suppliers, e.g. [...]. However, we do not order on demand, i. e. we set up a stock and the customer can order on the basis of the stock and not the other way around.'	Procurement & Inbound logistics	Origin of goods	Product-based	- Direct deliveries from supplier
				- Transshipment via central warehouse
		Strategy of stock	Traditional	Forecast-driven
		Frequency of delivery	Product-based	- Weekly - Daily

The results in Section 3 are chiefly based on findings from the expert interviews carried out, and partly complemented with literature review. The results are presented in the following order:

- 1) Customers and products
- 2) Delivery formats
 - a. Drive through (hereafter called *drives*)
 - b. Home deliveries (HD)
- 3) Supply and transport chain organisation
- 4) Organisational structure.

First, the individual points are described with regard to their design and characteristics in the respective countries. This serves to answer RQ1. The presentation of each aspect is followed by a derivation of the challenges (RQ2) and strategies (RQ3) to meet them. Results are then systematically summarised to form a typology of strategic organisations.

3. Results

3.1. Customers and types of product

Customers and their (shopping) needs are the focus of retailers' efforts. The following analyses therefore look first at the customer side of e-commerce.

3.1.1. Customers

According to Nielsen (2019), 22.1% of French households now buy everyday products over the internet and have them delivered to their homes. The *drives* concept (see subsection 4.1.2) has a customer base of about 26.7% of French households, but with a higher average shopping basket, at €68, than HD (home delivery) with €42 and a higher frequency of purchases (eleven versus five purchases per year).

The French interview partners gave an insight into their customers' profiles. In their experience, half of their customers visit the *drive* on their way home from work and around 50% of customers use the *drive*

service once a week, often also for weekly shopping. The starting point for their pick-up drive are the workplace and the home in equal parts. Regarding the age of customers, around two-thirds are below 40 years old and slightly more women use the service, especially women with children living in the household. Looking at the job situation, one third are in leadership positions. The interviews confirm market observations. The *drive*'s customers remain more family-oriented and generate more purchases in comparison to home deliveries.

In the German interviews it was not possible to obtain profiles for the collecting customers, but this was possible for home delivery. The current target group for online sales can be summed up as families, dual-income households with no children, and working people with limited time for grocery shopping. Retirees and pensioners are a customer group that has a lot of potential, but is currently under-represented. Reasons for this can be attributed to the fact that only a small proportion shop regularly online.²

Unlike in France, German customers see little added value in collecting goods. They prefer home delivery (Morganti et al., 2014). According to a study by McKinsey & Co., collecting goods only becomes attractive with a delivery fee of at least €3 (Joress et al., 2016). The retailers are aware of that fact and choose their offers accordingly.

3.1.2. Shopping basket

Customers often distinguish between products for which they want to make a choice on their own and products which are standardised and where the choice can be left to third parties (milk, butter, noodles, canned food, beverages, and hygiene articles, for example). This is reflected in the shopping baskets. Hygiene articles such as nappies or toothbrushes but also coffee are the bestsellers whereas frozen products are the least likely to be found in the *drive* shopping cart. In recent years there has also been an increase in the number of bio-products. Also, home delivery shopping baskets contain only a few frozen articles. The bestsellers of the *drive* include fresh dairy products. The share of fresh food online is mostly below 10%, but with a higher proportion at *drive*. The German online shopping cart is similar, with frozen and fresh products making up less than 10% of the shopping cart.

Shopping basket sizes are often larger than in a retail store. Considering the country specificities, this is especially true for Germany. The average number of items purchased is up to 1.7 times higher than that of customers who buy in a traditional hypermarket. This trend has also been noted by market experts in France (Dauvers, 2020).

3.1.3. Challenges and strategies

The dense and extensive store structure of German food retail outlets does not encourage customers to shop online. One big challenge is therefore to attract new customers. Customers' expectations are high and the willingness to change the procedure of the usual purchase of physical shopping is low. It is not only that the customer often finds it difficult to leave the choice of products, especially for fresh foodstuffs, to others, but they also want to see added value for changing their existing behaviour – if possible without surcharge. These challenges have already been addressed in the literature. The literature review of Gruert and Ramus (2005) suggests that especially people who are online a lot, so-called people with a 'wired lifestyle', tend to buy online. The analyses also propose that retailers' online concepts are particularly successful when they emphasise a combination of convenience and information-intensive foods (ibid.). However, it has turned out that willingness increases once an order has been placed and the customer has had a positive experience. Also, analysis by Mortimer et al (2016)

² Internet usage for reason of shopping decreases with increasing age. If 22.5% of all persons between 20 and 29 years order at least once a month online, only 3.1% of the people 70+ surveyed buy their goods online at least once a month. The shopping basket was not considered in the survey (Poleshova 2020).

show that customer satisfaction determines trust for both infrequent and frequent online grocery shoppers. If a positive experience occurs, the hurdle to ordering from other e-grocers is also lower. Encouraging customers to place their *first* order is therefore the real challenge. In order to simplify the ordering process, retailers make every effort to ensure the layouts of their websites are as clear as possible. The development of apps has also been considered by almost all providers, and IT plays a prominent role in this. Many providers take the recording of frequently ordered products into account and in some cases also enable the storage of standard shopping carts.

Compared to the non-food shopping basket, grocery shopping carts contain a large variety of products, but their value is much lower. Because of this, a large number of goods is needed to obtain the same value as non-food items (around 40–50 versus three non-food articles). Therefore, the composition and delivery of goods involve increased requirements, but the profit margin is lower. By setting a minimum order value, retailers are trying to increase profitability. The minimum order value has the side-effect of reducing ad hoc orders and increasing the tendency to order weekly purchases. These are not only more lucrative, but also easier for both retailers and customers to plan for the procurement of goods.

3.2. Delivery formats

Successful delivery to the customer is crucial for overall success (Morganti et al., 2014). “Successful” here means, besides a punctual delivery, a handover of the products in good condition both at pick-up and via home delivery. In the following, the different forms of delivery are considered.

3.2.1. Drive

The interviews showed that the concept of the *drive* plays an important role in the development strategy of French supermarket chains and is often used to expand their catchment area. Companies see an opportunity to gain market share in areas where they have no business. Another advantage compared to HD is that customers themselves assume responsibility for the “last mile”. Meanwhile *drives* are located in all departments of France and are represented in larger numbers than hypermarkets. The latter are mostly located near urban areas, and often near motorway junctions.

An interviewed site manager stated that the *drives* are also located in competitive areas. The legal requirements and costs of opening a new point of sale (PoS) are in the end higher than for establishing a location for a *drive*. The goal of the opening is thereby often the acquisition of new customers.

The product assortment, depending on what kind of *drive* is considered, range from about 1400 (rarely) to more commonly huge assortments with up to 39,000 references. Through an extensive assortment, *drives* often provide a greater offer than supermarkets and hypermarkets. The size of *drives* covers 200 to 400 m² and with adjoining storage area of 3000 to 5000 m². In view of the large assortment, total number and nationwide distribution of *drives*, the *drive* can be said to have become a hypermarket of proximity in all areas – urban, suburban, peripheral and rural.

However, apart from the breadth of the product range, research has shown that different types of *drive* can be distinguished. *drives* are almost exclusively used by bricks-and-mortar retailers to transfer the online ordered groceries to the consumer. There are some “click and *drive*” outlets where the customer parks his or her car on a platform and a grocery store employee places the goods in the customer car’s trunk, while others have vending machines or others – in fact the majority of *drives* – feature a reception area similar to that of a shop. These *drives* can be divided into solo and connected *drives*. Furthermore, based on the investigation in France, a distinction directly related to the storage of the goods and the transport chain is possible. The following classifications can be made.

3.2.1.1. Drive at store. This kind of *drive* is placed right next to a point of sale (PoS), a demarcated area in the car park. The *drive* staff members place orders directly in the trunk of the customer’s car. Ordered food is picked by employees of the attached food store. All goods offered in-store are also available at the *drive*.

The model “*drive* at store” is often attached to large stores like hypermarkets so that pickers have to cover an area of up to 10,000 m². The picking rate is about 60 articles per hour.

3.2.1.2. Coherent drive or drive accolé. Although this type of *drive* is connected to an existing hypermarket, it has its own warehouse on site. The warehouse is smaller than the PoS. The online ordered products originate solely from the warehouse. In addition, there are employees who work exclusively for the *drive*. The warehouse is optimised for picking so that the picking rate is up to 200 articles per hour. The disadvantage compared to the *Drive* “pick in store” is a smaller product range.

3.2.1.3. Isolated drive with attached dark store or drive isolé. For the isolated *drive* a new location without a supermarket next door is opened. There is a dedicated warehouse on-site for the *drive*. This kind of *drive* is usually located in the catchment area of a competing supermarket, and is often located near motorway intersections. The dark store is sometimes partly automated to reduce the number of employees at the site. The *drives* analysed in interviews were supplied every two days. The stock of fruits and vegetables is very low so that sometimes a supply more frequent than every two days is needed.

Some of the *Isolated drives* also function as marketplaces. Products that are not in the inventory of the retailer are directly delivered to the *drive*’s site and handed to the customer with an e-grocer’s FMCG.

3.2.1.4. Isolated drive without dark store. Among the newer forms are *Drives* without an attached warehouse, which open at new locations without being connected to a PoS or dark store. These *drives* can also look like collection stations with refrigerated compartments. The “isolated *drives* without dark store” are delivered directly from the online warehouse. The completed and picked orders are distributed from the online warehouse to the different isolated *drive* sites according to a “hub and spoke” system.

3.2.1.5. Piéton. The pick-in concept of inner-city supermarkets is actually not a *drive* but a concept for pedestrians. In 2019 there were 76 Piétons in France, most of them in Paris. The pick-up by car is not possible due to limited (and sometimes non-existent) parking space. This model has a counter within the supermarket. The assortment is, with around 10,000 articles, much larger than in the usual local inner-city stores. Therefore, this concept is especially attractive for customers without a car that enables driving to a hypermarket on the outskirts. The online ordered groceries are delivered from a dedicated online distribution centre. A delivery is available within 16 h if required. There is often a minimum order value of €30.

3.2.1.6. Click and collect/collection service/‘Abolstation’. This is a concept for collection in the stores from lockers, at a special counter at the PoS itself or in an extra isolated area with separate entrance. The picking, i.e. the compilation of the goods, of products usually takes place in the store. Only in some cases are the ordered groceries also delivered separately from an online distribution centre (mostly in connection with lockers). The place of picking varies depending on the provider. These models have more than 20,000 references (even those with about 80,000, including non-food, have been found) in France, so that their assortment can be compared to the assortment of hypermarkets. In Germany, this model of collection service is currently the only offered type of *drive* service. Picking takes solely place at the PoS.

So, there are diverse ways to organise the storage and picking for

getting orders ready for collection at the various types of *drive*. There are three different places of origin and storage of the online offered products: at the point of sale, in a local warehouse at the pick-up point (dark store) and in a distribution centre specialising in online orders. The latter can be regional or national.

In France, all three storage and picking concepts can be found, whereas in Germany, with its current focus mainly on home delivery, picking for *collection service* takes place exclusively in stores.

3.2.1.7. Challenges and strategies. With the attached *drives*, the shop area corresponds to the warehouse. The warehousing and picking for the online ordered products take place in the attached PoS. The advantage of this kind of *drive* is that there is no need to develop a new area for the opening. It is often assumed that this model has the advantage that its organisation allows synergies and economies of scale – not least through standardised logistics organisation, joint stock management, and reduction of storage costs – but, as the interviews revealed, this is often a false assumption. The model seems inefficient; there are increased costs due to greater complexity. In many cases there are conflicts in the inventory as the inventory management system is reaching its limits. The shelves at the PoS serve as an online warehouse with the result that there is a risk of running out of stock, with consequences for shop costumers but also for online shoppers. The availability of the products can fluctuate – for instance, products may still be available at the time of ordering but no longer during the picking process, so that the replacement of goods or the need for smaller shopping baskets can be the result. If this occurs it may be necessary that higher levels of stock are needed at the PoS and, depending on the order volume, an adaption of the store infrastructure (arrangement of shelves, for example) may be required. Also, the picking costs are very high as the products are not arranged for efficient picking, but arranged to attract customers in-store.

From experience and in order to increase efficiency, some retailers have adapted the arrangement of their shop products to online environments. This can include establishing so-called buffer zones where specific products that are in high demand, or which may be very heavy or bulky, are placed. Others connect small warehouses, dark stores, to the *drives*. Mostly these places act self-sufficiently, but there are also locations where the picking at dark stores can take place in combination with point-of-sale picking. In this case, products that are ordered particularly often are stored at the dark store and are only accessible to pickers. Products that are not in frequent demand are added from the PoS. The local storage of groceries at the point of pick-up make a quick response possible (up to two hours' lead time for click and collect service).

In recent years, and against the background of the establishment of *drives* as an existing sales channel, the first steps have been taken towards the introduction of warehouses that are exclusively responsible for online business. In this case the finished commissioned goods are brought to the pick-up point. The advantage is a more efficient and cost-effective picking, but the lead time for the order is higher so that the response to customer orders is less spontaneous. Also, the cost of opening such a warehouse is only worthwhile when companies offer online services on a larger scale.

Table 2 lays out the strengths and weaknesses of the various concepts.

3.2.2. Home delivery

Besides the *drives* there is also the possibility of having the picked groceries delivered to customers' homes. This method of delivery is the most widespread across the world. In France, home delivery for groceries is most common for urban areas where Paris is the biggest region. Preparations are currently underway to extend the offer to cities with over 10,000 inhabitants throughout France. This development has been accelerated by the Covid-19 pandemic.

Also, in Germany, home delivery is especially offered in cities. Often

Table 2

Strengths and weaknesses of different organisation of storage and picking for *drive* concepts from retailers' perspective.

	Online Distribution Centre (DC) for <i>drive</i> or Piéton	Store picking	Dark store at <i>drive</i> site
Strengths	<ul style="list-style-type: none"> • Inventory • High in labour efficiency • Two-stage order- picking possible • Semi or fully automated • Choice of location adapted/ optimised to online grocery (catchment area) 	<ul style="list-style-type: none"> • Use of existing supply chains • Use of existing sites • Small initial investments • Use of a (wide) range of shops • No further land development necessary • No duplicate stock-keeping • Capital investment low • Expansion into "new regions" is easier at first because there is no need to build an expensive warehouse beforehand 	<ul style="list-style-type: none"> • Arrangement of products enables fast picking • Requires only small areas in contrast to large online warehouses; can also be located in urban areas • Customer proximity
Weaknesses	<ul style="list-style-type: none"> • New development of areas/ territorial coverage is necessary • High investment costs at the beginning 	<ul style="list-style-type: none"> • Assortment limited to PoS stock • Challenging data synchronisation • Assortment and stock levels vary from store to store • Low in labour efficiency • Single-step picking • Arrangement of products not ideal for fast picking • Low storage capacity • Faster out of stock/risk of stock-outs • Competitive to sales-in-store influences shopping experience for customers; orders ready for pick-up can block paths in the store • High incoming orders can lead to refilling during operation even at high frequency times 	<ul style="list-style-type: none"> • Smaller assortment than online DC or hypermarket • Small warehouse structure (hardly any economies of scale) • Higher initial investment compared to store picking • If connected to a PoS, it will require a sufficiently large area for implementation (usually only available at hypermarket locations)

the whole assortment is offered by the retailer and can be ordered, whereas hardly any offers exist for rural areas. The offers in rural areas are often limited to durable foodstuffs. The interviewees stated that an expansion of the service for rural areas would be possible and there are considerations regarding how this could also be implemented. The main obstacle is high logistics costs, not least due to the wide distribution of customers. The legitimate question arises as to what surcharge the customer is, or would be, willing to pay. Since the willingness of customers to pay is low, there have been no attempts to extend this service to all types of food. According to the interviewees there is consequently a

limitation to non-fresh products. The range of non-perishable products is sometimes larger than in local shops. In some cases, the range is also being expanded – for example, test products (with a possible takeover later in the shop), special offers or pet food.

In rural areas and smaller towns, where a comprehensive range of products is not yet being offered online (mainly no provision of fresh groceries), food is delivered by a conventional transport service provider. On the other hand, the areas already developed for the online offer of the entire range of food products are covered with the companies' own logistics operations.

According to the offered assortment, in cities home deliveries are offered for the whole assortment which is also available in store. Sometimes, depending on the trader, additional products are also offered. These additional product offers rarely feature fresh food but rather non- and near-food articles as well as promotional products.

While the volume of orders is highest at the weekend, deliveries take place between 6 a.m. and 10 p.m. from Monday to Saturday, depending on the supplier. Agreeing to the interviewees, early morning times and slots after 6 p.m. see the greatest demand. To complete the ordering process, customers usually have to reach a minimum amount of the shopping cart value. Delivery in Germany is seldom free of charge. The amount of the surcharge depends on various factors: shopping cart value, time of day and size of the time window, delivery area, number of customers ordering nearby and other factors.

In Germany, delivery is carried out by the retailer itself, whereas in France the interviews revealed that for delivery some retailers have partnerships with companies that have a lot of experience in delivery, like Ocado or Amazon. In France, home deliveries are made almost exclusively with a service provider, although one specialising in food and fresh products. During the pandemic, where many people have been unable to go out shopping, some retailers have also started cooperation with logistics companies like Uber Eats or Deliveroo to offer (extended) home delivery services. These services are mostly limited to smaller orders as many deliveries are made by bicycle. This offer is mainly limited to the Paris region, however.

As with the *drives*, the origin and storage of products for online dispatch and the starting points of delivery differ. The delivered groceries can originate from a PoS or from a warehouse or distribution centre. The latter can be distinguished between original warehouse location/distribution centres (already used for delivery from PoSs), with a separate area for goods intended solely for online orders, and a new location for exclusive storage and order picking for online food. Home delivery is mainly offered in cities. Here the model of in-store picking often remains in place, above all in thinly populated areas. In big cities like Paris (where most retailers have their main focus) or conurbations like Lyon or Marseille, some retailers have set up new warehouses specifically for online groceries. Nevertheless, the French online department stores still have their focus on the *Drives*. In France, picking in the stores is often handled by service providers. In Germany, on the other hand, the picking is done by retailers' own staff at the PoS as well as at the warehouse.

In contrast to the supply undertaken by conventional supermarkets, home delivery is primarily carried out by sprinters. Since the onset of Covid-19, smaller orders are also possible, and these are delivered by bicycle or cargo bikes. In the overall picture, though, this is a relative exception and mainly limited to city centres.

3.2.2.1. Challenges and strategies. The main challenges reported by interviewees are the place of storage, picking costs and last mile.

Once the decision has been made to offer goods online, test markets are first established. In these test markets, customers are supplied from a supermarket. The disadvantage is that the area of stores is limited so that in areas with a high order volume, pickers and customers compete with each other. Furthermore, interviewees stated that a store-based pick up often leads to problems in merchandise management so that as soon as

the online offer moves beyond its test phase and the online customer base expands, deliveries are only made from purely online warehouses in Germany. In France, fewer retailers use dedicated online warehouses as the starting point for their deliveries. The problems with home delivery, especially during its introduction, are often a lack of logistical know-how, coupled with long preparation/commissioning times, low productivity, and high logistics costs. This is then reflected in higher product prices and up to two days' lead time for deliveries. Both these factors make it unattractive for customers. To counteract this, many retailers have entered into co-operation with logistics service providers, both for warehousing and the last mile, and have started to establish new locations for exclusive online distribution.

The interviews revealed that different types of warehouse are used for online groceries. Some retailers dedicate a specific area for online orders in existing warehouses, others are establishing new locations. These new sites are usually strategically chosen to ensure optimal supply to the entire area. They are therefore often located on the outskirts of cities, sometimes even within the urban area. The new warehouse locations are partially or fully automated to speed up the picking process. The design is strongly related to the budget that is planned and made available for the online business.

The interviews confirmed that intralogistics is often decisive in order to be able to act in a cost-neutral way. The highest possible efficiency is necessary in order to be in the black. Picking constitutes a large proportion of costs; in consequence, the costs per order should be kept as low as possible. According to the interviewees, the costs per order are between 60 and 75 cents. The aim is to reduce the total time spent on ordering by (partially) automating the process. In fully automated warehouses the minutes per order can be limited at up to five minutes. The downside of this model is the high initial investment costs. Furthermore, this model is only profitable if a certain order size is reached. The interviews confirmed that it takes a certain time to reach full capacity. The initial investments can only be generated through profits from bricks-and-mortar stores. Through automation, saving of staff costs can be made as only about 60% of the employees are still needed. In non-automated warehouses the pickers walk up to 15 km per day. These "footpaths" are completely eliminated in fully automated warehouses, as the goods arrive fully automated at the picker.

The biggest challenge is the last mile, regarding a successful delivery and optimisation of routes. For an optimisation of routes some interviewed retailers started to establish and use micro hubs between their online warehouses and their customers. These micro hubs can be of various types, and in mobile or fixed locations. Rare but in use are larger transport vehicles which can be used as mobile hubs, while other retailers use containers. The local hubs can be differentiated between newly developed small sites or micro fulfilment centres with a similar surface area compared to smaller shops. Existing shops are also sometimes used as hubs. The micro hub model is often chosen when an online warehouse is responsible for a large catchment area.

The efficiency of a tour is strongly dependent on the length of the tour and the number of customers. The latter is not only dependent on the volume of orders and the number of available vehicles. As a rule, up to 25 orders would fit into one delivery vehicle, but the length of the stops rarely allows more than 10 to 15 customers per tour. The stop length depends heavily on the order quantity (weight and volume), and accessibility of the building and parking situation (flat, floor, house, with/without lift). Besides parking, traffic jams and entering the delivery address are factors that cost valuable time. The traffic flow cannot be influenced, but attempts are being made to shift delivery windows to less busy hours. To reduce the time for entering customer addresses, one of the interviewed retailers has implemented an IT system where the various processes of ordering, customer address and routing do not have to be keyed in multiple times. This system integrates all delivery information in a single application. Therefore, time savings during the tour can also be gained through smart IT.

Home delivery usually requires the presence of one person from the

household at home. To avoid missed deliveries and to guarantee the presence of the customer, a time window for delivery is agreed in advance. This is done either by the customer actively booking time slots during the ordering process itself or by offering fixed time slots for delivery in certain (postal code) regions. For a successful delivery, IT extends to communication with the end customer. Customers receive a notification as soon as the goods are in delivery. Some providers inform customers that the goods will arrive in 30 min, others offer live tracking or a notification regarding the distance of the deliverer to the place of delivery, for instance the number of stops remaining. Due to the perishability of some products, among other factors, usually only one delivery attempt is made.

The fact that relatively few customers are willing to pay for convenience of delivery, and who find it easy to receive their purchases in an allocated time window, brings further complexity into the economic model of online grocery service. Agreeing a time window for delivery increases the first-time hit rate, but adds complexity to route planning (which is a challenge in itself). With conventional deliveries to PoSs, not only are the delivery points well known, but also the delivery frequency and quantities are already highly optimised. Unlike the shop network, the points of contact change daily due to customers' irregular ordering behaviour (Fig. 1). There are no fixed contact points, so present routes cannot be firmly established.

To generate better predictability, retailers try to encourage regular orders from customers. This can be done in different ways, and incentive systems such as discounts are usually chosen. By marking time windows in which deliveries within a radius have already been agreed upon, customers are encouraged to choose their delivery windows in a similar time window. If this is successful, orders can be better bundled in one area and tours can be optimised. Nevertheless, the offer of time windows often implies that the shortest routes are not taken, which therefore leads to a significant rise in kilometres driven and in costs (Fig. 2). Gevaers et al. (2009) calls this the ping-pong effect. The offer of defined time windows for the handover to the customer makes real-time planning necessary.

A more recent work also addresses the issue of delivery windows: Wagner et al. (2021) find that especially the choice of narrow delivery windows and short time spans between order and delivery increase logistics costs. For example, a delivery window of three hours is 3.045% more expensive for a company than a delivery window of nine hours (ibid.).

Furthermore, consumer density is mostly not high enough to operate at a tolerable level of costs. Same-day delivery presents a major logistical challenge in terms of costs and planning complexity. With more lead time, routes can be better optimised. Therefore, delivery offers are rarely for the same day but normally have a lead time of between 24 and 72 h.

Most retailers' concepts are based on the hub and spoke system, but it should be considered whether in many cases a point-to-point delivery would not be more appropriate. Another approach is that of the "milkman" principle. The aim is to use fixed routes to reduce drop costs and achieve better capacity utilisation per tour. However, this has an effect on the supply offer, as no individual delivery times can be selected by the customer. This model has not so far been used by the interviewed retailers.

The main differences in the offered delivery service is that France

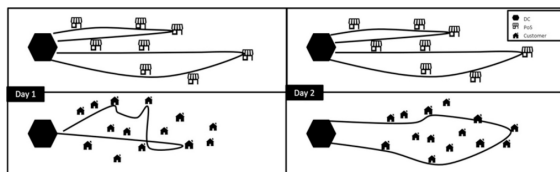


Fig. 1. Simplified display of tours for the delivery from PoS (above) and home delivery (below).

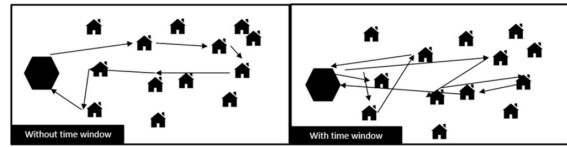


Fig. 2. Delivery without and with time window (author's own graphic based on interviews and on the results of Boyer and Hult (2005)).

relies mostly on *drives* where the last mile is left to consumers. With regard to home delivery, most French retailers rely on transport service providers, specialising in food, for delivery to customers whereas German bricks-and-mortar stores make deliveries to their customers themselves.

From the results, the existing forms of offer can be represented as follows (Table 4):

3.3. Supply and transport chain organisation

We can distinguish supply chains according to how they appear in different standard transport chains. Distribution structures can be classified according to various parameters. The classic approach distinguishes three distribution structures: decentralised, centralised, and direct. Another approach is that of Gudehus (2010), who argues that the tiered nature of a supply chain arises from the number of intermediate stations through which goods pass from point of delivery to point of receipt. Gudehus distinguishes five steps from direct running up to four levels of supply chain. Taking both approaches into account, we can see that the food sector in France is characterised by centralised and in Germany by decentralised distribution structures (Seidel et al., 2016a). These structures go along with three to four steps from supplier to points of sale (see Fig. 3). However, in both countries there are rather decentralised structures in the online grocery retail landscape. By applying the approach governing numbers of intermediates, the following picture emerges:

At first, with the introduction of online commerce, the upstream supply chain as such is not changed (Fig. 3(1)). Mainly changes in the front-end logistics occur, at least with regard to home delivery. When the first *drives* were opened and connected to existing shops, the supply chain did not initially change. The number of intermediates remained the same. But the picture is different when considering the establishment of a stand-alone "drive with dark store". Even though dark stores are often delivered from distribution centres like points of sale, this means an extension of the supply chain as it entails a new delivery location. With the establishment of online-dedicated warehouses, an extension by means of a further intermediate level of the supply chain has occurred (Fig. 3).

As long as the goods for home delivery have been assembled at the PoS, the upstream supply chain also remains the same. In the latter case, however, the supply chain has been extended, as the retailer is responsible for delivery to customers' homes. With the expansion of the online offer and the development of new locations for dedicated online warehousing and also with the use of micro hubs, the original supply chain has changed. This modification can take the form of an additional trans-shipment location or a change in the destination location (Fig. 3).

The various types of online offer as well as the different storage and picking locations were examined in the previous Section 3.2.

3.3.1. Challenges and strategies

The already existing optimised supply structures and supply chains of retailers represent both an advantage and a disadvantage. Bricks-and-mortar retailers have the edge over start-ups, for example, as they already enjoy an established supply chain. Their distribution structure is already optimised for the cost-efficient distribution to points of sale. However, the distribution of online food presents different challenges

Table 3
Decisions to be taken by retailers (based on interviews).

Steps	Relevant Factors	Examples	Necessity
1. Decision for new distribution channel	Product-related factors	Storage and transportability of the products Range of products	Adaption and expansion of information technology (IT)
	Company-related factors	Existing network of points of sale experience	
	Customer-related factors	Open-mindedness towards new offers Purchasing habits of the target group	
	Competitive factors	Number of competitors Market position of competitors	
	Legal factors	Competitors' offers Regulations governing the handling of foodstuffs Guidelines and regulations for the opening of sites Density of customers	
2. Decision from where to start delivery	Customer & area offer	Already established network	Turnover and market power of the company
	Existing network (PoS + DC)	Turnover and market power of the company	
	Available budget for expansion and redesign	Own assets Road network	
	Infrastructure	Guidelines and regulations for the registration obligation for opening sites, food hygiene requirements, etc.	
	Law/legal factors	Dry food – service provider can be used (Germany) Whole assortment → delivery by the retailer on its own (Germany), service provider (France) Drive or HD	
3. Design of the last mile	Assortment	Location Expectation	Food hygiene and transport requirements (Online) warehouses, PoSs and hubs
	Type/offer profile		
	Customer (as new participant in the distribution system)		
	Legal requirements		
	Network of the retailer		

than the previous structures can meet. The quantities to be picked at the warehouse are much smaller than those for stores. Customer proximity is also very important for quickly meeting demand and providing good product quality. Central distribution structures are therefore not particularly suitable.

Depending on the company, logistics costs account for 15–20% of sales prices. A modification is therefore equivalent to savings potential. As a consequence of the duration of, and retailers' varying levels of experience in, the online business, most providers have adapted their supply chains. In order to be able to better guarantee the response time to orders, proximity to the customer is a great advantage. The author's analyses revealed that e-commerce alters the original chain, not only on the last mile, but also in the preceding stages (see Fig. 3 and Section 4.3). New locations close to the customer are developed. Depending on the

size of the catchment area and customer density, several small online warehouses or a large one are set up, which are then supplemented by small (micro and mobile) hubs. These hubs are delivered like PoSs from online warehouses. Smaller vans then take over for last-mile delivery to customers' homes. There are also approaches for using the existing shop network as a distribution centre, both for collection and as a hub, which therefore represents a starting point for home delivery (Section 3.2).

All new (micro-)fulfilment locations, which are more scattered than the original warehouses for the delivery to PoSs, are as close to the customer as possible, and are optimised for efficient picking for smaller quantities than those DC for the PoS. These micro-fulfilment locations can take on different forms, with some connected to existing points of sale while others are opened in the outskirts of cities or in the surrounding area with a good connection to the catchment areas. There are also hybrid models, where already existing warehouses are extended by means of an area reserved exclusively for online business.

When picking in the store takes place (store-based picking system), the process chain of stationary retail is only extended by the process elements of delivery logistics. This is the case in France and in some testing areas in Germany. Few companies retain this model later in an advanced stage as the picking costs are too high. In addition, store picking can lead to competition between picker and customer but, more often reported and far more relevant, to problems with store inventory management (see Section 3.2).

In the case of advanced companies, the upstream transport chain is also evolving (Fig. 3). When *drives* function as marketplaces, this opens an additional supply chain from the supplier directly to the *drive*. Fig. 3 illustrates the different transport chains and highlights the changes that take place when online grocery is additionally offered by retailers.

New places of origin of goods – that is, new suppliers – appear in connection with online food, when a new assortment is established. This is the case when, for example, shipment regions act as test markets for new products, the online shop also functions as a marketplace (for the sale of products not yet listed in the range) or if products are offered which can only be purchased online (not listed in the range).

The main differences between France and Germany are, on the one hand, the online offer and, on the other, the fact that French retailers use specialised transport services for delivery. In Germany, transport services are only used by retailers for the delivery of durable food. In addition to the development of new areas for the storage, handling and picking of goods, new areas are being developed in France for the collection of goods, the *drives*. In Germany, instead, the new site development focuses on the distribution centres.

3.4. Organisational structure

Before introducing e-commerce, it is first considered which model is suitable, where it is often not clear whether the chosen model can be applied in inner city, urban and rural areas. Since online business is loss-making, especially in the beginning, and the number of customers is a major factor, most retailers focus on large urban areas first.

The interviews revealed insights into the different steps taken when bricks-and-mortar retailers decide to offer a new distribution channel. Highly simplified, three main steps have an effect on the shape of the online grocery model. The analyses have enabled an identification of factors that are decisive for the various forms of online food supply and logistics. These are summarised in Table 3:

To increase customer loyalty to the retailer, a name similar to the stationary banner is often chosen for online sales.

3.4.1. Challenges and strategies

For many retailers, the introduction of online sales first represents new territory. In order to gain initial experience, many bricks-and-mortar outlets start by offering easily transportable products such as dry goods and non-food. Until sufficient experience has been gained, some retailers also enter into cooperation with experienced partners.

Table 4
Existing types of e-grocery service design, on a modular principle.

	Design forms				
Assortment	Full assortment	Partial assortment including fresh food up to full assortment 1400–39,000 references Dry food + non-food			Full assortment
Type of offer	Drive & HD	Drive	Drive & HD	HD	Drive & HD
Storage & picking	At PoS	At dark-store	At local distribution centre/ Separated area at existing warehouse/DC	At central distribution centre/ Separated area at existing warehouse/DC	Specialised distribution centre only for e-commerce
Degree of automation	Manual	Partly automated			Partly automated Fully automated
Delivery area	Last Mile HD Delivery within the city limits		Delivery within a certain region		Nationwide International
Lead time	2 h		24 h		72 h 2 weeks
Delivery time window	Within 1, 2, or 4 h		2 h		no no
Delivery	Own service (G)	Service provider (F)	Own service (G) Service provider (F)	Service provider (G, F)	
Price model	Minimum order value and service fee	Minimum order value and service fee	Minimum order value without service fee	Only service fee	Service charge
Payment methods	Cash on delivery	Credit card	PayPal	Invoice	Instant bank transfer/ direct debit Prepayment
Goods transfer	Type of collection point Click and collect at counter in store		Click and collect at parcel locker	Drive	Piéton
Opening	Monday – Saturday		Monday – Saturday (rarely Sunday) 7 days a week		Monday – Saturday

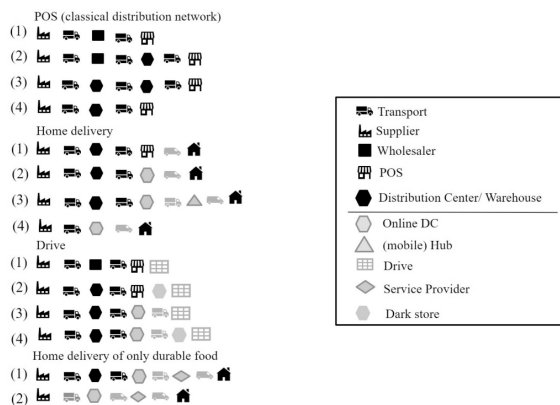


Fig. 3. Transport chains in online grocery: existing bricks-and-mortar structures coloured in black, changing and new structures coloured in grey.

This has happened in the field of storage and distribution as well as in the realm of delivery.

For retailers, cost optimisation and the satisfaction of customer needs have always been the focus of retailers. Now with online commerce, the customer is at the centre of all efforts to first of all satisfy the customer and to achieve a certain market penetration. Cost optimisation is of secondary importance, even if it is essential for survival in the long term. Nonetheless, the challenge is to optimise costs in order to achieve purchasing profits. The customer represents a planning uncertainty due to his or her irregular purchasing behaviour. Due to the mostly irregular receipt of orders, it is difficult to plan routes in advance and these are usually only planned on a daily basis. Customer locations change compared to store locations, which remain the same. Retailers therefore provide incentives for customers to order regularly (see Section 3.2).

Besides logistical challenges, discussed in detail in Sections 3.2 and 3.3, the challenges also include technical ones. IT plays a major role, not only the part that is visible to the customer such as the structure of web

pages and how simple the websites are to navigate, but especially the adaptation of internal processes. With the offer of online shopping, retailers need to shift their category management processes away from a product-centric approach and more towards a consumer-centric one, in order to align themselves with shoppers' preferences and preferred paths to purchase. Retailers use machine learning to enable demand-driven inventory placement. The goal is to have a product database of good data quality across all channels, regardless of whether they are operated separately (multi-channel) or as part of a network (omni-channel). If systems succeed in being intelligently networked so that procedures do not have to be keyed in multiple times, large processes can be optimised and high costs saved. This also applies to logistics.

4. Discussion and conclusion

This paper has looked at restructuring in the field of logistics in stationary food retailing by offering food products online. On the basis of expert interviews with online food retailers, combined with in-depth desk research the paper compared the strengths and weaknesses of different patterns of storage and picking, and the various forms of offers were assigned to a modular scheme. The analysis has also shown that different offering models require the implementation of varying storage and picking processes, resulting in different challenges to the supply chain organisation. The implementation is primarily linked to the strategy of the retailers. Nevertheless, the steps and their main influencing factors could be systematised. Overall, it could be determined that the supply chain is influenced by the design and type of service offer as well as by the selection of the type of storage location at the storage site. Customers act as new participants in the distribution system and IT plays a paramount role in taking this into account as efficiently as possible.

Looking at the grocery markets in France and Germany, there are diverse solutions in different markets. In France, online groceries are mainly processed via the *drive*, whereas in Germany home delivery is preferred. The approach and concepts in both countries are very different, but have the same goal: to keep customers, be competitive, increase sales and attract new customers. The evaluations showed that the main challenges for the online sales of groceries are of an operational

nature. Low profit margins in particular present a challenge so that efficient order fulfilment and delivery are essential for e-grocers.

In both markets a highly competitive intensity in food retail makes low logistics costs an essential competitive factor: this is why retail companies rely on sophisticated and automated procurement procedures. But logistics are of strategic importance when linking the online and stationary sales channels. However, logistics are often determined by inefficiency and historically evolved processes instead of being aligned with the new sales channels. Thus, one could say online grocery is still in its infancy in terms of logistics. But with the growing customer base and the experiences gained since the beginning, these structures are gradually improving and there are more and more efforts by retailers to reorganise their distribution. In contrast to offline distribution, where procurement and warehousing structures have been centralised over years, decentralisation is now occurring in some areas. Smaller online warehouses are being opened close to customers or, if central structures remain, larger central online warehouses are being opened, supplemented by regional transshipment points/(mobile) hubs close to customers and conveniently located. Due to the new interlinking of locations, this results in an increased volume of traffic on the retailers' side.

Furthermore, the claim to be able to respond flexibly or even spontaneously to customer wishes/orders is associated with high costs. However, due to the related increase in costs, food retailers are very interested in optimising the last mile. As a consequence, they have developed a variety of tools (see Sections 3.2 and 3.3) to smooth routes and orders and to make better forecasts. In the future, further options have to be created to reduce logistics costs. Cooperation between retailers on the last mile could be one option for further reducing costs for retailers, whilst at the same time contributing to the reduction of distribution-related emissions. Establishing these will be difficult due to the competitive situation, but enormous cost savings, which could be gained by bundling and by improving the efficiency of last-mile transport, are attractive. Growing pressure to cut back on transport-related emissions, particularly in urban areas, where inner-city driving is more and more restricted, could be a further incentive. It is important to investigate the user expectations of both retailers and final customers towards such bundling on the one side. On the other, research into potential traffic and emission reductions related to such consolidation needs to be undertaken.

What do these developments mean for (passenger) transport? *Drives* have so far had little direct impact on passenger transport. Their indirect impact is not to be underestimated though. Particularly in peripheral, semi-urban areas the replacement of local shops by centralised *drives* makes it impossible for customers to shift from a private car to more sustainable forms of traffic, as food shopping requires the use of a car. Whether the supply chain for the retailer remains the same depends on the location of the *drive*. If it is adjacent to an outlet, not much changes. If it is drive-only and centrally located in an industrial area, major simplifications may be realised by the retailer: cheaper locations, fewer staff for the sales floor, easier storage of goods. Locations that are additionally developed as a *drive*, and that are not connected to existing locations and do not replace existing outlets, mean new supply points and partly also new supply chains as additional, purely online warehouses are set up for delivery.

As far as home deliveries are concerned, we are currently seeing a continuing increase in the number of shipments, further accelerated by the Covid-19 crisis which has brought online grocery to the fore (as of November 2020). The mixture of confinement, avoidance of public spaces and even the limiting to small gatherings of people have all contributed to making local shopping more difficult or even impossible, and may even have had a favourable effect. Next year this development will probably be statistically apparent and will show whether there has been sustained growth in online grocery sales. A work by Dannenberg et al. (2020), who studied the impact of COVID-19 on the grocery market, confirms an increase in the online grocery market, but also notes

that retailers are primarily trying to meet and successfully fulfil the increasing order volume rather than to expand the offer to new areas. The authors also state that even e-grocery services experienced an extraordinary growth during the pandemic crisis this does not yet indicate a long-term shift from stationary to online grocery retailing.

Compared to store deliveries, distribution is far less optimised; on the one hand, the transported units are much smaller and, on the other, the "uncontrolled" order behaviour leaves little room for optimising delivery tours and routings. This also results in more traffic as the existing shops continue to be supplied as usual and the tours driven for home deliveries are added. As regards customers, the question arises as to whether online grocery shopping at least changes their mobility behaviour positively. This is not easy to answer since it is unclear to what extent online purchases actually substitute journeys taken for individual shopping trips or whether they are made rather as a supplement. If the latter is the case, then an increased traffic flow is to be expected. Additional research in this area is needed to shed light on the question of whether online grocery shopping means supplementing or replacing physical shopping. And beyond that, what customers do with their newly acquired free time. Do they make other trips?

The development of e-grocery services also raises issues about the future design of supermarkets. Will there be a change in the physical retail landscape? Since there are few fresh products in the shopping cart, especially with HD, it could also be conceivable that the PoS could focus on freshness and reduce the amount of shelf-stable food and non-food products and thus also the amount of retail space in future. The interviews also revealed that once online grocery becomes firmly established, this provides an opportunity to reduce the number of physical stores. This could be attractive for retailers as maintenance costs as well as personnel costs in the warehouse are less expensive than those that have to be spent for a full-service grocery store. But what does that mean for the local supply and for employment? The effects of online trade on transport and urban development are therefore a particularly fruitful area for further study.

CRedit authorship contribution statement

Saskia Seidel: Conceptualization.

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Innovations in e-grocery and logistics solutions for cities

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Abstract

Offering products via the internet is affecting the traditional “bricks and mortar” retail structure. But, as selling online products is not successful for all types of articles, not all retail branches are affected similarly by internet sales. Groceries are still a niche in online trading but are expected to grow fast. In this article, we want to compare France and Germany, where the rise of e-grocery has arrived almost at the same time although with considerable differences. We focus on innovative concepts in e-grocery as well as their consequences on transport and logistics.

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Keywords: E-grocery, Food retail, Final deliveries, Logistics, Home delivery, User behaviour, France, Germany

1. Introduction

Today we have widespread internet access in most countries, 76% in Europe (ITU 2014), which makes it possible to get in contact with each other easily. That also applies for communication between companies and people. The accessibility of reaching people via the internet is further advantaged with growing smartphone penetration. The internet offers the possibility for retailers to get in closer contact with consumers. Furthermore, it offers not only the opportunity of sharing information, but also of adding another distribution channel. Many retailers make use of it and, by adding another distribution channel, become cross-channel[†] retailers. But also other filière-players use the internet

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[†] also known as multichannel (sales channels are independent) or omnichannel retail (all sales channels are integrated)

to sell their products. Consequently, these days there is almost nothing which cannot be ordered online. Even groceries are making their debut and can be ordered online.

Besides the United Kingdom (UK), France and Germany are the largest European distance selling markets, worth respectively €63.4 billion and €51.1 billion, of which about 54% refer to goods and 46% to services (Ecommerce Europe, 2014). These countries are also the three biggest European food markets with €183bn for France (2013), €175bn for Germany (2013) and £175.5bn for the UK (IGD, 2014). Food online sales compared to total sales are relatively small but are expected to double by 2016 (cf. table 1). While in 2011 only 4.5 million people in Europe stated that they have ordered food online at least once, about 15 million stated that in 2014.

Table 1. Current turnover and forecast in online food retailing for selected countries. Source: IGD, 2013.

Country	2012 (€ bn)	2016 (€ bn)
UK	7.1	13.7
France	5.0	10.6
Germany	1.1	2.5
Netherlands	0.6	1.6
Switzerland	0.7	1.1

A short look at e-grocery development

The sustainable online grocery development in France and Germany started later than in the UK, where an offer of e-grocery by “traditional supermarkets” started at the beginning of the year 2000 (Linder and Rennhak, 2012). At this time Ocado and Tesco introduced e-groceries in the UK, and all major UK grocers followed around 2006 (O’Farrel, 2014). Therefore the UK can be seen as the European pioneer in e-grocery. At the beginning of the year 2000 online shopping for food was also marketed heavily in other European countries. But companies had more start up difficulties there. Many companies were quite optimistic and invested in e-groceries, e.g. Otto in Germany or Telemarket in France. But after only a short time, most e-groceries stores closed down (including Telemarket and Otto). As it turned out, these companies were ahead of their times. Besides slow internet connections which probably made the internet ordering/shopping inconvenient and time-consuming, also the high logistics costs were likely another reason for the lack of success. As reasons for their failure, failed companies claimed their problems were mainly high storage costs, picking and logistics costs, and the complex delivery requirements for fresh food, especially for the last mile segment. Another reason for the developmental disruptions could be that internet access was not as dense as today and people only began little by little to shop online. Then, only a few years later, when the internet found its way into everyday life, some companies restarted their efforts.

As the different size of turnover shows (cf. table 1), e-grocery plays out in every country differently. We also find different e-grocery concepts favoured in different countries. Accordingly, there is no one-size-fits-all approach for online food retailing. “Click and collect” (CC) and “home deliveries” (HD) are the two main possibilities which can be distinguished. But within these two possibilities, retailers try to find more innovative solutions to differentiate themselves from other e-retailers.

Aim of the present paper

In this article, we want to compare France and Germany, where e-grocery was introduced almost at the same time but varies in its form and speed of development. The two neighbouring countries have different commercial and sales structures for food. Looking at grocery shops, differences in size of stores, in selling concepts, and in offered assortment (e.g. frozen food stores, popular in France and scarce in Germany) are to be found (Seidel et al. 2014). Furthermore, the types of retail formats are dissimilar: discounters dominate the German food market in the number of points of sale (POS). With a total turnover of €62.1bn, which represents 44% of the grocery market share, discounters have also the highest turnover of all formats (USDA Foreign Agriculture Service, 2012). In contrast, discounters in France hold a market share of only around 10% (Bosshammer, 2011) and the highest share of food

turnover is generated by large hyper and supermarkets. A difference in consumer behaviour can also be considered: German households spend around 11% of their total consumer spending on food and non-alcoholic drinks whereas French people spent around 13.5% (BVE, 2012). Differences occur also regarding food e-commerce. As mentioned above, all major food retailers in France and the UK offer e-groceries at least via one way (CC or HD) whereas in Germany only a few food retailers offer e-groceries.

In France, where e-groceries are mainly offered in combination with “Drives” (a “click and collect” form of online shopping with access primarily by car, also known as “Click & Drive”), e-grocery was introduced around 2004 with the opening of Auchan’s Chronodrives. The greatest success of the Drive-concept was in 2012, when the number of Drives exploded from 1,000 in 2011 to 1,700 in 2012. Today all French major actors of the food retail sector have entered the e-grocery market, mostly in combination with Drives. This development is also reflected by the number of Drives (cf. table 2). In 2014, with about 2,110 more Drive sites than hypermarkets (2,022) can be found in France (DGE, 2014).

Table 2. Drive characteristics in France. Source: DGE, 2014.

Type of Drive	Number	Number of customers (in thousands)
“Picking” (Drive next to supermarkets, no storage)	1,446	332
“Déporté” (Drive with dark store, with storage)	421	989
“Accolé” (Drive next to supermarkets with storage at site)	223	722
Total	2,110	2,042

In Germany, a revival of e-grocery started around 2009 when Rewe set up a drive-through concept in Cologne. A new impetus to the German online food market was then added when Amazon announced they will soon start to enter the food market by selling groceries online. Many companies hope by offering e-grocery before Amazon, and thereby being part of the early movers, they will succeed to stay in the market or to be at least one step ahead of Amazon. This strategy was successful in the US, where US retailers who moved early won market share in the longer term. In the US, Amazon, with about 22,000 customers, is the biggest provider of e-fresh food (Rudarakanachana, 2014).

To be successful in the “new market” e-grocery, dealers try a lot of innovative concepts, on which we shall focus our attention. As an additional step of the technological innovation process, we consider, as suggested by Raul Green and Michel Hy (2002), use of the internet a powerful component in redefining supplier-retailer relationships. In this context the following questions arise: Who actually offers e-groceries? Why are these actors interested in e-grocery? What are the constraints and what are the opportunities for e-grocers? Is logistics a constraint or a driver for the success of online fresh food?

Most literature spotlights consumer preferences and/or behaviour, whereas comparably few consider logistics, e.g. Huebner et. al (2014). Others like Vanelslander et al. (2013) consider the most commonly used supply chain (SC) and analyse these in terms of optimising logistics costs. We consider that the logistics issue is essential and, following the work of Hesse (2002), Paché (2002) or Kessous (2001), we think that e-grocery will sustain and extend market shares by controlling logistics.

By analysing innovative e-grocery concepts which stand out from other food online offers, we want to explore how logistics requirements are considered. Thereby, the term “innovative” involves two dimensions for us. First, we shall examine new players that are trying to enter the food market and who have not been in contact with consumers before, known as “filière players”, or providers that have not handled food before. Second, we shall look at marketing concepts that stand out from other e-grocers’ concepts. The present begins by reviewing different solutions for fresh food and analysing them in the context of the following five points: Institutional context (including law), economic context (level of competition), actors involved in e-grocery, spatial context, and consumer patterns. The review is based on recent scientific publications and professional literature. Moreover, online press, press releases and homepages of several online grocery offers as well as annual reports have been gathered and analysed. Additionally, short interviews with different e-grocers in France and Germany were conducted. Building on this, the next section proposes an analysis of the framework conditions, as well as of the drivers and constraints, particularly regarding the role of logistics, of

the e-grocer concepts. The last section discusses the results in light of current territorial factors underlying the observed evolutions.

2. Innovative solutions in e-grocery in France and Germany

In our research we identified eight innovative concepts in France and Germany. The concepts are analysed in view of socio-economic and spatial contexts which explain significant differences in the development of e-grocery in each country.

2.1 Different contexts for the development of e-grocery

Institutional Context

The institutional framework conditions of e-grocery are mainly the same as for “normal” supermarkets. From a general point of view, there are no special laws, subsidy legislation or support from cities or municipalities that promote the establishment of e-grocers in Germany. However, France introduced a specific law to regulate commercial activities. Since the law of modernisation of the economy (LME) was introduced in 2008, retail trade projects with a sales area reached at least 1,000m² (from creation or extension) requiring an authorisation of commercial exploitation (AEC). Since March 28th, 2014 this obligation applies also for Drives (ALUR Law). Still in France, we can find forms of sponsors when the Chambers of Agriculture encourages farmers to develop Drives with the label “bienvenue à la ferme”. There are 54 farmer Drives with this label in France.

A general law which applies for all type of groceries but gains a special importance in the context of business to consumer (B2C) food deliveries is the regulation regarding cold supply chains. Small shipments therefore need complex treatment for different kind of products, e.g. splitting the consignment into separate boxes. The EU regulations on food hygiene (EC) no. 852/2004 and no. 853/2005, including the management system HACCP (Hazard Analysis and Critical Control Points), define the framework for the organisation of transport for fresh products.

Economic context

With respect to the competitive food market and their high market share, the “bricks and mortar” stores form the main competitors for all e-grocers. Besides these stores, other e-grocers form the competitive framework for all e-grocers.

There are different reasons for companies to invest in e-groceries. In regards to the stagnation of hypermarkets in France, the internet offers the possibility of reigniting growth in sales (Picot-Coupey et al 2009). The aim of strengthening consumer loyalty may be another reason why an online sales channel is offered by retailers (Schramm-Klein, 2003). For other “filière-players” and start-ups, e-grocery offers the possibility of entering the food market without setting up a branch network.

But it has to be noted that framework conditions such as small margins and high logistics requirements, e.g. for products which are sensitive in handling, complicate a market entry. As a result, e-grocery often turns out to be unprofitable. The early years in e-grocery development are therefore very dynamic, with changing players, as not all providers manage to make profits. One example is Ocado, one of the most successful British e-grocers, who took 15 years before being able to record figures in the black (LZnet, 2015).

Actors involved

Besides traditional (bricks and mortar) food retailers, the internet offers new opportunities for other stakeholders within the food supply chain (producers, wholesalers, service providers) to enter the grocery market by getting in direct contact with consumers. But also pure internet players and new start-ups try to enter the food market by offering food online.

By our desktop research we found more than 90 providers each in France and Germany who offer groceries via internet. As mentioned above, Drives are especially successful in France, although home deliveries (HD) are also frequently offered and used. The providers who offer Drives are mainly multichannel-retailers. By the implementation of Drives they mostly fall back on their existing branch network.

In a comparative analysis of French and German e-grocery providers, it is conspicuous that in France, mainly the “filière players” use e-commerce to diversify their offer and sell their products directly to consumers. In Germany, beside the “filière players”, who often specialise in a specific assortment, we find many individual initiatives and start-ups outside the food industry which enter the online food market and are often supported by transport service providers. One German transport and logistics service provider, *DHL*, even offers e-grocery.

Small and medium-sized food retailers rarely offer their products via the internet. In cases where they offer e-groceries, they are supported by actors specialised in e-marketing and online selling as well as by transport service providers.

Generally it can be stated that besides new players on the B2C food market, new relationships between “filière players” are also evolving. As a consequence, relations in supply chain are also changing (see 3.2).

Spatial context

Most online offers for food are accessible in cities, with big urban areas which present a large catchment area being clearly favoured (Paris, Ruhr area, Berlin). The locations of Drives are mainly located in the outskirts of cities close to working places or traffic nodes. They are often affiliated to already existing stores but are also placed at new sites, e.g. a dark store. These dark stores are retail outlets or distribution centres that provide food exclusively for online shopping. It is noteworthy that French retailers offer e-groceries nationwide, with home deliveries mainly offered in city centres, and Drives mainly in rural areas and outskirts.

In Germany retailers are still experimenting with different offers, searching for the right offer to address customers via internet. The small number of Drives (< 20) offered in a few urban areas are more reminiscent of a test phase and witnesses that the “click and collect” concept does not really work so far. The HD concept, apparently more attractive for German consumers, is therefore the most offered e-grocery delivery form. As long as home deliveries are offered close to locations of multichannel retailers, deliveries are often done by retailers’ own distributors, whereas in remote areas deliveries are made via postal services such as *DHL* or *UPS*. Pure internet players mainly rely on service providers for B2C deliveries.

Consumer Patterns

According to Bovensiepen et al. (2014), 87% of German consumers buy groceries solely in shops. The reasons why and when consumers shop groceries online has been considered in many papers (e.g. Picot-Coupey, 2009; Plachetta and Röttig, 2012; Farag, 2006, 2003, *etc.*) and it is clear that changes in consumer shopping is a material factor in redefining supply (Moati, 2009; Filser et al., 2001). Widespread internet access, which is increasing with growing smartphone penetration, facilitates the access of retailers’ online concepts for consumers. In 2012, smartphone penetration of more than 50% in France and Germany was documented (Schindler, 2013). Since then a further increasing has been recorded. Initial studies show that continued growth in smartphone penetration involves a shift in internet user behaviour. As a result changes in the way consumers’ access internet services have been recorded. Users are able to be always connected and have instant access to different kind of services (Erricson, 2014). Besides searching for information and checking emails, buying online has become one of the most significant online activities.

A great number of people are looking for opportunities to save time in everyday routines, grocery shopping can be one of them. Online grocers and multi-channel retailers try to adapt themselves to this development. Aiming, for example, at employed parents, e-grocers place their Drives in business areas to attract customers during the journey between their working places and homes.

When the question is posed as to how many per cent of consumers shop for food online, different answers and figures can be found. But it is sure that consumers in the UK and France shop more regularly for food online than Germans. Whether this is more related to the wider offer of online grocery in UK and France to consumer behaviour or is rather a result of both is not clear yet. But experience to date shows that food shopping via the internet does not replace but often complements traditional shopping. An interesting aspect in e-grocery shopping which cropped up in our interviews is that purchase baskets of online groceries tend to be bigger than the purchase baskets bought in shop. This might be an indication that customer expectations are different from one shopping channel to another.

2.2 Identified innovative concepts

During our research we identified eight innovative concepts which differentiated themselves from other e-grocers, in terms of concept offer or actors involved. The analysed concepts are illustrated in Table 3.

Table 3. Innovative solutions compared

Name	Location	Special characteristics
Bonduelle Bienvenue (since 2012)	Villeneuve d'Ascq (Lille region)	Send a food brand without supermarket intermediary
Diadiscout.com (2014-2015)	4 stores in Paris	Discounter Use of chilled lockers
Monmarché.fr (since 2007)	Paris region first and all over France	Direct selling wholesaler-consumer
Arcimbo (since 2013)	Villeparisis (Paris region)	Fresh-produce Drive associated with a standard Drive
Venteprivée Miam Miam (since 2012)	All over France	A general pure player that tests the sale of fresh products
allyouneed.de (since 2012)	No stores only HD delivery German wide,	Initially transport and logistics service provider More products than many POS
Kochhaus.de (since 2010)	11 stores HD German wide	Recipes with delegated products
Emmas Enkel (since 2011)	Stores and HD in 4 urban areas	Corner shop culture combined with ITC

The e-grocers in Germany presented here are mainly start-ups, whereby *allyouneed.de* has a special status as this concept is strongly supported by the transport and logistics service provider *DHL*, who is also the main shareholder of this concept. In France no service provider has so far been involved in online food retailing; all have been “filière players”.

Auchan, one of the leading food retailers in France, is one of the early movers in French e-grocery with its *Chronodrive*. In February 2013, *Auchan* decided to start a new concept named *Acrimbo*, to compensate for weak sales in fresh food of the Drive format. *Acrimbo* is a store dedicated to fresh products, primarily organic and labelled products, which is geographically associated with a Drive. *Acrimbo* offers click and collect and direct sales. Home delivery, which was originally proposed, was discontinued. Another innovative concept for fresh products is provided by *Dia*, a European hard-discounter. The company, which is mainly located in the inner cities rather than on greenfield locations and therefore has difficulties to attach Drives to its stores, introduced an e-grocery service via chilled lockers. The lockers are offered at four POS in Paris. Products ordered online can be collected in store. The French pure player *Vente-privée* has also engaged in the sale of fresh products with its concept *Vente-Privée Miam Miam* and attributes itself to short food supply chains. Two other innovations attract our attention because they constitute a real change of organisational model: *Bonduelle Bienvenue* and *Monmarché.fr*, which respectively show how industrial agribusiness and wholesalers are trying to get into the e-grocery market.

Bonduelle is a French company producing processed vegetables. *Bonduelle* products are sold through traditional distribution channels (supermarkets, mini-markets) and through catering circuits (restaurants, institutional food service). With *Bonduelle Bienvenue* and e-commerce, the company can sell directly to the end consumers without any intermediary. The store is designed like a showroom for the entire product range. The aim of the company is to develop this type of store close to *Bonduelle* factories all over France. Another example that shows that e-commerce is a way to remove intermediaries is *Monmarché.fr*, e-grocery offered directly by the *Rungis* wholesalers. The *Rungis* International Market is the principal market of Paris, and it is the largest wholesale food market in the world. Through

the new sales channel via the internet, this market, initially dedicated for professionals, is also opened to end-consumers.

All analysed German innovative concepts offer a fresh food assortment; moreover, two of them offer a full assortment. The one who limits its offer to fresh and dry food is *Kochhaus*. This multichannel retailer has assessed the competitive German food market by selling food via a special concept. Food is only offered in combination with recipes. When recipes are chosen, all required ingredients are provided. The intended target group consists of gourmets, curious hobby cooks and employed persons with limited time who have a desire for healthy or balanced meals and are interested in new cooking recipes. The concept of selling food on the basis of a recipe basis was initially offered via stores but is now also available online. In the meanwhile seven German online start-ups have followed suit and also offer this concept. The concepts of the eight providers differ in the ordering process, with or without subscriptions. But the biggest distinctive feature is if the delivery service is a national or regional offer. The concepts of all recipe-food players are quite similar but differ in one point: the origin of products. Whereas some receive their products mainly from (local) producers, others source their products also from supermarket chains. One may have thought that these differences can be attributed to their spatial presence, so that in case of a nationwide offer it is easier to rely on a German-wide supermarket chain rather than to build up a nationwide network with producers. But as our researches showed in these cases, the reverse is true.

The entrepreneurs of *Emmas Enkel* developed an e-food-retailing concept where the corner shop culture ('Tante Emma Laden') is connected with all advantages of an online shop. The primary focus of this concept is to put the service aspect for consumers in the foreground. Customers have different options to buy their food: in a store at the counter or to order via a tablet in the store, to order at home, via telephone or via smart phone on the move. Beside the different ordering proposition, different ways of how the customer can gain his products are also offered. The orders may be packed ready to collect at the store or delivered to the customer's home. To make this service possible, the store differs from normal retailers' points of sale (POS) by having a bigger storage site than the sales area at the POS. The company currently works without its own warehouses, all products are directly delivered to the shop. The enterprise, which is currently in an expanding phase, was recently joined by *Metro Group*. It is remarkable that last mile deliveries are recognised in-house as an important part of the selling concept. The founders therefore prefer to make their deliveries to consumers with their own staff rather than to outsource the service.

The last innovative concept which should be introduced here is the concept of *Allyouneed.com*. This start-up, which was founded in 2012, is 90% owned by *DHL*. *DHL*, which already had a lot of experience in shipping food products from countries of production to major clients in Europe, also decided to position itself in food deliveries in the last mile segment. Therefore *DHL* is the first transport and logistics service providers who ventures to the sale of food. In addition to selling of products also all deliveries to consumers are made by *DHL*. The therefore enterprise widened its logistics concept to make an end-to-end supply chain for food possible. As the assortment of about 20,000 products includes also fruits and vegetables, the vehicle fleet was extended with refrigerated vehicles.

Our studies showed that the marketing concept to reach customers was usually prioritised. Accordingly, logistics implementations were considered only as a second thought.

3. Consequences for transport and logistics

As explained above, most online offers for food are mainly accessible in cities. There is, however, an important difference between France and Germany. The success of Drives of French retailers allows the majority of the French population to have access to e-grocery. Home deliveries are more developed in Germany, which may explain the importance of *DHL*'s role in the development of e-groceries offers. The constraints and the investments in the last mile vary from one option to another; this also applies for the organisation of the supply chain.

3.1 Home delivery or Drive?

After the decision has been taken to offer groceries online, the next decision to be taken is how to get the products to the consumer. Even though there is much space for diversity there are mainly two options, HD or Drive (cf. table 4).

With HD, providers have to decide if they make the deliveries themselves or if they work with a service provider. As making HD themselves means a lot of personnel, acquisition, and maintenance costs, many e-grocers decide to cooperate with logistics service providers (LSP). But also LSP are not only confronted with pre-packed and palletised food but often with the requirement to take care of and/or to package food by themselves. Therefore buildings, vehicles, cargo agents and employees must comply with the requirements of food law, which is especially of importance for cold chains (food safety).

Even if food is already packed for transport, requirements differ for other non-food products. The various products must be treated differently on their way to the end consumer, regarding sensitive handling for some products or cooling where necessary; goods therefore have to be packed in separate boxes. Furthermore, all fresh products need special storage, and rapid handling and transport. Furthermore, the shift from day to hour deliveries offered by most e-grocers constitutes an increase of logistics complexity.

Table 4. Sales and logistics strategies for e-grocery. Source : own elaboration.

Sales Strategy	Delicatessen	One product	Market place	Partial range	Partial range	Entire Range	Entire range
Examples	Gourmondo Comtessedubarry	M muesli Fromages	Oekokiste Laruchequiditoui	Edeka24	Chronodrive	Rewe. Auchandrive	Allyouneed Super-u
Concept	Generally dry products not available in supermarket	personalised / local products	Same type of products of different producers or sellers offered via one platform	Dry products ordered online and delivered to consumers' home	Supermarket offers a selection of their products online	Products ordered online are ready for pick-up by customer (full assortment)	Products ordered online and delivered to consumers' home (full assortment)
Outbound logistics	HD or pick-up points (PP)	HD	HD or PP	HD	Drive	Drive	HD
logistics requirements	Few technical requirements for fulfilment and transport	Few technical requirements for fulfilment and transport	Few technical requirements for transport or in terms of PP pick-up by consumers	Few technical requirements for fulfilment and transport	pick-up in POS or dark store	High fulfilment requirements	High fulfilment requirements

Increase in fulfillment and logistics requirements



In summary, home delivery causes a lot of efforts and costs. As it is frequently unprofitable, some retailers stopped deliveries after a short time, as did, for example, Arcimbo. Other grocers do not even find logistics service providers who offer HD. These grocers are forced to switch to another delivery concept. Diadiscout is one example of a retailer who did not find a service provider for HD and had no equipment for doing HD themselves. As a result chilled boxes for picking orders up at retail branches were developed and offered as an alternative concept. This case shows that even if logistics are not prioritised when it is planned to introduce e-grocery, it can have a big effect on the implementation.

More attractive for HD are delivery solutions with only minor effects on logistics. As long as the same type of product is given, transport is easier to implement, even for hand-sensitive food. An example of the assembling of same kind of products is the concept of the delivery of boxes with only fruits and vegetables.

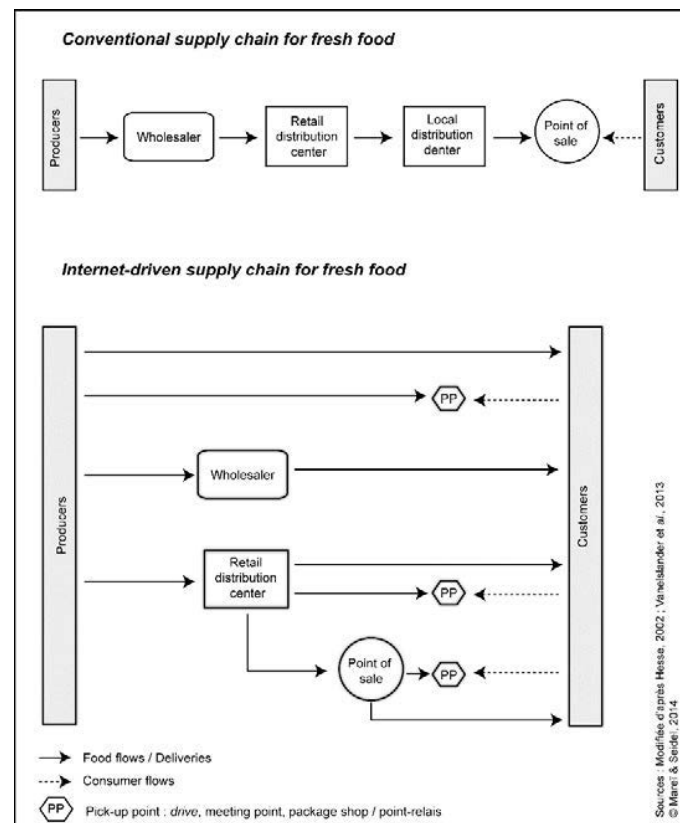
A concept where food safety does not affect the delivery is the store-based "click-and-collect" service like drive. This way of providing products to consumers is interesting as it only means additional costs for picking up goods in store or warehouse (dark store), high delivery costs are avoided. This may explain the success of Drives and all forms of pick up points (farmer drives, meeting points,) and why especially French e-grocers rely on this delivery possibility when offering products online.

3.2 Changes in supply chain

The direct selling of food from producers to consumers is not a new development. The possibility of buying food via regional markets, via catalogues (e.g. *bofrost*) or direct at the farm existed before. But the internet enhances the direct access to the consumer. For the deliveries (last mile) to consumers, new stakeholders, mainly SP, have to be involved. In this case, the direct deliveries to consumers mean two changes in supply chains: new actors involved (LSP) and a rise of additional supply chains (not only conventional SC from producer to wholesaler or to retailer but also from producers to consumers, see Figure 1). Furthermore, e-commerce offers other actors involved in food supply chains the opportunity to offer food directly to consumers. This causes changes in relations between suppliers, distributors and consumers (Figure 1), so that the changes in supply chains are about two main things: new actors are directly involved in the food B2C market (producer or wholesaler) and, directly related to this, intermediaries are skipped. In cases where pure online players offer food to consumers, it means that new intermediaries enter the food SC.

Cross-channel retailers have different opportunities from where the delivery to the consumers starts. As long as the amount of orders is manageable via their stores, most retailers' deliveries start from their POS. Another opportunity is delivery from warehouses which are suited for the pick-up process for small shipments. The warehouses suited for pick-up process can be affiliated to already existing warehouses or be located near the catchment area. Supply chains of cross channel retailers change mainly in the last mile segment. Therefore the additional sales channel often means an additional supply channel. As long as the last mile is done by a service provider and not by the retailer itself, a new stakeholder is involved in this last mile segment.

Figure 1. From conventional supply chain to internet-driven supply chain for fresh food



4. Conclusion and discussion

More and more companies offer e-groceries for various reasons. For one thing, it offers the possibility of a market entry, some (producers, wholesalers) see the possibility of widening their sales by adding additional customer groups, other companies want to secure their leading market position or see the possibility of enlarging their market share. Our interviews showed that the growth of e-grocery is currently more about strengthening customers' loyalty and gaining market share rather than a question of economic gains. This can also be seen in the French market where e-grocers do not make much profit with Drives and managers explain that making a profit is in this context not of utmost priority. However, we can see that Drives are the main tool for French e-grocers in their B2C relationship as they crisscross the country.

Which form of e-grocery is offered can be mainly related to the type of e-grocers, the type of existing branch networks and the areas where the e-grocery service is offered. The main objective and biggest challenge for e-grocers is still – as regards the question as how to get the groceries to consumers – the logistics and transport issue. Thereby, home deliveries are problematic due to the last mile and are the most challenging part of e-grocery. One opportunity, at least for German e-grocers, could be the development of a service provider specialised in last mile food deliveries. Being able to refer to an already existing logistics network would facilitate delivery to consumers. Above all, a great deal of extra work for deliveries is the moving from days to hours, and that is particularly true for fresh food, which requires close attention for storage and transport. As a result it is still to be assumed that logistics will decide the future of food online sale. Regarding effects on supply chains, three different kinds of changes were recorded in internet-driven supply chains: new actors get involved, new relations between actors occur, and additional supply methods are registered. One effect on cities in France and partly in Germany is the higher visibility of delivery services: daily, more and more delivery vehicles branded with the name of online grocers or the big service providers for food, such as Star's service in France, can be seen. As a consequence, the issue of freight transport is made more visible by e-grocers in large cities. With regard to a further increase of home deliveries, the question of managing flows and road sharing become more essential in urban planning. Furthermore, an increase in e-grocery could be reflected in grocers' resettlement location policy and so become interesting for urban development policy. More broadly, e-commerce confronts cities with storage questions, with poor availability of land next to cities, and also with the daily management of e-commerce flows with logistics issues.

Looking at the consumer side, the adoption is currently in an initial stage, whereby a bigger utilisation of e-groceries by French consumers can be recorded. The authors expect that with a further manifestation of daily internet use and a further incorporation in daily routines, the willingness to buy food online could increase. A prerequisite is that e-grocers manage to take consumer demands into account by offering simple ordering processes and guarantee speed and reliability of deliveries. Nevertheless, buying products online may remain complementary to physical food purchase.

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