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LOUVAIN School of Management

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Design of a framework to orient traditional grocery retailers toward targeting the right omnichannel supply chain strategy

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Chapter 1 : Introduction

E-commerce has known an incredible rise in the last few years and has become a fatality for all traditional retailers. While various sectors (like music, travel, clothing, ..) have been very successful in the development of online sales for their customers next to their usual activities, comparatively the grocery sector has not yet totally made the transition. The main explanation lies in the cost of last miles delivery which is quite challenging in the grocery due to product characteristics. Consequently, there are still lot of uncertainties regarding the most suitable network structure that will permit to have an optimized model in terms of profitability.

Traditional grocery retailers, with a model based on large network of stores, have already changed a lot over the past years. They have switched from a single store-based model to a multi-channel network able to respond to the online demand of their clients. However, clients 'expectations are evolving, and grocery retailers have to follow. It has led to the most recent organizational model called omni-channel. The goal of this model is to propose a seamless experience to the clients amongst the different channels. It implies that all the channels interacting with the customer must be perfectly aligned/coordinated to offer them a unique proposition.

The omni-channel concept has placed the supply chain at the centre of grocery retailers' business. Indeed, the logistic has to become much more flexible since clients are willing to buy products at the stores or to pick up product next to the stores at pickup points or even being delivered directly to their home. The internal supply chain structures of a grocer will also differ, depending on the market and the customer's expectations.

This paper will firstly analyse and develop the supply chain possible structures of a traditional grocery retailer. We will describe the different distributions means, the multiple replenishment methods and then all the characteristics involved by each of these organizations. This will allow us to highlight the "structural" variables inherent in a company.

Secondly, we will investigate the “contingent” variables that bias the declinations of these structural variables. These contingent variables are mostly function of the market and its customer’s specifications.

Thirdly, we will drive a case analysis on a global and leading grocery retailer, Carrefour, to endorse the link between our framework and the decisions that Carrefour has taken. This enable us to show that our framework is useful to guide and orient retailers in their supply chain omni-channel strategy.

Chapter 2 : Background

2.1 The grocery market[1]

The grocery or Food and Beverage sector is a section of the retail industry. According to the Cambridge Business English Dictionary, the retail sector is "*the part of a country's economy that is made up of businesses that sell goods through stores, on the internet, etc. to the public*" (Retail sector, para 1).[2]

The distribution channels include mass merchandisers (hard discounters), supermarkets and discount and local shops (Nielsen, 2017b).[3]

LARGE STORES LEAD THE WAY, BUT SMALLER FORMATS ARE GROWING MORE RAPIDLY

The grocery sector has long been composed of major players and smaller competitors. The companies that share the bulk of the cake are giant dinosaurs in addition to very innovative companies.[4]

On a value basis, large supermarkets and hypermarkets account for just over half (51%) of global sales, but smaller formats, such as traditional and convenience stores, grew at a faster rate. In fact, year-over-year sales growth in convenient stores (+6%), small supermarkets (+5%), and traditional stores (+4%), doubled, or more than doubled, that of large supermarkets and hypermarkets, which grew a modest 2% each.[5]While the U.S. supermarket chain Walmart Store, Inc. continues to hold the title of the world's largest supermarket chain in terms of annual revenue, Germany and Australia also dominate the top 100 list of global food retailers (Statista, 2016).[6] The fourth and

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[1] Definition: A grocery store or grocer's shop is a retail shop that primarily sells food.

[2] https://dictionary.cambridge.org/dictionary/english/retail-sector?q=the-retail-sector

[3] Grocery universe 2017.

[4] In the U.S., for example, the industry is made up of roughly 38,000 stores. (Walmart alone has roughly 4,600 U.S. locations).

[5] Report: "The Future of Grocery: E-Commerce, Digital Technology and Changing Shopping Preferences Around the World." The Nielsen Company. Apr. 2015. Web. 10 Nov. 2017.

[6] https://www.statista.com/statistics/…/leading-20-retailers-worldwide-based-on-revenue/

third largest supermarket chains are based in Germany and the fourth and fifth largest grocery retailers are based in Australia.[7]

The grocery market has always been a tough one, with low margins (Cooper, 2016)[8], fixed costs like food stocks and warehouses and the fact that these stocks are highly perishable when compared with other sectors. Moreover, consumer behaviour concerning food is changeable and is also quite different from one region to another. Funny fact, did you know that in Charleroi (Belgium), where in the past lot of Italians migrants came to work in mines, the demand for pasta is much higher than in the other parts of the country? This example puts into light that even in a small country like Belgium, the consumption of a product like pasta is already a differentiating factor.

DRASTIC CHANGES

For several years, the retail industry has undergone a drastic change in the way it reaches its customers and therefore how it sells its products. Industry giants like Carrefour or Walmart have been operating since their creation under a rigid and a one-path model, built around their supermarket and waiting customers to come to buy their products. This strategy was mainly reactive (Ishfaq & Raja, 2018).

The emergence of new management ways and technologies has very quickly changed the rules of game for this industry and customer experience (Deloitte, 2014). The customer is at the centre of all the attention and the competition is now focusing on how to attract/maintain customers' attention. The strategy has to become pro-active.

The impact of technology can be felt in many ways, whether it involves new ways to pay (by facial recognition, smartphone), to buy (online, in a shop), to be delivered (click and collect, home delivery, drive-in), or to be informed (Nielsen, 2015,

[7] 2016 Global Powers of Retailing report from Deloitte Touche Tohmatsu and STORES Magazine

[8] For example: In France, on 100 euros of turnover, the net margin (before tax on companies) is on average 1.3 euros for large and medium-sized retailers.

2017a). Technology has reduced the asymmetry of information that was present for so many years between the supermarkets and their customers.

In 2017, retail e-commerce sales worldwide amounted to 2.3 trillion US dollars and e-retail revenues are projected to grow to 4.88 trillion US dollars in 2021[9]. The top three online stores' revenue amounted to almost 100 billion US dollars in 2017. Online shopping is one of the most popular online activities worldwide, but the usage varies by region—in 2016, an estimated 19 percent of all retail sales in China occurred via the internet, but in Japan the share was only 6.7 percent. Desktop PCs are still the most popular device for placing online shopping orders, but mobile devices, especially smartphones, are catching up (Statista, 2018a).

At the moment, 25% of people already order groceries online and 55% of them are planning to do so in the future (Nielsen, 2017a). This trend is spreading amongst all the sectors but not at the same speed in every country. For instance, in China, the leader in term of e-commerce sales, the online retail sales represented around 12.9% of the market in 2015. Next to this, 40% of the Chinese respondents already buy fresh groceries online, while this number dropped to 9% in Europe (Nielsen, 2017a). There is still a huge difference between European countries in their e-commerce development. France and the UK are, for the moment, far ahead of their neighbours; in the UK, online grocery shopping has grown at 10–12% every year (Nielsen, 2017a).

However, sales are not only going online, which is good news for classical brick-and-mortar retailers. Are we just reliving an era of more than 50 years ago, that of the milkman? Indeed, online sales represent a complement in the service offer by the retailers to their clients.

BRICK-AND-MORTAR IS NOT DEAD

This is a point that giant e-commerce companies have understood and are putting into practice like Amazon with its acquisition of the US food retail company, Whole Foods at the end of 2017. In fact, shipping fast perishable goods can be very costly,

[9] Annex 1

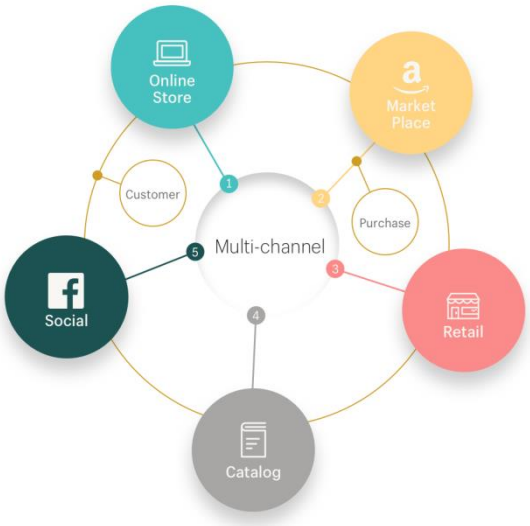
about 20% of the product's revenue. This number can drop to 3% for expensive goods like jewellery (Chopra, 2016). This is the traditional grocery retailer expertise, which can efficiently reduce the shipping costs for products with low value. Taking the problem only with a brick point of view or with a click point of view is not possible any more. We are in the era of the brick and click.

Online sales through "Click" are simply a new offer in the panel of tools provided to the customer, while the shops and "mortar" will still represent the experience of shopping. Mortar shops are here to stay, especially when you take fresh products as a reference, for which clients are still very reluctant to go online (Nielsen, 2017a).

People do not like shopping to buy their food. Indeed, only 15% of food shoppers said they like doing "food shopping" (McKinsey, 2013). Companies have to rethink the way they interact with their customers inside their stores. They need to bring back innovation and the excitement that people could have when shopping.

2.2 The main trend: the multi-distribution channels

With the development of the internet and the apparition of e-commerce, the number of ways for retailers to reach their customers has drastically augmented (Melacini, Perotti, Rasini, & Tappia, 2018; Von Briel, 2018). When they started to make use of this new online trend, traditional retailers started to propose a multiple channel service-oriented model.



This model was customer-centric, meaning that each channel built by the company was separated virtually, considered as if each channel had its own client, and was separated physically, without any cross-functional strategy between the channels, with separated teams, strategies, tools or objectives (Wilding, 2013). However, this model does not offer a good answer to an actual dynamic customer, who has tastes that are changing and who wants to travel from one channel to another and decide how they want to have access to the products.

THE STRATEGY: OMNI-CHANNEL

Following the Accenture definition (Accenture, 2014):

"*Omni-channel can be defined as a* ***synchronized operating model*** *in which all of the company's channels are aligned and present a single face to the customer, along with one consistent way of doing business. In this model, companies replace the many views of the customer they often hold today with one unified view of the customer—enabling them to respond in a consistent way to the customer's constantly evolving needs.*"

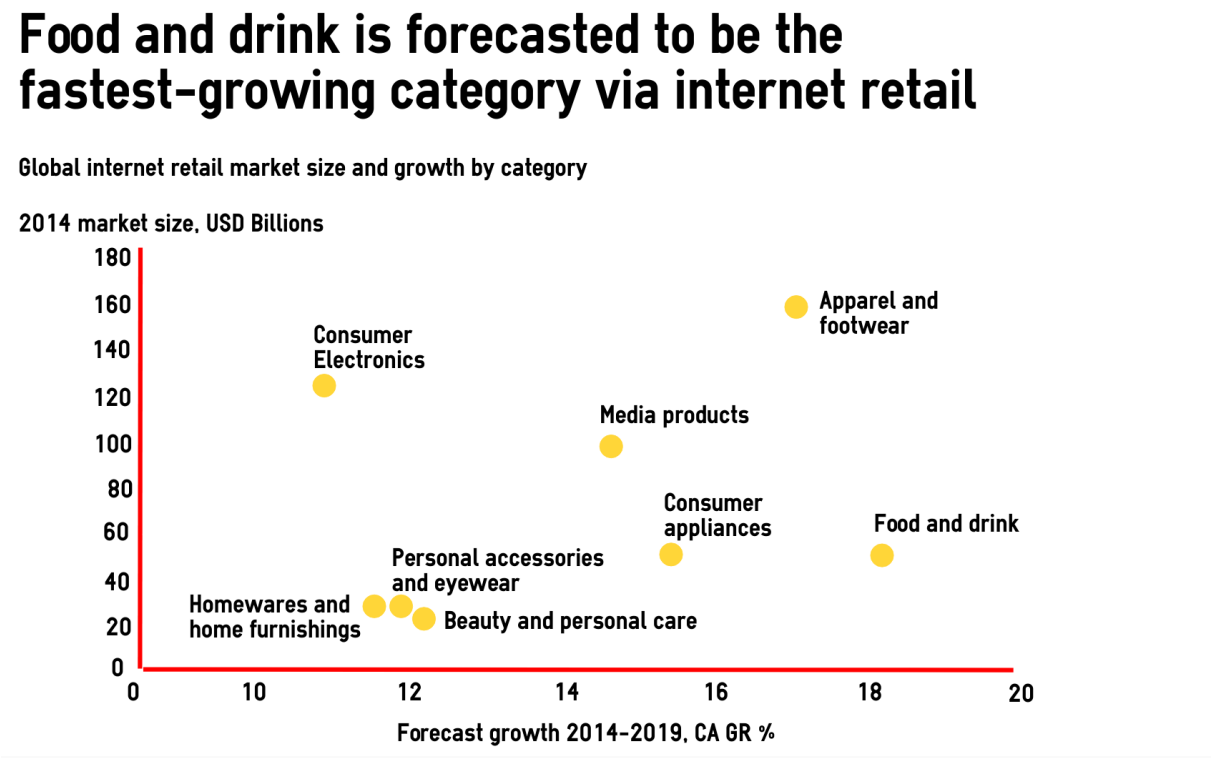
The goal is to create a global and synergized environment for customers, providing them with all the tools they need to have the best shopping experience across all the different channels, including online, mobile channels, mail order, self-service, and physical stores that are aligned to provide a homogeneous shopping experience, with a global company proposition (Breugelmans & Campo, 2016).

2.3 The importance of the supply chain

"*Omni-channel has placed supply chain firmly on the front line. With consumers now expecting to browse, purchase and return goods across a variety of channels, the supply chain has to reach beyond the retail store to the consumer's home and dedicated pick-up points. This requires real-time, channel-agnostic visibility of inventory across the supply chain and a single view of the consumer as they hop from one channel to another*." (EY, 2015).

From a traditional single brick-and-mortar strategy, retailers have reoriented their strategy (EY 2015). The first reason is economic.

If we refer to a survey lead by EY (2015) amongst a large panel of retailers and manufacturers, 88% of them believe that they can no longer rely on traditional sales channels, like their store(s), to drive their future growth. While the annual store growth is forecasted to stay around 5% between 2014 and 2019, online growth during the same period is evaluated at around 15%. Indeed, the EY annual report has calculated that on average, a shopper who buys products in store and online will spend twice as much as a shopper who only buys in store. Moreover, related to our subjects, in the grocery sector, the food and drink segment is the segment of goods that is planned to have the fastest growth in the coming years.



Graph 1: Global internet retail market size and growth by category

Source: Adapted from EY. 2015, p. 9

IT IS NOT A PRIORITY

According a McKinsey survey (Kumar, Lange, & Silén, 2017) amongst a group of leading consumer-packaged-goods (CPG) companies in Europe to get information on their omni-channel strategy, 80% said they were working on it, but less than 25% of them were believed to be on the right track. They agreed that the most difficult part of this journey was to build the right supply chain capabilities. Indeed, supply and logistics represent a very big challenge for grocers, for which online orders count for around 60-70 items, while a general merchandise order contains one to three products (Fernie, McKinnon, & Sparks, 2010). So, the increase of distribution channels in the grocery industry and their synchronization is putting supply chain as a top priority in order to build an efficient omni-channel strategy.

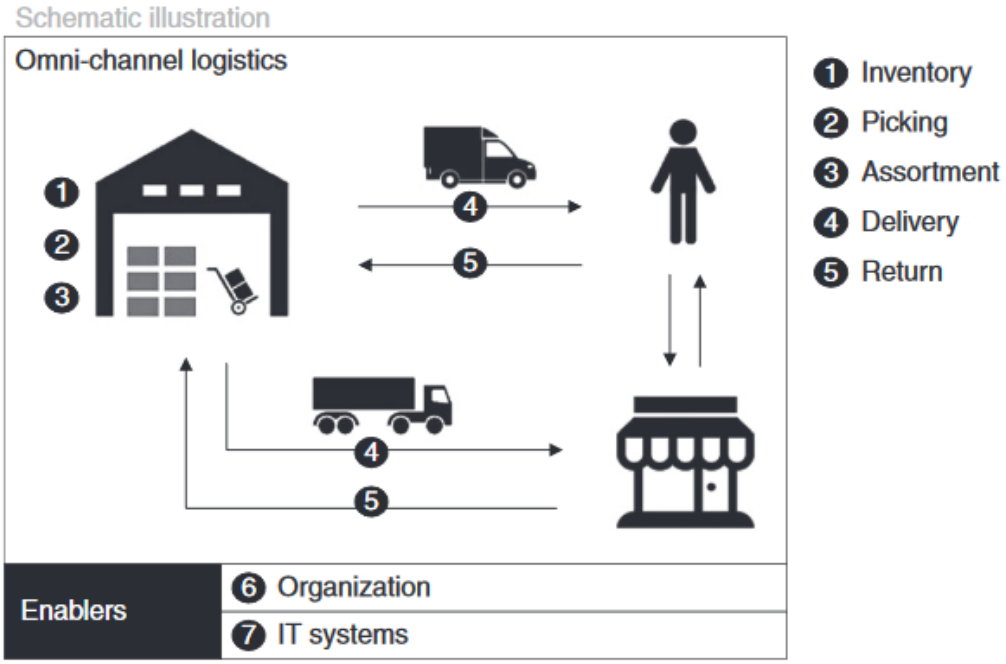


Figure 1: Omni-channel logistic scheme

Source: Hübner, Wollenburg, & Holzapfel, 2016c

In other words, omni-channel puts logistic and cost optimization at the centre of supermarkets' evolution, with the aim of reaching a global and efficient omni-channel strategy.

Logistics and supply chain are key factors in this omni-channel strategy for many reasons. Indeed, in order to have this environment where each channel is linked and smoothly complements each other, there needs to be a **cross-functional collaboration** between them (EY, 2015). For instance, cross-channel inventory management is a point that needs to be completely invented for many retailers. They were used to invest in large distribution centres (DC), with a simple DC-to-store environment with a one-way replenishment, which is now totally outdated since flexibility is mandatory (Kumar et al., 2017). Indeed, with all the possible channels, like "home deliveries", "pick-up deliveries", or "collect and go", the logistics are much more time sensitive, and the classic scheme with few big DC has become inadequate to respond efficiently to the market demands. To be in a position that permits you to fulfil customer expectations, the inventory needs to be much closer to the clients in order to propose faster than ever deliveries.

2.4 The approach of the problematic

Our goal is to build a framework of decisions, in the context of an omni-channel strategy, that will drive grocery companies amongst the different factors and parameters that must be integrated in their focus when they decide to implement the most effective supply chain strategy possible. The supply chain is part of the different strategies put in place by the management to offer an efficient customer journey. In order to attract the client, the company has to launch classic and digital marketing campaign (marketing/comm strategy). The customer has to dispose the right payment tools (IT and financial strategy) and the workers have to be well educated (HR strategy), etc.[10] Our paper will focus on the supply chain omni-channel strategy of grocery retailers without analysing all other important aspects of the problem.

2.4.1 The objective and the method

We will base our analysis on the contingency theory used by Lim, Xin, & Singh Srai which "*maintains that structural, contextual, and environmental variables should fit with one another to produce organizational effectiveness*" (cited in Lawrence & Lorsch, 1967) and the relation between structural and contingent variables that has been applied by (Lim, Xin, & Singh Srai, 2018), for which "*the environmental and contextual variables are jointly branded as contingency variables since the object was to examine how these variables impact the structural form of LML(List mile logistic) distribution*".

The first objective of our work will be to understand and discover what **structural variables** are to be considered while enforcing a framework for an omni-channel supply chain strategy. In this aim, we will investigate the actual supply chain structures which are mostly available to any classical grocery retailers that started from "brick-and-mortar" stores to the development of its internal supply chain network.

[10] https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/1982844362?pq-origsite=summon

This part will integrate several aspects of an internal supply chain network, like[11]:

- the supply chain distribution
- the internal lead time optimization
- the inventory and replenishment
- the network nodes and flow
- the collaboration

After that, we will put into light **the contingency variables** that are important to take into account when building an omni-channel strategy which is best suited to the market demand (from a supply point of view). Each of these particular variables will influence one of several structural variables.

The second objective is to build a framework, composed of contingent and structural variables, which highlights the most impacting factors and parameters that will influence the supply chain strategy that companies are going to implement.

These two parts of the work will be the outcome of a literature review, including scientific research, as well as reports and surveys conducted by serious consulting companies, data provided by global organisations, and the professional press.

The third objective is to confront our framework with the strategy of a specific grocery company, Carrefour, on two different markets. This will allow us to prove that the framework raises crucial points and that it represents a real efficiency tool for the management. The Carrefour analysis will be supported by the interview of a director of the company, who will give an internal opinion about what Carrefour has already undertaken and what they plan for the future.

[11] Annex 2

Chapter 3 : Framework

The objective: the creation of a framework that identifies the different market/consumer parameters and analyses the different supply chain network possibilities for a traditional grocer building an omni-channel strategy

We will now focus on analysing the most important possible declinations of the supply chain channels that companies can apply, according to their existing structure, their presence in specific markets, and their customers' position.

We are going to fragment the analysis according to product flows. Our reasoning is simple, we will analyse parts of the subjects by taking a reverse logistic point of view, so coming from the customer/end user, to the distribution channel to the stores of the company. We will also consider key elements like: the network nodes and flow, the possible collaborations, and the internal lead-time optimization inside the company.

Figure 2: Reverse logistic scheme[12]

After this global comprehension of the different declinations of an omni-channel supply strategy for traditional grocers, we are going to transcript key factors revealed into **structural variables**. Still, we must always keep in mind that we are building an omni-channel supply chain strategy framework. Our logic is simple; we constantly try to keep the customer as our cornerstone.

[12] https://www.newcastlesys.com/blog/the-importance-of-reverse-logistics-in-your-supply-chain

3.1 Channels segmentation: Distribution and orders delivery

Grocers have to build a strong distribution network to carry their omni-channel strategy. There are several factors and variables that will impact and influence the distribution channels organisation and the choice made to serve customers in the most efficient way. For instance, these factors include the delivery speed, the delivery locations, or the customer characteristics like revenues, gender, or age. Distribution includes the last-miles challenge and this topic is certainly one of the most important points that the global retailing industry must tackle, since it can represent up to 50% of a retailer's total supply chain cost (Hübner, Kuhn, & Wollenburg, 2016). There are a lot of different definitions for the last miles; we will therefore mention the working last miles definition created by Lim et al. (2018):

"*Last-mile logistics is the last stretch of a business-to-consumer (B2C) parcel delivery service. It takes place from the order penetration point to the final consignees preferred destination point*."

THE PLACE WHERE YOU HOLD YOUR STOCK WILL PLAY A HUGE ROLE IN THE SUCCESS OF THIS CHALLENGE

Actually, an omni-channel supply strategy can be composed of three ways of distributing online orders to fill most of the customers' demands (Hübner, Kuhn, & Wollenburg, 2016):

- the e-grocery pick-up, which has three main variations (collect and go, drive-in attached, or solo)
- the direct home delivery (attended or unattended)
- the initial outsourcing is done using a third-party logistic (3PL).

3.1.1 E-grocery pick-up

Clients opting for e-grocery pick-up can collect their orders either at a "collect and go" place inside the store or at dedicated parking where they grab the merchandise themselves, or they go through a drive-in system next to the store (attached drive-in) or at a specific location (solo drive-in). In this case, we will analyse the different options from a logistic point of view and we will make the hypothesis that for both the company and the client, the "collect and go" or the "attached drive-in" option represent the same supply challenge. Indeed, preparing the products for the clients just inside or next to the store is quite similar in the constraints it involves.

CLICK AND COLLECT REDUCE LOGISTIC COSTS BY 70%

E-grocery pick-up also call "click and collect" (C&C) via drive-in is one of the most used delivery systems that grocers have created. This model has been particularly famous in France and is currently spreading to many countries such as the United States or England. Via this system, products are ordered online and then picked and packed in a distribution centre or in a store, depending on the replenishment option chosen. The biggest advantage of C&C is that the customer will support the last miles. This option can reduce logistic costs by up to 70% (Colla & Lapoule, 2012; Hübner et al., 2016b). Indeed, the pick-up option is much more profitable than home delivery by around 30% (McKinsey, 2013)[13].

While opting for a pick-up delivery strategy, amongst the first thing a retailer needs to think about is its current store's network (Kilgour, Larke, & O'Connor, 2018).

[13] Annex 3

This is crucial, because this figure will drastically impact a company's future opportunities and investments budget.

The two main reasons behind the acquisition of Whole Foods by Amazon in June 2017 was to dispose of direct contact with clients as well as to access a tremendous network of 470 stores[14] in the United States, Canada, and the United Kingdom. In other words, Whole Foods gave Amazon the brick-and-mortar platform that many internet retailers have begun to realise is essential to minimizing the costs of returns, delivery, and marketing. "Online players and small local retailers bring complementary strengths that together can create an omni-channel supply chain that is both cost effective and responsive to customer needs" (Chopra,2016).

According to some experts, this move will increase Amazon's neighbourhood network by a factor of 5.[15]

As mentioned, there are two types of drive-in systems: the "attached" and the "solo" drive-in (Hübner, Kuhn, & Wollenburg, 2016).

- The "attached" drive-in is situated next to a store and its fulfilment is therefore dependent on the store's inventory. There are no specific deliveries made for the drive-in. Products available online are the products available on the store's shelves. Workers of the store will realise this task as an additional part of their job. They will need to get into the store like any customer and gather all the different products mentioned in the online order.
- The "solo" drive-in is constituted of a pick-up point for customers that is placed next to a small warehouse. Orders are made and delivered from national or regional warehouses to the "solo" warehouse. This "solo" drive-in warehouse and station can also be situated just next to a traditional store.

Here below, we are going to cite both major strategy and the initial situation that is more likely to lead to one option or another. Then we will mention the different advantages and disadvantages that both options represent for the company as well as for the customer (Hübner, Kuhn, & Wollenburg, 2016).

[14] Annex 4

[15](https://www.wsj.com/articles/amazons-deal-for-whole-foods-seen-as-ideal-for-urban-pickup-and-delivery-hubs-1497700800)

	"Attached" drive -in	*"Solo" drive-in*
Primary goal	• Defensive strategy	• Aggressive strategy
Key success factor	• **Large initial store network,** less risky, no big additional cost	• **Boosting existing results**. Online sales and pick-up deliveries in augmentation
Cost involve	• 130- 300,000 USD (Colla & Lapoule, 2012)	• +/- 4 million USD (Colla & Paul, 2012; Hübner, et al., 2016b)
Advantages	• **Increase sales** in a specific area • Augment customer **loyalty** • Improve **operational efficiency** by gathering sales (on and off line) delivered to stores	• **Market shares** increased by taking advantage from new roadmap and tendencies (i.e.: 50% of drive customers are coming back from work, "solo" is adapted to people's flow characteristics (Colla, & Lapoule, 2012) • Increase **the market coverage** and attract **new customers**: drive-ins developed in zone of at least 15,000 citizens with approximately 250 orders a day (Colla & Lapoule, 2012)

		• **Efficient inventory replenishment.** Out of stock reduced by better management of products flows -> gap between real-time inventory and official inventory
Challenges	• **Cannibalisation** of store sales • A**dditional work** for the organisation • Presentation and the disposition of the products **not picking-efficient.** (Hübner, et al., 2016b) • **More expensive:** manual cost in stores more expensive than in DC • **Low visibility of the inventory** and no real-time figures of the inventory collected	• High **initial expenses** • **Not in every place** • More profitable where store network is not well developed
Advantages for the customer	P**reparation time**: 30-40 min	**Preparation time**: 20 min
	Alternative to a home delivery service which is more expensive **Convenient and time saving**	
Disadvantages for the	Efficiency depends on the **number of daily orders**	**Less references** due to the storage capacity: 6-13,000

customer	- low or medium online sales = no real impact on the customer - high sales level = negative impact for the brick-and-mortar clients when workers come, pick, and go with online orders	versus 20,000 in big hypermarkets (Colla & Lapoule, 2012)

3.1.2 Home delivery

Home delivery is certainly the most prevalent way of delivering groceries online in the world. The main challenge of home delivery is that the company fully assumes the last-miles cost, which is much more important in this sector than, for instance, apparels, since margins are quite low on groceries. However, people want to save time and what is better than having your orders delivered on your doorstep? The challenge lies in the cost and its reflection through the price that must be paid at the end by the customer.

We are now going to analyse both declinations of the home delivery that exist today. We will try to understand in which situation a company can propose this service to its clients (Hübner et al., 2016b).

- Attended home delivery: the customer needs to be present at home during a certain time frame (around 2 hours), when the company guarantees to come within this period. If the customer is not present, the package will not be delivered.
- Unattended home delivery: the customer's presence does not change anything in the delivery process. The package is, in any case, going to be put in front of the doorstep.

	Attended home delivery	Unattended home delivery
Primary goal	• Increase online grocery sales	
Key success factor	• Maximize vehicle utilization rate -> reduce transportation cost • Dense populated geographic area -> important demand (Settanni & Singh Srai, 2017)	
Cost involved	• Depending on online sales, outsourcing of the service, or investment in a vehicle fleet	
Advantages	• Important online sales permit to augment turnover and market shares (Fernie & al. 2010)	
		• Augment time slot possibilities and reduce demand mismatch
Challenges	• Complex delivery matrix • Specific time restrictions from multiple customers • Delivery schedule between all the orders • Educate customer to be on time	• Applicable in specific markets, low theft risk related to the GDP of the country
	• The price is highly dependent on the **geography of the market** and from **where the orders are shipped (**Settanni & Singh Srai, 2017)	
Advantages for the customer		• Compared to attended home -> reduction of 40% in cost for the retailer. Customer can hope a price decrease (Hübner, & al. 2016b)
Disadvantages for the customer	• Waiting for the order -> up to 2 h.	

Source: Adapted from Hübner et al., 2016a

3.1.3 Outsourcing

Online demands have brought a broad new challenge for traditional retailers: the fragmentation of volume and a huge last-miles distribution problem. Growing from a non-profitable home delivery service to a beneficiary service is a big challenge for grocery retailers. The online demand in a specific area will be the key factor that will drive a home delivery service to become an attractive provision for the company.

It is when this demand is too weak that calling out for third-party-logistics (3PL) represents an opportunity. The role of these types of companies is to gather the online demand of several retailers selling products online, in order to make an aggregation of volumes to deliver (GRA. 2018). Thanks to this aggregation, they are able to

reach a certain number of "delivery stops" on a truck journey that will permit them reach a profit-earning capacity.

We will not go deeper in this 3PL analysis because it **goes out of our internal company structure analysis**, but what is important to keep in mind is that grocery retailers will have to use them until they reach a certain level of online sales. We will therefore also develop in the next chapters at which moment working in a partnership with a 3PL is profitable for a grocery retailer.

3.2 Fulfilment/Replenishment systems

The challenge of an omni-channel network is that multiple demands are all different in their requirements, in that the customer type and expectations, or the size of the basket, are coming from different channels. There are varied options to perform an efficient fulfilment and replenishment of the inventory, each with their pros and cons.

We are going to investigate all the different replenishment options through several scientific research studies and calculations, keeping in mind that our decision framework is for grocery companies willing to implement an omni-channel supply strategy.

The three replenishment options for online groceries are the following (Ishfaq, Defee, Gibson, & Raja, 2016; Ishfaq, & Raja, 2018):

- The integrated fulfilment. Companies are integrating their online orders in their classical store's order-fulfilment system. Therefore, you have a combination of stores' orders and online orders that will be sent to supermarkets. This replenishment model can also be subdivided into two; we will develop it further.
- The dedicated fulfilment centre (DTC). Distribution centres (DC) are specially built for the online orders. Most of the time, retailers will use this option when online sales have reached a certain threshold that permits them to really make economies of scale. This fulfilment model can also be subdivided into three options.
- The integrated central warehouse. Online order and stores requirements are fulfilled at the same time. The big difference with the DTC is that a DTC will only handle online order. The integrated central warehouse will highly increase the synchronization between the different types of orders, but at the same time, the complexity of its management will need experience and a certain level of global sales.

We are now going to analyse each of these replenishment options in order to get a global overview of their advantages and disadvantages on an economical, organisational, and

service point of view. We will analyse three main categories of factors, which are subdivided into eight key points:

- Cost associated
    - **Online fulfilment capabilities**, degree of complexity of the replenishment system and the investment involved.
    - **Inventory description**. Where the inventory is located and in which format (pallet, package, single product).
    - **Transportation cost**. Will describe the additional transportation cost implied by each fulfilment option.
    - **Picking.** The place where product is picked, called the break open point, and the level of efficiency that is possible to be reached at each of these steps. It is also tied to the picking cost of each step.
    - **Limit**. It can be minimum limit, like the need of reaching a certain threshold to become profitable or a maximum limit like a number of sales from which the model will no longer be sustainable.

- Service provided
    - **Product availability and variety**. This touches the challenge of out of stocks, the inventory visibility, and the frequency at which a product can be reordered and delivered. While the variety is associated with the number of references that are possible to be offered to the customers through a specific replenishment option.
    - **Responsiveness**. The lead time to reach customers.

- **Market perspective**, the type of structure best suited to apply this type of replenishment model.

3.2.1 First replenishment options: The integrated fulfilment, brick-and-mortar

In this type of network, all the online orders are fulfilled from the store network of the company. So, this system is based on a previous well-established store network. There are two subdivisions of the integrated fulfilment (Wollenburg, Hübner, Kuhn, & Trautrims, 2018):

a) all the online orders are assumed by the stores

b) a solo pick-up point is also taking care of some of the online orders.

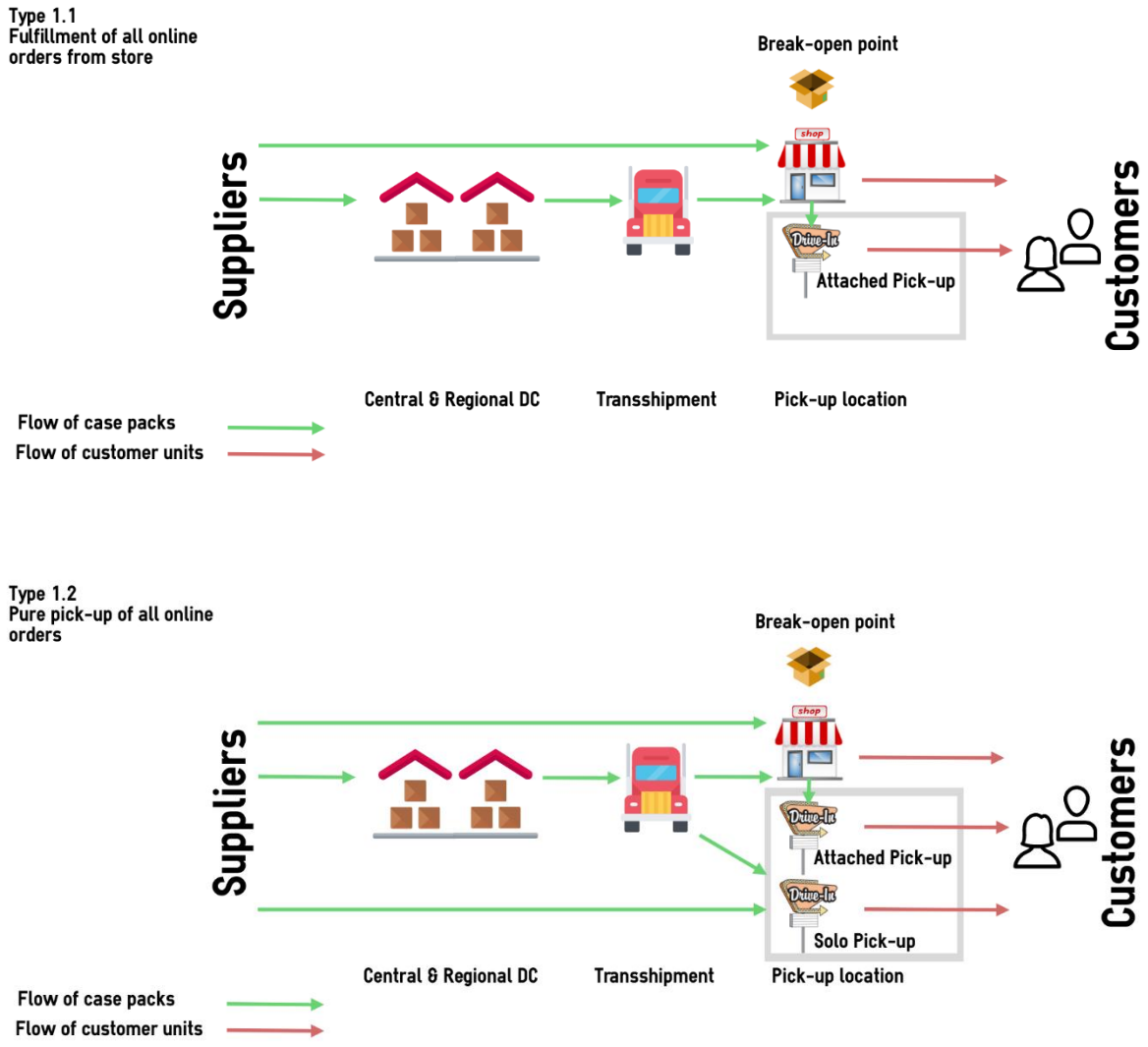


Figure 3 & 4: Integrated fulfilment

Source: Adapted from Wollenburg, 2018

	Declinations	**All online orders assumed by the store**	**Part or whole of the online orders are handled by a solo pick-up point**
Cost associated	Fulfilment capabilities	Low cost: cost related to a drive-in attached pick-up point (Fernie et al., 2010)	Higher cost: new solo pick-up points accompanied with small warehouses
		The complexity of product flows is still very simple and does not include lot of IT investment	
	Inventory	Products transferred from the supplier to the DC of the retailer (national or regional DC, depending on the market size) -> sent to stores on a pallet format. There are often different product on the pallet that are in a case pack format No additional inventory in stores or in the DC	Same as the other method but products are sent to **stores and to the new warehouse** on a pallet format. The product will be stored in customer unit at the warehouse of the solo pick-up point **Multiple inventory holding** with additional inventory in in the new DC
	Transportation cost	Transport from national DC to stores stay at the same high level of efficiency Permit a low last-miles cost from store to customer (dependent on store geographic coverage)	
	Picking	High operational efficiency in the national and regional DC; no distinctions between online and offline demand	
		Low picking efficiency in store, since shelves have only been thought of with marketing and sales considerations in mind (Ishfaq & Raja, 2018)	The warehouse at solo pick-up is much more efficient in picking than stores

		Break open point at the store (when the product is unpacked at a customer-size level)	Break open point at the store **and at the warehouse** of solo pick-up
	Limit	Very quickly, you reach an online sales threshold and therefore this option becomes an issue	**Need to reach** a certain level of online sales to amortize the new DC
Service provided	Online products' availability and variety	Low inventory accuracy due to the problem mentioned in the pick-up distribution system (difference real and official inventory figures) Mismatch forecast replenishment and inventory due to the difference in purchasing behaviour of online and offline consumers (Fernie et al, 2010)	**Better inventory accuracy** thanks to the warehouse that manages most of the online flows
		High probability of items being out of stock	**Lower probability of items being out of stock**, less impact on store's inventory
		Higher probability of product replacement in online orders	**Lower probability of product replacement** in online orders
	Responsiveness	Low lead time due to the proximity of stores from customers' houses	
Market perspective		Strategy fitted for an initial large store network	Strategy still takes benefit from large store network, but this is less of a necessity

According to Wollenburg et al. (2018), at a threshold of 5% of online sales in store, switching to an online sales DC is recommended. An interesting fact: following the research led by English writers (Fernie, J.,& al., 2010) in the last 20 years, there has been a global trend: a reduction of the inventory in shops (back-storage and in-store) supported by a quick response replenishment. Therefore, the additional room capacity for online sales is quite reduced in stores.

3.2.2 Second replenishment options: The dedicated fulfilment centre (DTC)

3.2.2.1 First limit: the online sales threshold

There is a level of online sales to be reached if a company wants to have a profitable dedicated fulfilment centre. Under 300 million USD, a DTC is not going to be profitable because you won't reach the necessary economy of scale. The advocated strategy is then to use your existing assets, your own store network, or to contract a part of your online orders delivery to 3PL (Ishfaq et al. 2016).

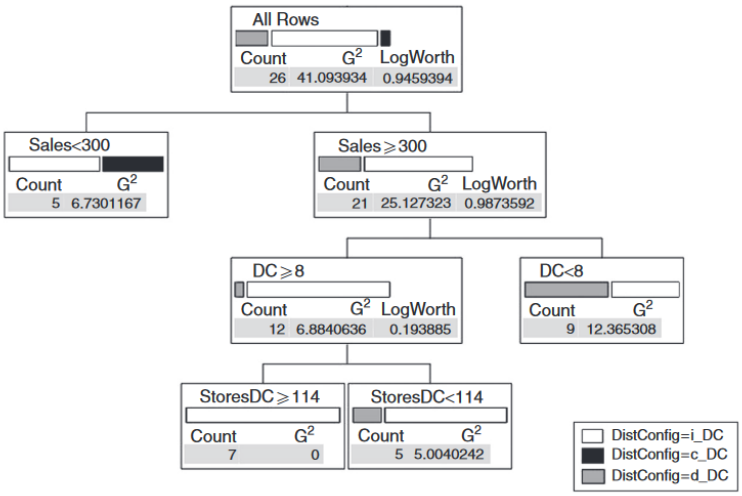


Figure 5: Decision tree for fulfillment

Source: Ishfaq et al., 2016

The two key success factors of a cost-effective implementation of a DTC are:

- the warehousing cost
- the ratio between the order-fulfilment cost of the DTC and the same cost for a classical DC.

The main advantage of a DTC is its operational efficiency. From the origin, traditional DC have been built and structured with the goals of picking, handling, and delivering pallets or several layers to stores. On the order side, dedicated distribution centres' principal mission is to fulfil single online orders in the most efficient way. So, when you start to build up DTC, it is in the hope that the better operational efficiency of the DTC will compensate the additional investment.

A single formula can represent this idea:

Relative order-fulfilment cost of DTC to DC: $\frac{D_F}{D_P}$ where

$$Fulfillment\ cost\ level\ DTC = D_F$$

$$Fulfillment\ cost\ level\ DC = D_P$$

$$Warehousing\ cost\ level = F_F$$

A DTC starts to be valuable when you reach a high demand rate of online sales.

At a certain level of demand, DTC investment is advised if the difference between the cost of an order replenishment from a DTC and from a DC covers the new DTC warehousing cost.

For instance, with $F_F = \$\,10.OO$ per sq.-ft.-per year, which is the average cost of warehousing operations in the south-eastern U.S. region, D_F must be quite low, so $D_F/D_P = 85\%$ for the DC become profitable and manage a part of the orders.

Table 5: DTC-fulfillment: Order fulfillment and warehouse operating costs.

DTC Order Fulfillment Costs		DTC Warehousing Costs					
		$f_{\mathbb{F}} = \$5.00$		$f_{\mathbb{F}} = \$10.00$		$f_{\mathbb{F}} = \$15.00$	
$d_{\mathbb{F}}$	$(\frac{d_{\mathbb{F}}}{d_{\mathbb{D}}})$	$\mathbb{F}$	$\mathbb{D}$	$\mathbb{F}$	$\mathbb{D}$	$\mathbb{F}$	$\mathbb{D}$
\$5.25	0.75	100%	–	100%	–	75%	25%
\$5.95	0.85	100%	–	65%	35%	–	100%
\$6.65	0.95	–	100%	–	100%	–	100%

Table 1: DTC-fulfillment- Order fulfillment and warehouse operating costs

Source: Ishfaq & Raja, 2018

As mentioned previously, the online sales level is very important when evaluating the possibility of a DTC. You can see on the left column of the chart below that when the demand decrease, gradually the advantage of using the DTC diminish in favour of the DC.

Table 6: Order delivery process.

				Order Fulfillment Method			
				DTC	DC	STORE	VENDOR
Discount Level (Δ)				($\mathbb{F}$)	($\mathbb{D}$)	($\mathbb{R}$)	($\mathbb{V}$)
1.00 $\delta_{\mathbb{D}}$				100%	–	–	–
0.95 $\delta_{\mathbb{D}}$				64%	36%	–	–
0.90 $\delta_{\mathbb{D}}$				64%	36%	–	–
0.85 $\delta_{\mathbb{D}}$				–	100%	–	–
0.80 $\delta_{\mathbb{D}}$				–	100%	–	–
Special cases:							
$\delta_{\mathbb{F}} = 0$	$\delta_{\mathbb{D}} = 0$	$\delta_{\mathbb{R}} = 0$	$\delta_{\mathbb{V}} = 0$				
√	√	√	√	75%	4%	–	21%
–	–	√	–	–	–	100%	–

Table 2: Order delivery process

Source: Ishfaq & Raja (2018)

3.2.2.2 Second limit: the company network and nodes

After the online sales of the company, the other most important point that will impact its replenishment strategy is the composition of its actual physical network, the number of DC and stores (Ishfaq et al., 2016)

- If the number of DC is low—approximatively less than 8—the final fulfilment options for the online sales will be balanced roughly through the integrated distribution (the stores) and the DTC.
- If the number of DC is superior to 8, another factor (the number of stores) will automatically take much more importance due to a large distribution network.
- If the store network reaches a certain threshold, around 114 stores, its store inventory capacity will permit the company to handle most of the inventory through a store replenishment with both online and offline sales. Meanwhile, if this store minimum is not attained, the fulfilment will be split between the stores, the DTC (but few DTC replenishments due to the stores fulfilment capacity) and the available DC. The DTC or the online DC will have to manage the online orders partially or in whole.

3.2.2.3 There are three types of DTC

DTC managing online orders depending on the products and interrelation of DTC-stores
The process is a bit more complex. Most of the products of the online orders will be picked at the DTC and only specific references like fresh products are going to be provided by the store. Either the command is pick-up at an attached point and the flow of goods come from the DTC to the store, or the DTC delivers directly the client with home delivery or a solo pick-up point, but before stores send fresh goods to the DTC.
Below, we will mostly underline the differences when DTC manages only home delivery orders (Wollenburg et al., 2018).

Figure 6: DTC fulfillment

Source: Adapted from Wollenburg, 2018

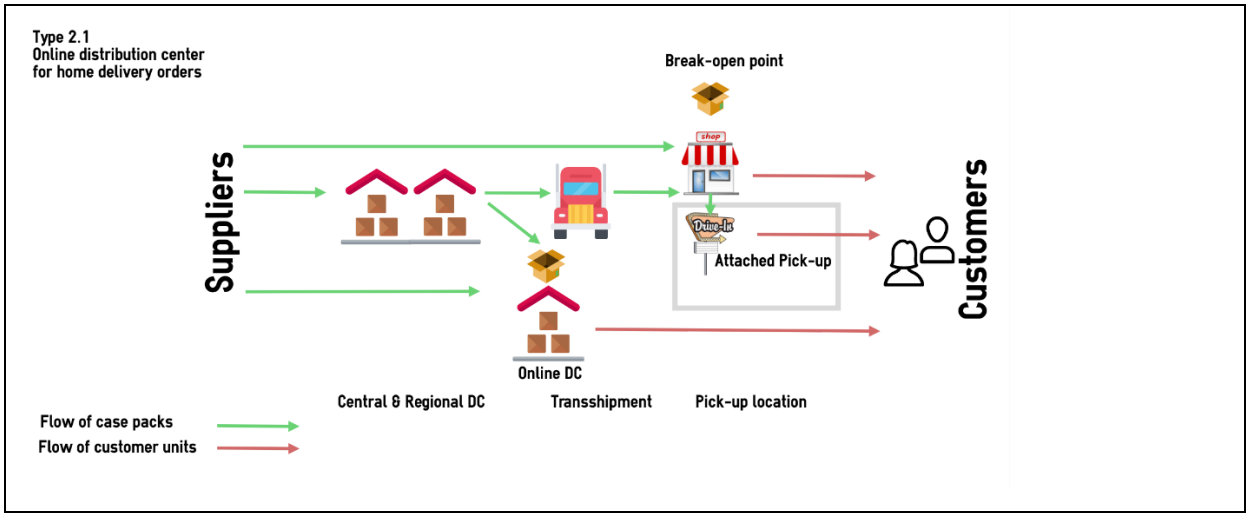


Figure 7: DTC fulfillment

Source: Adapted from Wollenburg, 2018

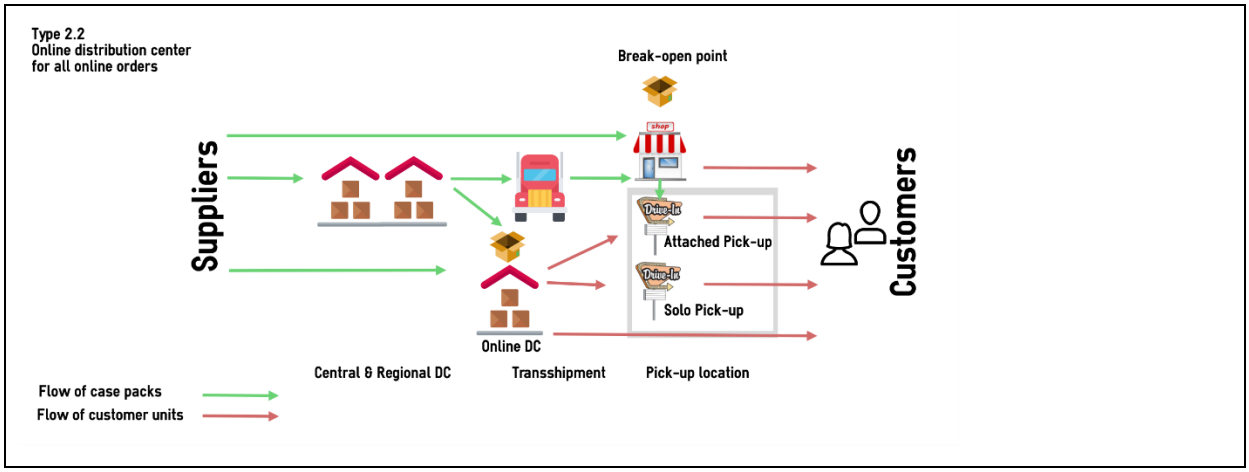
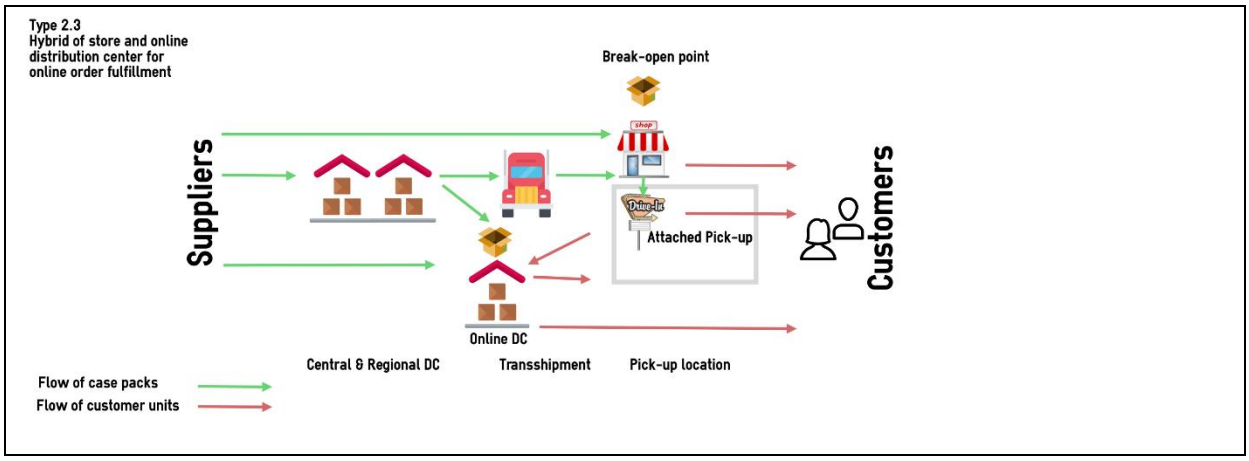


Figure 8: DTC fulfillment

Source: Adapted from Wollenburg, 2018



	Declinations	**DTC managing home delivery commands**	**DTC managing all online orders**	**DTC working partially for online orders and partially with store demand**
Cost associated	Fulfilment capabilities	High cost: creation of new dedicated warehouse		
		a certain degree of automation and IT involved at the DTC		**a high degree of automation** and integration, with lot of IT
	Inventory	Products transferred from the supplier to the DC of the retailer -> sent to stores and to the new dedicated DC on a pallet format. The product will be stored in customer unit at the DTC		
				cross-inventory: inventory pooling between DTC and stores. Huge service level provided

		Multiple inventory -> additional inventory in the new DC	No multiple inventory -> **no online sales for the stores**	Multiple inventory -> additional inventory in the new DC
	Transportation cost	Transport from national DC to stores stay at the same high level of efficiency		
		Permit a low last-miles cost for home delivery thanks to DTC covering a bigger geographic area and therefore being able to make orders regrouping		
		Few internal transportation costs	More **internal transportation costs**, with DTC delivering to pick-up points	All these inventories connection between stores and DTC will lead to lot of product flows and therefore **high transportation cost**
	Picking	High operational efficiency in the national and regional DC, no distinctions between online and offline demand (Hübner et al., 2016b).		
		More efficient in picking than stores but stores still manage pick-up deliveries. **Low economies of scale**: absence of coordination between stores and DTC	No more pick-up of online orders in store and augmentation of orders managed at the DTC. **High global picking efficiency**	The DTC is much more efficient in picking than stores but stores still manage a **few pick-up deliveries** (for specific products like fresh goods)

		Break open point at the store (when the product is unpacked at a customer-size level) and at the DTC	**Break open point only at the DTC**	Break open point at the store (when the product is unpacked at a customer-size level) and at the DTC
	Limit	Need to reach a certain level of online sales to amortize the new DC		
Service provided	Online products' availability and variety	Better inventory accuracy for home delivery thanks to the dedicated DC	**Best** inventory accuracy, **no online sales picked in-store inventory**	Better inventory accuracy, **few online sales picked in-store inventory**
		Still probability of goods being out of stock in store with pick-up solely handled by stores	**Very Low** probability of items being out of stock in store with the end of pick-up by stores	**Low** probability of out of stock items in store with the end of pick-up by stores
		Higher probability of product replacement in online orders	**Very low** probability of product replacement in online orders	**Low** probability of product replacement in online orders
		Mismatch forecast replenishment and inventory due to the difference in purchasing behaviour of online and offline consumers		

		Wider number of references **for home delivery**, not dependent on offline store shelves	**Wider number of references for all online orders**	**Bigger choice** of products than in both previous network model, thanks to the inventory pooling between the DTC and the stores
	Responsiveness	Medium lead time; DTC are not as many and as close to customers compared to stores		Small lead time; stores or DTC can reach customers
Market perspective		Very profitable in small but dense geographic areas, where economies of scale are attainable	Economies of scale are **attainable more quickly** for the DTC since it handles all the online sales	

3.2.3 Third replenishment options: The integrated central warehouse

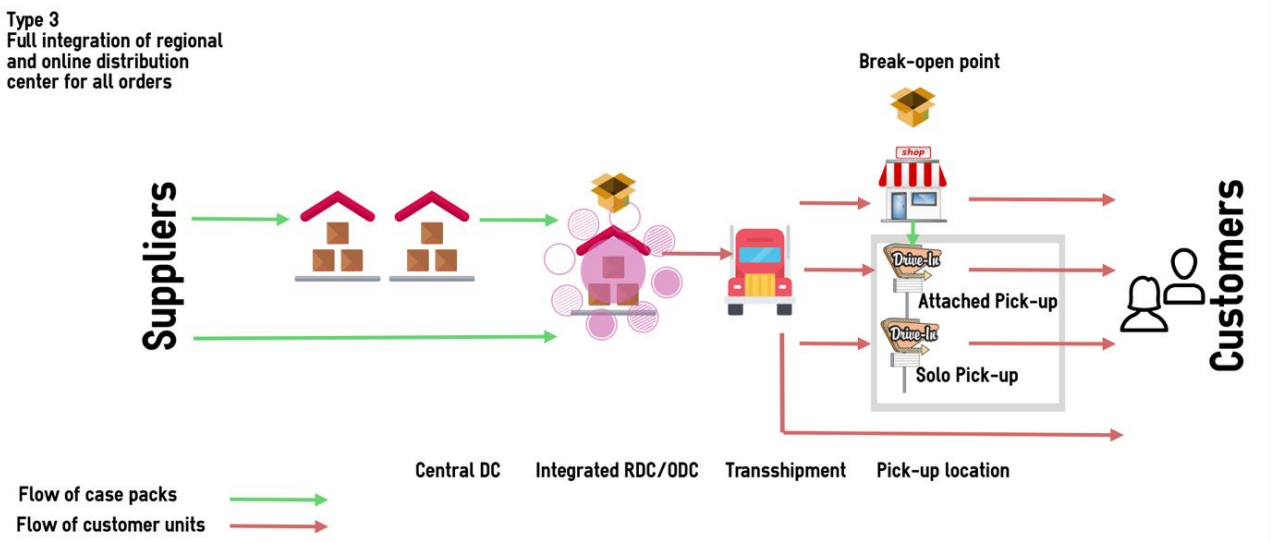


Figure 9: Integrated central warehouse replenishment

Source: Adapted from Wollenburg, 2018

In this specific case, regional and online DC are going to be merged. This new kind of DC will provide all online but also offline orders to the stores. This type of replenishment structure is only sustainable for stores of small sizes and is not plannable with hypermarkets or supermarkets. Indeed, the goal is to stock all the items in this new DC on a customer unit basis. This DC will then supply the home delivery service, the store shelves, and the pick-up points. All these different channels can be served with the same truck (Wollenburg et al., 2018).

	Declinations	**The integrated central warehouse**
Cost associated	Fulfilment capabilities	• **Very high cost involves:** creation of new merged warehouse where regional DC are rebuilt • The complexity of product flows will need a **high degree of automation and IT** involved at the merged DC
	Inventory	• Only one online inventory holding at the merged DC • Customer unit base product, so permits low inventory at the store • Pooling effects for online and store references, therefore you have a **very efficient cross-inventory** inside your logistic
	Transportation cost	• Transport from the new DC to stores are much more frequent and therefore **increase transportation cost** • Possible joint transportation for convenience store, pick-up, and home delivery orders

	Picking	• High cost for storing and picking all the products in the merged DC at customer unit size • The customer base picking is very costly for store replenishment • Break open point at the merged DC
	Limit	This type of network is very well suited to supporting high demand increase
Service provided	Online products' availability and variety	High frequency replenishment of the stores, low probability of out of stocks (high internal service level) Huge assortment for online sales can be proposed by the retailer (as huge as offline of a small store)
	Responsiveness	Medium lead time; DTC are not as many and as close to customers compared to stores
Market perspective		• This type of DC-store network needs an important initial small-store network • Highly dense geographic area is also a necessary condition • A huge online sales threshold needs to be attained to amortize this new kind of DC

3.3 Structural variables

All the possible declinations of a grocery retailer structure have been analysed and developed above. We can synthetize these alternatives with two main delivery models and three principal replenishment ways of managing orders.

After spending time describing all of them, we will now decline industry structures into **structural variables**. These variables are influenced by contingent variables that we will develop afterwards and these fluctuations in the variables will permit us to give indications with the aim of building the most suitable network for a grocery company.

3.3.1 Inventory location

The inventory location includes the different places where the inventory is stocked when an order is done. The inventory can be located in different places where the associated cost will be different, but it can also be stocked in different formats and this will influence the picking cost.

3.3.2 Break open point

The break open point is the moment when workers unpack products at a customer-size level. This point may be one or more and the locations are diverse. This concept is very important in the picking efficiency of the grocer's logistics.

3.3.3 Number of nodes

All the nodes in a network are all the different steps that will be followed by the products. The number of steps/nodes will depend on the complexity of the network, the number of DC, and the cross-inventory and pooling. The number of nodes will also cause an augmentation in the number of transports and flows between these nodes (Lim et al., 2018).

3.3.4 Distribution services

These are the different ways of delivery that a grocer is providing to its customers. There are several distributions models, like the pickup or home delivery, which have several declinations. All these distributions models have their own characteristics, constraints and their good application will depend on the market situation and the customers' needs (Lim et al., 2018).

3.4 Contingent variables

Now that we have found, developed, and presented the **structural variables** of our framework, we will subsequently move to the identifications of the different **contingent variables** that come out from the market analysed and the customers present in this market.

3.4.1 Deep into the customer's profile

In this part, we will investigate and analyse the different contingent variables typical of the market and the customers that will influence the structural variables we have found. The goal is to reflect as precisely as possible the different trends of the market through these variables and offer a global overview of our targeted market.

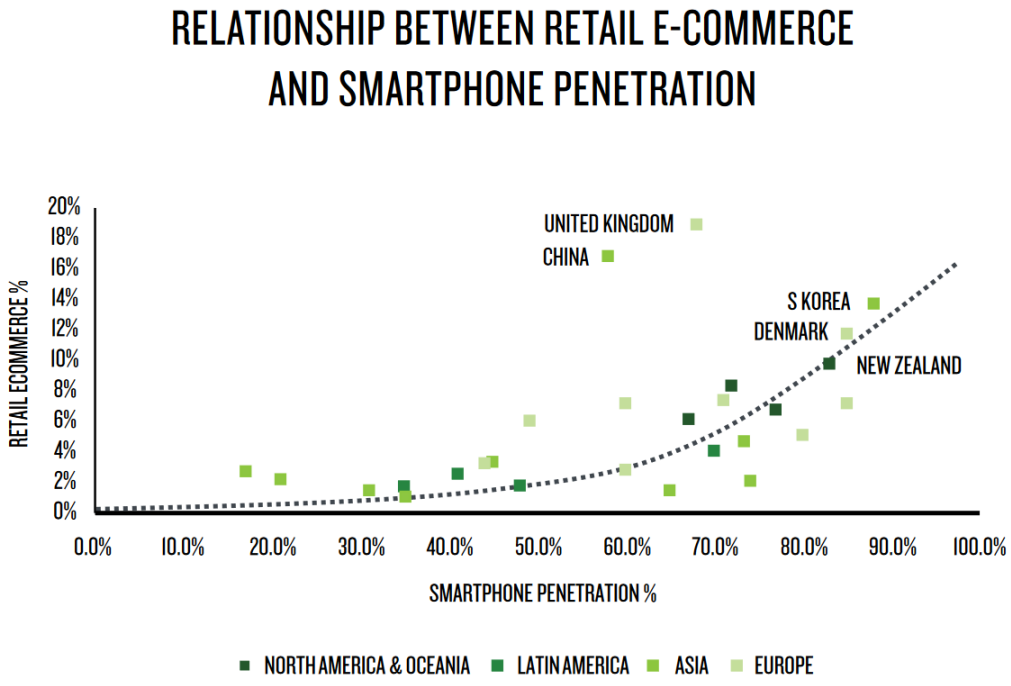
As mentioned above, several customers' insights are going to drastically influence the possibilities of an omni-channel strategy's implementation, since the performance of a distribution network will depend on the customers' needs and the cost of meeting these needs (Chopra, 2003).

We are now going to explore the different aspects of a customer profile.

3.4.1.1 The smartphone and the digital implementation

There is a relation between the smartphone penetration of a market and the retail e-commerce presence in this market (Deloitte, 2014). As mentioned in a report of Nielsen, this penetration is an important factor in grocery e-commerce; the correlation between e-commerce and smartphone is around 40% of its penetration. This figure is huge, but the remaining approximatively 60% is composed of multiple other factors that we will develop.

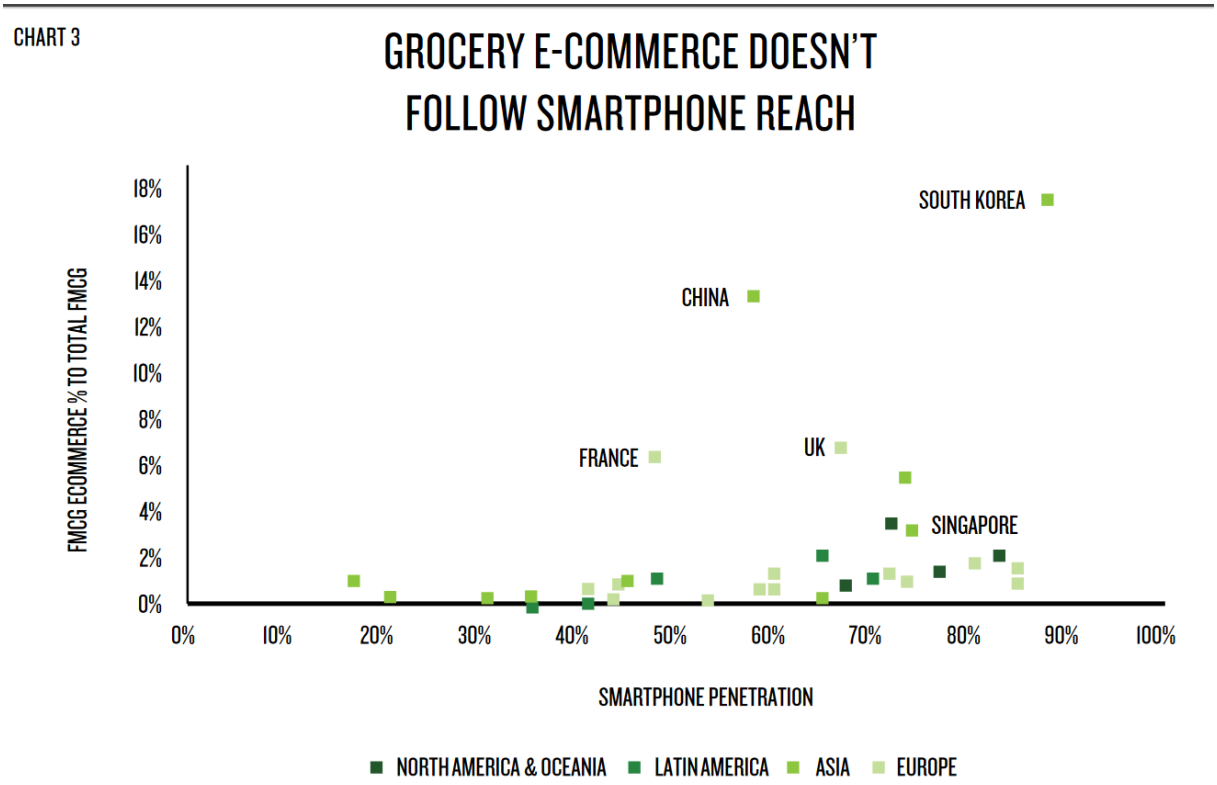
CHART 2



Graphe 2: Relationship between retail e-commerce and smartphone penetration

Source: Nielsen, 2017b

We can effectively see that the relationship between both variables is positively correlated, but that this is clearly too short to provide a global explanation of the evolution of retail e-commerce.



Graph 3: Grocery e-commerce doesn't follow smartphone reach

Source: Nielsen, 2017b

When we compare both graphs, we see that there is a huge difference between retail e-commerce and grocery e-commerce. Some players, like France, have quite a huge growth in groceries e-commerce, while this is contrasted with its global retail e-commerce. Another good example is South Korea, where there is a food retail e-commerce that has had fabulous success, while its retail e-commerce integration is comparatively not far above the average.

3.4.1.2 Cultural nuances

Cultural nuance, even though it looks much more abstract than the other factors, is also a point that companies must take into account while opting for a re-organisation of their supply chain. Indeed, people's habits and comportment can have a much greater impact on a strategy than we could think. "Socio-cognitive factors can play a role in the emergence of new business models in this context" (Hübner et al., 2016b).

People have, in each country, a specific relationship with their market that is linked with their culture, habits, and the feeling they associate to the activity of shopping.

Indeed, cultural factors cannot be quantified, due to their intangible aspect but we can mention various situations to impregnate ourselves with this idea to get the conviction that it can represents a barrier to the development of an OC (omni-channel) strategy or on the contrary, which can help for a smooth adoption of an OC strategy.

For instance, we can take the example of Singapore, which is striking by its specificity.

Singapore is a small but deeply dense city, with a very strong IT development, which normally makes it a perfect place to integrate e-commerce with different channels for grocers. However, it has taken much more time than anticipated to convince people to buy some of their products online and to interact with their stores in a new way. The main reason behind that reluctance, is that the shopping landscape, supermarkets, and stores were perfectly integrated within citizens' lives (Nielsen, 2017b)

Indeed, Singapore is a small city in terms of perimeters, but is also ranked number three in terms of people density. We could therefore have thought that home delivery and the last-miles problems would have been quickly adopted in the aim of reaching the island's citizens. Nevertheless, Singaporeans have always loved doing shopping, and therefore supermarkets were located at strategic points in their shopping path, for instance close to subway stations. This shopping landscape has led to a deep affection of Singaporeans for shopping, and therefore this has been a barrier in the e-commerce development of Singapore from the very beginning.

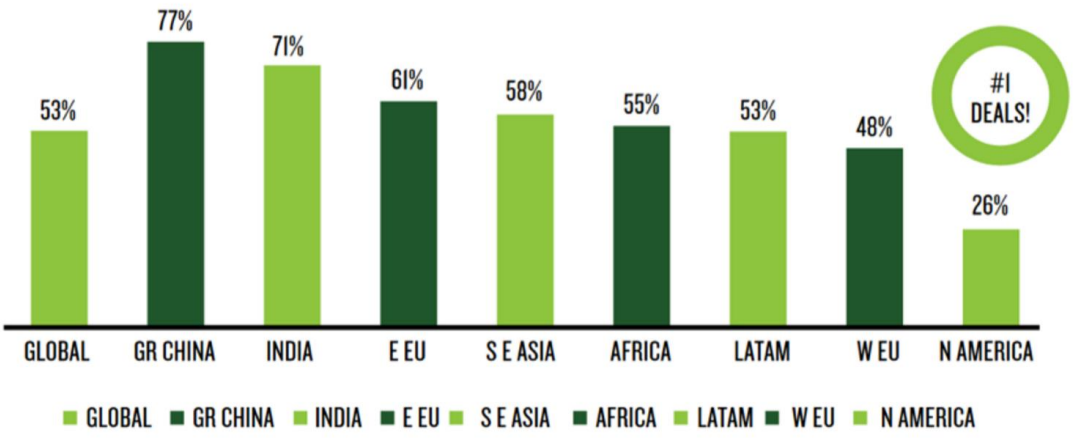
Secondly, we can find the total opposite with the case of South Korea.

As mentioned before in the graph comparing the grocery e-commerce compared to the total e-commerce of the FMCG sector, South Korea is by far the most impressive (around 18%). According to Kantar (2016), in ten years, the country will account for 25% of the global online grocery sales. There are several key success factors present in South Korea. First the density of the population is quite high in Korea, but what is particular to Koreans is that they work a lot, much more than in other countries. Therefore, they do not have much time to spend in stores. They need frequent, flexible, and fast delivery options. Another important factor is

technological; Korea is the most digital developed market worldwide, with 85% of the citizens having a smartphone and practically 100% of the people between 10–40 buying products online (Corsini, 2016).

Korea and Singapore are not that far off in terms of digital implementation, with rank 1 for Korea and 4 for Singapore. However, their food retail development has been quite different. Singapore has a higher population density, but as mentioned, factors and parameters relative to its neighbourhoods have led to a different development.

3.4.1.3 Behavioural trends amongst customers



Nielsen Connected Commerce Study-2016-BASE: All Online Consumers

Graph 4: Regions where convenience is the number one factor with e-commerce

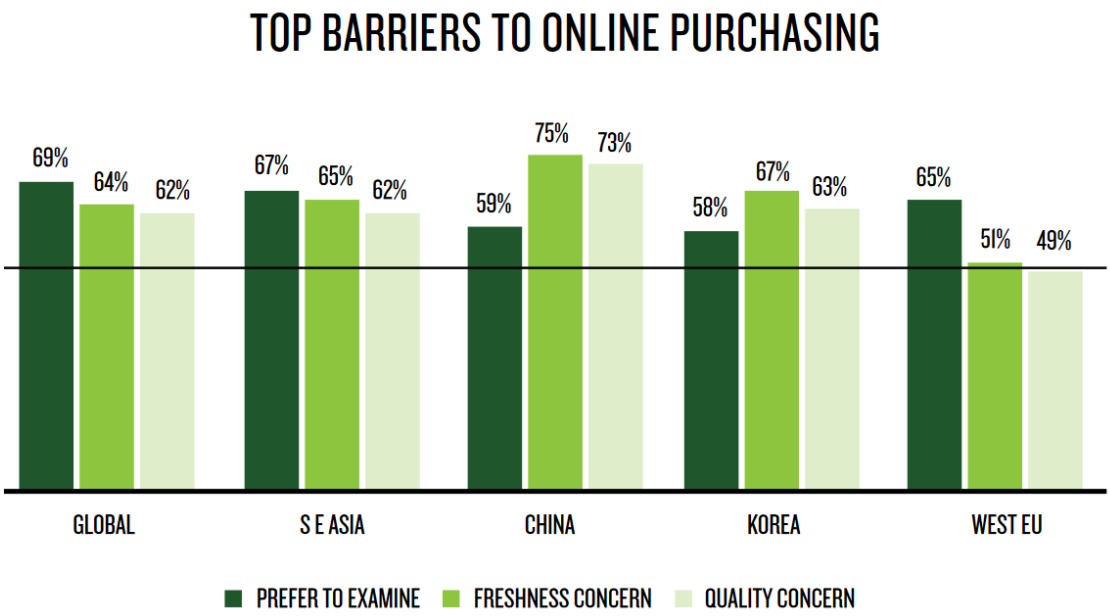
Source: Nielsen, 2017b

The “world consumer” is really interested in e-commerce within the grocery sector. The first thing that consumers value the most is the simplicity, the convenience, and the time that can possibly be saved using these new tools. In fact, this trend is recorded in almost every market, with one exception, North America, where price is the most important factor related to e-commerce, with new possible deals.

On the other side, there are three main factors (quality, freshness, and visual controls) which make brick-and-mortar store stay in the race and which keeps

clients coming to the stores. It is mainly due to these points that we currently have a “brick and click” model, where omnichannel is the keyword, with a common service integrated on several channels.

CHART 6:



Graphe 5: Top barriers to online purchasing

Source: Nielsen, 2017b

However, these barriers differ between countries, or more generally, amongst continents. Indeed, when you take fresh food, Asian people are less reluctant to try ordering these kinds of goods online. In 2017, 40% of Chinese consumers tried ordering fresh groceries online and it was 39% for South Koreans. The contrast is clear when you take a western part of the world, like Europe or America, where this figure dropped to 9%.

- Product freshness

The capacity of a grocer to propose online fresh groceries is limited and providing this type of service is very complicated. The freshness of the products supply will depend on the distribution channel (home delivery or pick-up at the store) and on the internal lead time of the products, the different processing steps of the product (Lim et al., 2018).

- Order visibility

Store visibility for your consumers is also going to weigh into the balance. The more nodes in your network you have or different dispatched locations of your inventory, the more difficult it will be to give efficient information about the available products in your stocks and shelves. The trend tends to serve a desire from customers to get in-store visibility (Accenture, 2014).

3.4.1.4 Customer physical convenience

A distribution system leads to customers having a physical convenience of 100% if am order is delivered on their doorstep, since they do not even have to lift a finger the degree of physical convenience is going to be impacted by the distribution type you are going to use to make your delivery.

However, your allocation strategies and therefore the location of your pick-up network will play a huge role in this level of convenience. According to studies, 50% of people who go through the drive-in do it when they return home from work. Also following these studies, the area of attraction around a drive-in, which is the perimeter around which customers will be supplied in a store, is comparable to a supermarket. In fact, 80% of the customers of the drive-ins are only 15 minutes from the collection point. In addition, the penetration rate is twice as high when one goes from 15 to 10 minutes of time in distance.

3.4.1.5 Order response time

The responsiveness the online customer demands is evolving over the year. Their expectations have increased and nowadays having an effective response time to online sales is clearly a key success factor[16][17].

However, the responsiveness you provide to customers must be adapted to the kind of customer you are addressing. According to an EY survey (2015), 40% of “click and collect” consumers do not want to pick-up their order the next day.

The responsiveness of your network will depend in its automation and the capabilities you have put in place.

[16] Annex 5
[17] Annex 6

3.4.1.6 Product availability and variety

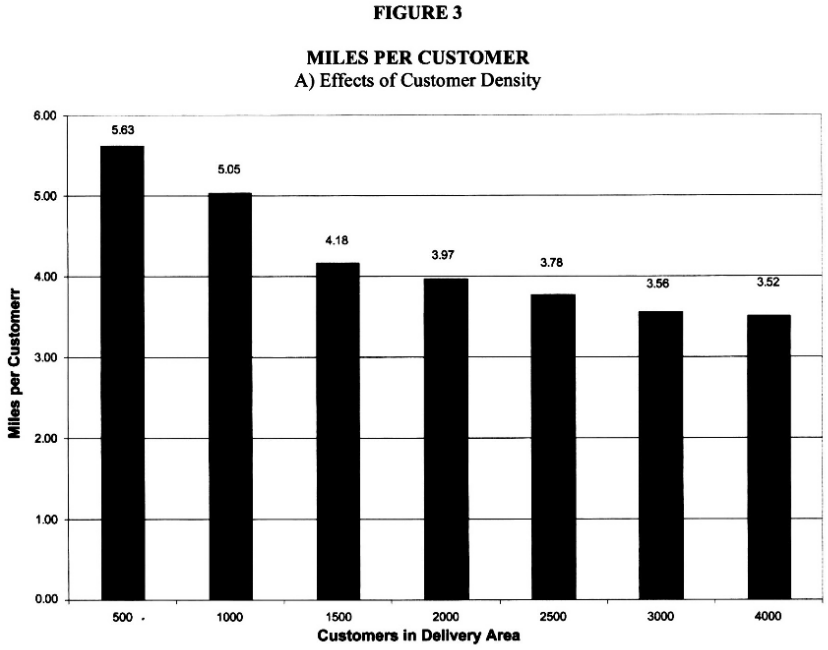
For a grocer, the variety and the number of references he will proposed will depend on the demand from its clients and their taste. It is linked with the product freshness mentioned before, but also to the number of references the customer expect to see on the web shop. This variety proposed to its clients will be function of the type of stores that constituted its network as well as the type of replenishment used.

Secondly, the availability of the products is also an important factor driven be the type of client the grocer faced. Some can be flexible concerning product replacement when others not. This availability will be the function of the capacity of the retailers to manage their inventory and the product flows between its replenishment and distribution system.

3.4.2 The market's influence

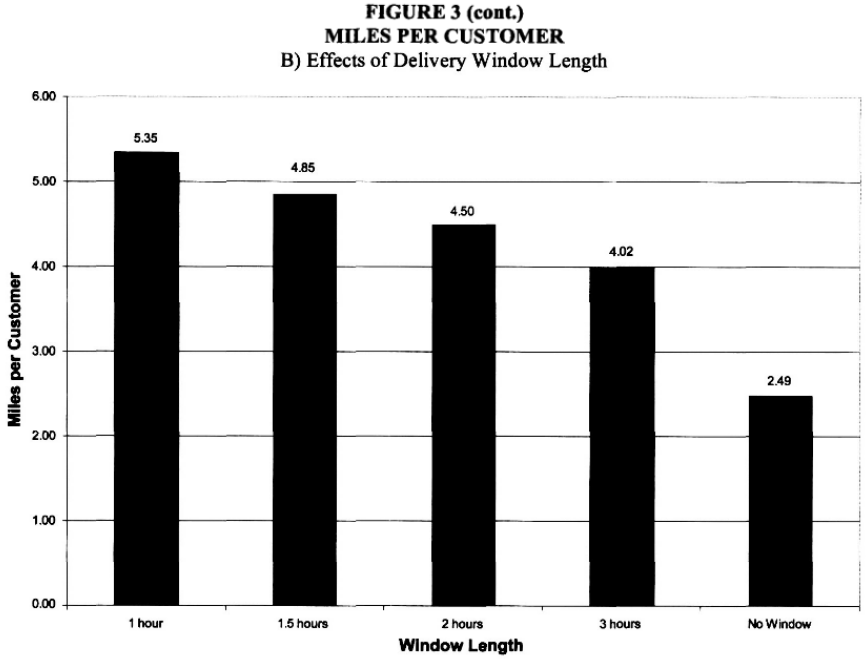
3.4.2.1 Customer density and delivery widow

In the vehicle routing problems, where companies try to optimize their logistics costs, two of the most important factors that will affect the delivery efficiency are the density of the customer (Bethlahmy & Schottmiller, 2011) and the delivery widow: the range of time between which the company must deliver (Boyer, Prud'homme, & Chung, 2009; Hübner et al., 2016b). There is a negative correlation between the cost per miles and the density of the population, while there is a negative correlation between the size of the window length and the cost per miles for a delivery.



Graph 6: Relation between cost per miles and the number of customers in the area

Source: Boyer, Prud'homme, & Chung, 2009, p. 195



Graph 7: Relation between cost per miles and delivery widow

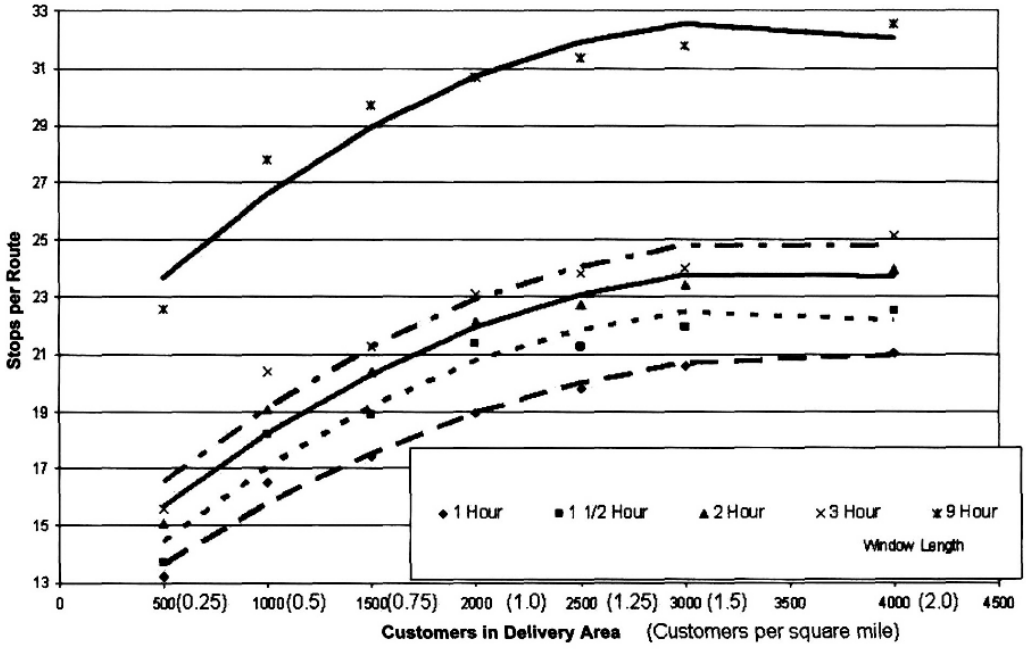
Source: Boyer et al., 2009, p. 196

The negative relation between customer density and the cost of the last miles is quite straightforward, as is the negative correlation between the time widow and the cost of the delivery.

We can see on the following graph both variable effects on the number of stops a truck will make in its daily journey. The number of stops per journey is linked with the profitability of the delivery. The shape of the five different curbs shows that the bigger the widow, the more probability there is for a truck to have increased delivery points on its overall journey. Moreover, you can see with the abscise, that when the density of the population per square miles augment, the number of stops on the truck journey rises too.

FIGURE 2

STOPS PER CUSTOMER ROUTE



Graph 8: Relation between stop on carrier route and population density

Source: Boyer et al., 2009, p. 194.

3.4.2.2 Size of the market, demand

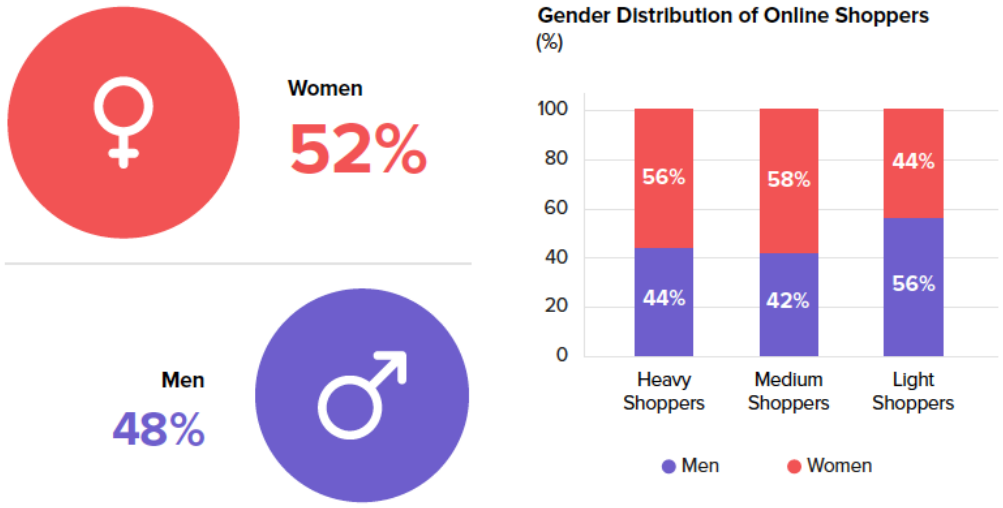
The size of the market analysed will be a major factor in the analysis of the possibilities applicable by the food retailers. This variable will have an important influence on all the others. From a situation where the market represents only a few million to a billion-dollar market, the power and the possibilities of the players to capture a portion of this turnover will be totally different. In a large market, the online orders will be proportional, and therefore it opens up more options, such as collecting orders for home delivery. Secondly, the size of the market is also be related to the current situation of the retailer, including its store network, as well as the number of warehouses and storage and distribution centres.

3.4.2.3 Age and gender

The younger generation is keener to buy online (Cuthbertson & Piotrowicz, 2014). Following a study from Nielsen (Age matters with digital shoppers, 15/09/2014) "*Not all age groups are shopping online to the same degree. And the age group that has grown up in the digital era—Millennials (age 21–34)—is leading the way. Older generations represent a sizeable 40% share of online purchase intenders. The older the age, the greater the decline in online shopping intent. Globally, Generation X (age 35-49) comprise about 28% of those willing to make a purchase online, and Baby Boomers (age 50-64) make up about 10%. The Silent Generation (age 65+) contributes roughly 2%. The youngest age group, Generation Z (under age 20), represents about 7% of those who intend to purchase online*."

There are differences of online sales in age categories, but there are also differences in distribution and delivery choices. For instance, millennials prefer to click and collect over home delivery (Nielsen, 2018).

Online shopping is particularly popular amongst women, who comprise 52% of all online shoppers. This effect is further reflected amongst heavy shoppers (56% are women) and medium shoppers (58% are women), whereas men only gain majority (56%) amongst light shoppers.



Graph 9: Gender distribution of online shoppers

Source: Verto Analytics, 2018

3.4.2.4 GDP and revenues disparity

The GDP of a country is very important, since online sales will directly depend on this global purchase capacity: "*there is the issue of whether customers are willing to pay more for a premium service. Some of them do not want to pay more and may be satisfied with a lower level of customer service at a lower cost*" (Cuthbertson & Piotrowicz, 2014).

For example, in the US, households earning between $100,000 and $150,000 are significantly more represented amongst online shoppers, while households making more than $150,000 per year are represented significantly less amongst online shoppers[18].

Secondly, this GDP factor will affect the panel of distribution a company can envisage. "*Whereas in Switzerland an unattended delivery model raises no concern for theft due to a high GDP, in some regions of the UK potential theft of delivery boxes would cause large problems*" (Hübner et al., 2016b).

[18] Annex 7

3.4.2.5 Price sensitiveness

*"Price is one of the main factors that will drive a consumer to buy products online or not. The problem is that for the moment, the price that people are willing to pay is low, between 3 and 7 euros" (*McKinsey, 2013). It is a problem, since the last miles remain as one of the biggest challenges of most grocery retailers[19].

3.5 Final model

The presentation below is a good summary of the different contingent and structural variables that have to be taken into account for a traditional grocer building its omnichannel supply chain strategy.

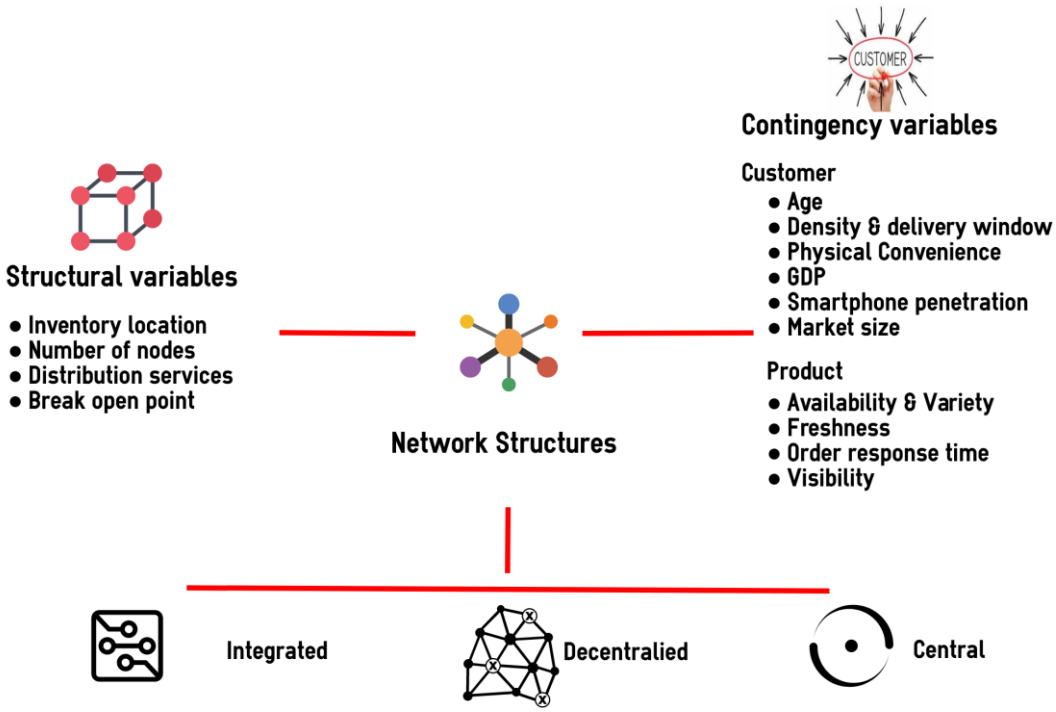


Figure 10: Relation between the contingent and structural variables

Source: Adapted from Lim, Xin, & Singh Srai, 2018

[19] Annex 8

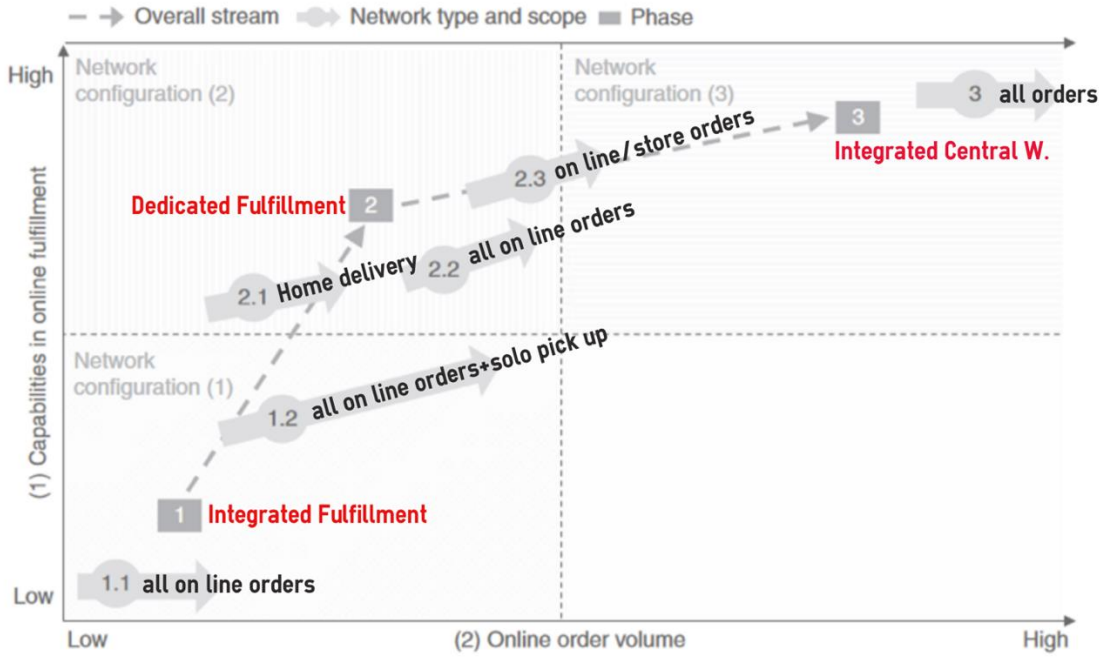


Figure 11: Evolution of the Fulfillment's structure of a retailer

Source: Adapted from Lim et al., 2018, p. 316

The present framework describes the possible evolution of a supplier network according to different parameters. We will now make a brief explanation of the major factors unchaining the transition from one network structure to another.

- From a traditional grocery retailer network to a growing omnichannel strategy

  Starting to sell products online, the grocers will start to provide services, like pick-up or home delivery. The objective is to enter in the online sales competition without making big investments. The online sales will be provided from the stores' inventory (if an initial store network exists) or solo pick-up station. This permits them to fulfil online sales rapidly, with low transportation costs due to the proximity of shops and the solo pick-up to the customers.

  Online sales are integrated in the large delivery from national DC to stores and solo pick-up, which permits optimization of truck transportation costs.

- Transition from integrated fulfilment to dedicated DC

As online orders start to rise (millions of online sales per year), efficiency in the store decreases. This leads to low inventory visibility, a diminution of the products' availability and of their variety.

Moreover, stores are not fit to fulfil online orders, due to high picking costs (break open point situated at the store) and the need to reach a certain online sales threshold must force the grocer to invest in more efficient replenishment capabilities.

- From an integrated fulfilment to dedicated fulfilment centres

Dedicated DC permits the handling of augmentation of online sales with centres built to manage online orders in the most efficient way, in terms of cost and service. The concentration of online sales augments their product variety and their inventory management. There will be a possibility for a really fresh online product offer. This will also lead to an improvement of their products' availability.

This kind of network will, as mentioned, need big investments. This will permit new possibilities like cross-inventory or inventory pooling between the DCs and stores.

The inconvenient aspects include transport costs, which increase with the augmentation of nodes (DC, stores, etc.) and therefore the flows between them. On the other side, the break open point will be situated upstream in the network, where the picking efficiency is more adapted and less expensive.

- Transition from the DTC to the integrated central warehouse

This model can only be applied with a deep/large network of convenient stores and in a very dense geographic area. The idea is to have a merged warehouse that supports all of the online delivery and convenient stores' fulfilment.

The goal is to have the most efficient cross and pooling inventory possible, with trucks transporting product at a box or customer size level for home, pickup and store delivery. This type of network is able to respond very quickly to demand changes. This will lead to a huge replenishment frequency of the stores, and

therefore important flows between the nodes, leading to high transportation costs.

Chapter 4 : Empirical analysis: case study

4.1 Recall and Approach of the Study Question

As part of this thesis, we decided to address the position of the supply chain in an omni-channel strategy for grocery retailers. Our goal is to guide companies that operate an omnichannel strategy in the design of their network structure with an analysis and decision-making tools based on different contingent variables impacting company's structural variables.

In the previous literary review, we were able to discuss the different ways for a grocer to build its logistic network, ranging from the retailer's distribution means to reach its client to the replenishment of the products and the location of its inventories. We could understand that a company's strategy will depend on the customers it serves and the market in which it operates.

Our objective in the next part will be the support of our model. To do so, we choose to analyse the omni-channel supply chain strategy implemented by the French Group Carrefour in two different markets: the Belgian market and the French market.

We will analyse Carrefour's strategy in these two markets and try to make a link with the various variables we have already identified. Through our contingent variables, we will consider: the foundations of these two markets, the behaviour of customers and the way Carrefour positions its logistic as part of an omni-channel strategy to meet its new online demand. Via an analysis based on facts and qualitative studies, we will be able to confirm or refute the omnichannel strategy solutions applied by Carrefour Group keeping in mind the different contingent and structural variables that we developed through our review of literature.

We will also complete the analysis of the Carrefour strategy with an interview conducted with Gilles Ballot, Chief Commercial Officer Carrefour Europe North/ East. He will bring us an internal analysis of the factors taken into account by Carrefour.

4.2 Carrefour Groupe's race towards omnichannel

“Create an omnichannel universe of reference” (Carrefour, 2018b)

Carrefour wants to be at the centre of the change that is looming for the years to come and for this has created a restructuring plan called "Carrefour 2022". The goal is to become an actor of change, where the omnichannel will play a key role in the structure of the company. First, Carrefour plans to invest in growing formats and e-commerce. This strategy would be reflected by the creation of new convenience stores, the expansion of its driving fleet as well as the expansion of its home delivery service in several new cities. Secondly, Carrefour is also developing a single e-commerce platform and is concomitantly investing in a new command preparation platform (CPP).

We will now try to see if the Carrefour group has integrated or not the key elements deduced from our literature review.

4.3 French market and consumer analysis

To begin, we will focus on our contingent variables developed as tools for analysing unavoidable consumers and market factors in the implementation of an omni-channel supply chain strategy.

4.3.1 The market

- Market size

Nowadays, France is the third largest market in Europe in grocery retailing, with sales amounting to 224.7 billion euros (IGD, 2018). France is one of the leading countries in Europe in terms of online sales for this sector, with a percentage of e-groceries sales equal 5.6% of the market (Statista 2018c). This figure is high compared to neighbouring countries, but we see that there is still lot of room for improvement compared with a country like South Korea where in 2017 this figure was close to 10% (Credit Suisse, 2017).

- GDP

France GDP level is very high, and the online spending of French consumers is also in the European upper average (PlanetRetail, 2014).

- Density

In terms of population distribution on the French territory, we can see on the graph below, a very high population density in the north-west and south-eastern part of the country. Several cities -like Paris, Lyon, Bordeaux or Marseille- gather also a large number of habitants.

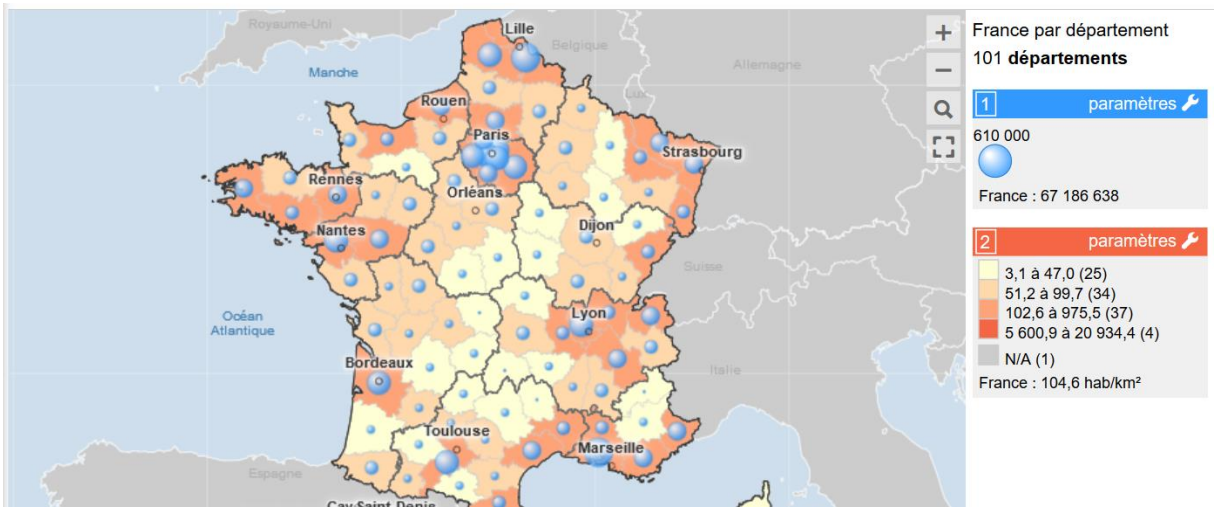


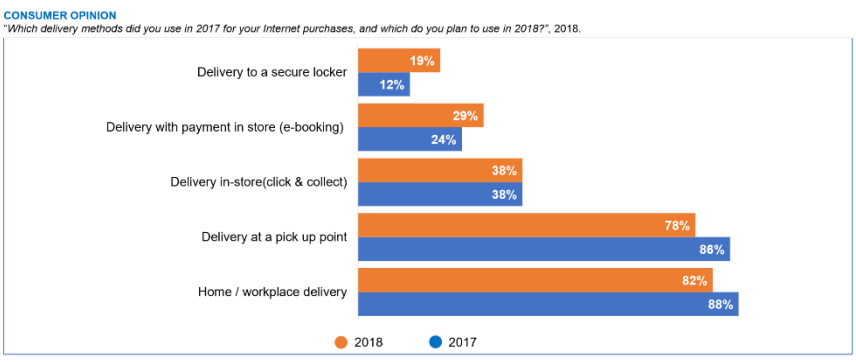
Figure 12: Repartition of population density in France

Source : Insee, 2018

4.3.2 The customer

- Preferences

The expectations of the French consumers for the delivery methods are contrasted. The attraction of drive-in (86%) and home-delivery (88%) are already very high in France with a clear majority of French using both means of delivery. Having to pick up its own order or going through a locker system seems to restrain the French customers even if these figures are increasing.

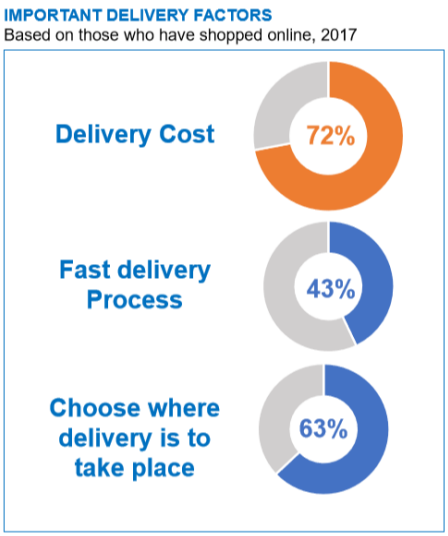


Graph 10: French consumer opinion regarding delivery methods

Source : Ecommercefoundation, 2018

- Price sensitivity

For the level of price sensitiveness and the response time expected by the French, the cost of delivery remains the key point valued by people when they go shopping online. On one hand they expect a quick execution of their orders with a fast delivery service. On the other hand, the cost of delivery remains their top priority and therefore the first barrier to overcome for a grocery retailer.



Graph 11: Important delivery factors for French consumers

Source: Ecommercefoundation, 2018

- Age

France follow the global trend in Europe of an aging population (Eurostat, 2018). Indeed, the age group gathering millenniums and their elders (between 15 - 64) represents in France 59.99% of the population compared to the European average of 55.6% (Ecommercefoundation, 2018). It is important to underline that this tendency will continue with an overall increase of elderlies in Europe and France.

In addition, within the different age categories in France, the category of people between 20 - 60 years are the more likely to order online (Ecommercefoundation, 2018).

It is also interesting to note that the distribution of age categories in France is highly contrasted with a high concentration of young people (under 20 years) in the north. At the opposite, the south of France concentrates “old” people (more than 60 years old).

- Smartphone penetration

Regarding the integration of the smartphone in the everyday French life, we see via the graph in annex 9 that the smartphone penetration rate was almost 77% in 2018. This is important percentage compared with the European average of 65% in 2018 (Statista, 2017)[20].

4.4 The Carrefour omnichannel strategy in France

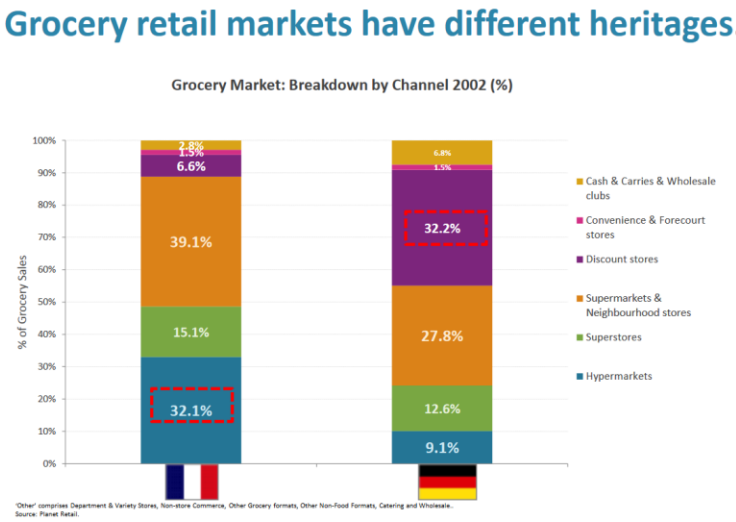
4.4.1 Initial situation of the company

Carrefour Groupe is a worldwide company with markets presence all around the world. The company has a deep relation with Europe ranking number one with 65 billion euros of grocery sales in 2013 (PlanetRetail, 2014).

The company has started its business in France and has always kept its roots in heritage. The group was also number one in grocery sale in the country in 2013 with a total sales revenue of 45 billion of euros equivalent to 18,7% of the total French market shares.

One of the biggest characteristics of the French market -also reflected in the global asset composition of Carrefour in France- is the proportion of large stores. Hyper and supermarkets are quite present in the country. For instance, as you can see bellow, the hypermarket proportion in France is more than 3.5 times what you can find in Germany.

[20] Annex 9



Graph 12: Breakdown by channel

Source: PlanetRetail. (2014)

Another interesting aspect about France and therefore Carrefour, is the number of stores per millions of habitants in the country. In France this number is near 190 stores per million of habitant and this number is quite high compare to the average percentage in the European union (Nielsen 2017c).

4.4.2 Carrefour Omnichannel supply chain strategy in France

- Distribution services

Currently, Carrefour Group propose a whole panel of delivery possibilities to its customers. Their offers are locally different

In rural suburban area:

- A tremendous drive network exists with around 576 drives in France. Around 15,000 different references were available and in 2016, 4.6 million deliveries were booked through this service (Carrefour, 2017).

In some urban centres:

- Home delivery, called Ooshop, is proposed with a possible delivery time in D+1 and D+2. Again, around 15,000 references are available through this service. This service is only accessible in some big cities like Paris, Lyon, Marseille or Nice. According to last Carrefour announcement, the group plan

to start providing this service in more than 20 cities for the end of 2018 (Carrefour, 2017).

- Super-fast home delivery service within one-hour. This service is only available in Paris and its suburbs with an assortment of 2,000 Skus. The delivery cost is around 5 euros. Due to the speed of the delivery, all the products are taken from the stores 'stocks (Carrefour, 2017).

- Inventory

Carrefour has adopted a quite defensive strategy, building drive points always attached to its stores. However, this "defensive strategy" must be interpreted. As mentioned before, Carrefour dispose of many hypermarkets and supermarkets in France. The company is taking this as an advantage and uses these shops as warehouses for its picking points. The objective for Carrefour is to create 170 new attached drive in 2018 and half of its shops will be proposing "click and collect" in 2019. In reality, the ultimate goal of Carrefour is to reduce the space allocated to shelves in these markets to transform them in small warehouses or even some of them in dedicated DC/ dark stores. That's why, Carrefour has planned to reduce its total hypermarkets size of 100 000 square meters for 2020 (Carrefour, 2018b).

Next to its current store's network, Carrefour has also started to build a dedicated DC called a PPC "Plate-forme de préparation de commandes" (2018 in Aulney-sous-Bois). So, this PPC is totally dedicated to online sales and its role will be to handle most of the drive and pickup online sales, in the region of Paris (Interview). Carrefour France has already started a first project in 2016 near the city of Lyon. However, Carrefour has announced that its PPC would not manage all the fresh part of the groceries still provided by the shops near the drive in.

- Break-open point

For most of the services provided, Carrefour is using its network structures and the flow of pallets between its warehouses and stores to fill the online orders. This means that most of the drive-in orders are filled from the stores' shelves. The home delivery orders are either filled from classics stores (supermarkets and

hypermarkets) for the D+1 or +2 delivery or from the convenient store for the specific express delivery.

As mentioned before, the principal objective of the new PPC warehouse will be to provide picking and collect points nearby. Therefore, the picking points for those places will be up streamed and will take place in the PPC. These PPC would permit to reduce the global picking cost and to dispose of more product for the drive-in, which is actually one of the major defaults of the Carrefour drive service (Interview). The only default could be a light reduction of the time response resulting from the delivery time needed between the PPC and the stores.

- Number of nodes

The PPC represent a new step in the whole chain of online products replenishment. The PPC will be placed between national DC and pickup points.

Next to this, the new CEO of Carrefour Group (Alexandre Bompard) has announced a plan to build 2,000 new convenient stores in the world including France in order to develop a specific strategy of fast delivery managed by convenient stores. Linked with this announcement, Carrefour will start an express delivery service in 15 new cities in 2018 (Carrefour, 2018a).

4.5 Link between Carrefour omnichannel strategy in France and our framework

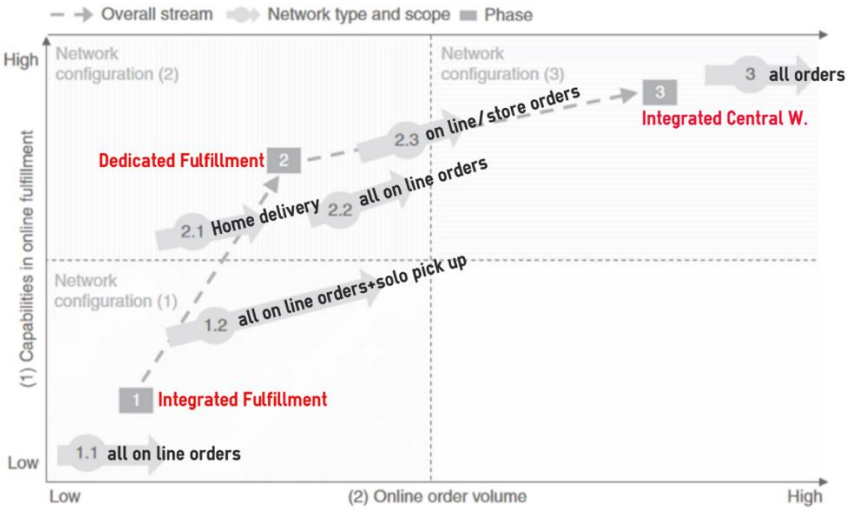


Figure 11: Evolution of the Fulfillment's structure of a retailer

Source: Adapted from Lim et al., 2018, p. 316

4.5.1 Description of the situation through the framework

The grocery online sales of Carrefour have already reached a threshold with billions of euros. So, we expect Carrefour to propose more than just a simple integrated fulfilment network where all its online sales are handled by stores. The particularity is that Carrefour is at different stage of our framework, depending of the region where the group operate.

- In the very densify area, where the online demand is the highest, Carrefour has opted for the implementation of specific DTC, that they called a PPC. This DTC is responsible for the fulfilment of pickup points. As mentioned before (3.2: Fulfilment/replenishment system) the advantage of the DTC is that it allows to increase product availability that cannot be handled by stores after reaching a certain threshold in online demand. Gilles Ballot also specified (interview) that PPC permits to increase sales due to a super-efficient logistic, where out of stock are nearly eliminated at drive points.

  Moreover, with Carrefour's strategy of increasing further their park of convenient stores in big cities, like in Paris or Lyon, the group focus on a model comparable to "the integrated central warehouse" (3.2.3) based on a large convenience store network where online order will be delivered as fast as possible, very close to the clients.

  Both strategies have been implemented in Paris, which is the most densify city in France with 2,2 million of citizens (intra-muros), and Lyon, which is also a big city and at the opposite side of the country (Figure 12 above). The population is also much younger around Paris and Lyon, an important factor as far as the probability of buying online is higher amongst young people. We can therefore notice that market contingent variables have been considered by Carrefour to choose where to apply these strategies that are fitted to respond to high online demands.

- Carrefour has also taken into account contingent variables related to French consumers 'expectations since the company has invested in their two favorite

delivery means: home and pickup delivery while integrating their price-sensitivity. Indeed, when the order reaches a certain value, shipping or pickup cost are free.

- Its initial network of stores is a huge leading card for Carrefour and the company is using the heritage of its "initial" business. Carrefour initial network structure could be place at the position 1.1 (integrated fulfillment, with stores managing all online orders) on the graph above, but at the **end of the arrow**. Thanks to its huge store network, Carrefour 'stores can handle online sales until an important threshold. Moreover, Carrefour strategy is, as mentioned before, to increase stores' inventory capacity. This permit them to provide a drive-in service with a wide range of available products. In fact, the company is actually decreasing its number of classical warehouses and at the same time changing the organization of its stores in order to integrate portion of the inventory dedicated to online orders. This way of doing things could be associated with the image of trying to extend this arrow mentioned before as far as possible to the right, an attempt to augment the maximum manageable threshold.

4.5.2 Description of possible changes through the framework

Thanks to our framework, we have been able to analyze several decisions that Carrefour has taken in France in the implementation of its supply chain omni-channel strategy. We are now going to analyze, with our framework, in which direction Carrefour should go to optimize what the company has already undertaken.

- At the moment, Carrefour is not using all the potential of its DTC since they are only dedicated for the fulfilment of pickup points and do not fulfil home deliveries. Since truck travelling from DTC to stores are often specifically dedicated to online sales delivery, they are also super-efficient in last-miles logistics and home delivery. It is the reason why in point "3.2 Fulfilment/replenishment system filled by DTC", DTC are always managing partly or totally home deliveries. But even if Carrefour is not doing it for the moment, according to Gilles Ballot (Interview), this will be made in the future.
- Concerning Carrefour's will of investing in their convenience stores and replicating a model comparable to the "the integrated central warehouse" (3.2.3).

The mismatch with the initial model is that PPC do not deliver offline orders to convenience stores. Consequently, there is no cross pooling or cross-inventory between online and offline sales of convenience stores. Therefore, this situation will not use most effectively the high frequency of transport between the convenience stores and the PPC. In the future, shipping online and offline order together to convenience stores could drastically augment Carrefour efficiency.

- Changing the organization of their store in order to integrate portion of the inventory dedicated to online orders seems to be a good idea until a certain point. This strategy is sustainable in certain region, but in other areas they will need to think about building new PPC. Carrefour has a bad reputation regarding online product availability (interview) and this is certainly linked with the effort of avoiding investing in too many new DTC.

4.6 Belgium market and consumer analysis

To begin, we will analyse our contingent variables in order to provide tools analysing key consumers and market factors necessary in the implementation of this omni-channel supply chain strategy.

4.6.1 The market

- Market size

In Belgium, the home consumption turnover was equal to 25.5 billion euros in 2015, which corresponds to an increase of 2.4% year-to-year. Compared to its neighbors, the online groceries sales are not well developed. Indeed, the share to online is only 4.6%, so a bit more than 1 billion euros (Nielsen, 2017c).

- GDP

The GDP in Belgium is quite high and ranked 11 amongst the European countries. The average income of Belgians amounted to 17,698 euros in 2015. The net taxable income of the Flemish is on average 7% higher than the national average (18.970 euros). The income of the Walloon amounted to 16,684 euros against 13,831 euros for the Brussels (source: the Statistics DG of the FPS Economy).

- Density

Belgium is on average a densely populated area but there are drastic contrasts amongst the different regions. The south part of the country is much lower in population with generally less than 100 inhabitants per km (Kantar, 2017). There is an exception in this part of Belgium with Luxembourg and some other cities. Most of the densify cities of Belgium are located from Brussels to the north of Belgium where there are several places with more than 500 inhabitants per km (Kantar, 2017): the Antwerp-Brussels-Ghent triangle and the Walloon axis of old industrialization.

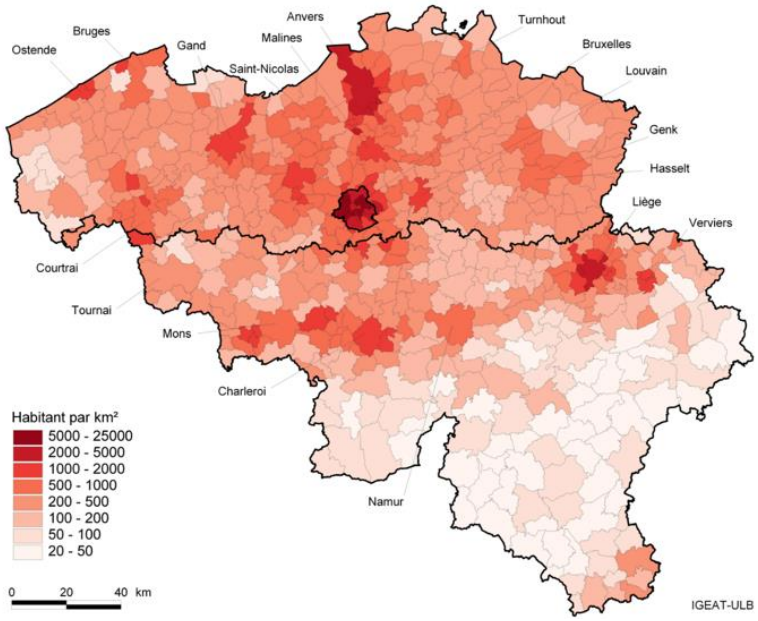


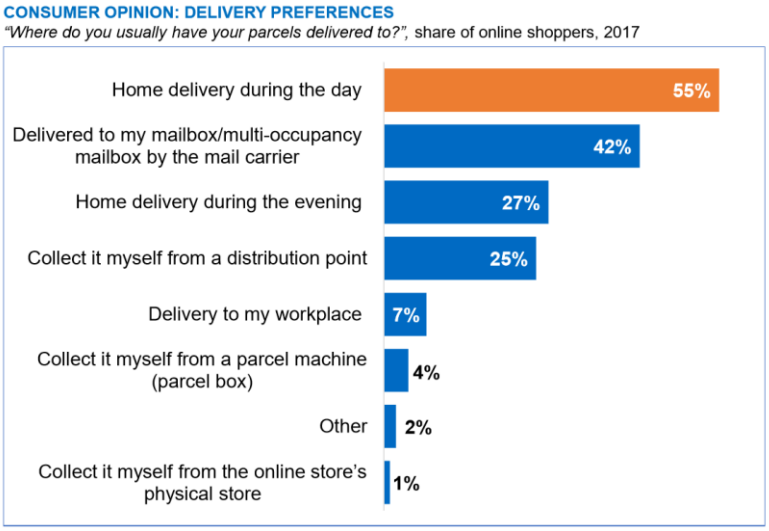
Figure 13: Density Belgium population in 2010

Source: SPF Economie, 2010

4.6.2 The customer

- Preferences

With the following data, we find that the demands of the Belgians in terms of delivery and preference between the different means is clearly expressed, which is very different from the French consumer. We see on the graph bellow that the attraction of the Belgian for home-delivery is super high. In fact, most of the other delivery (collect myself) method are not taken that much into account.

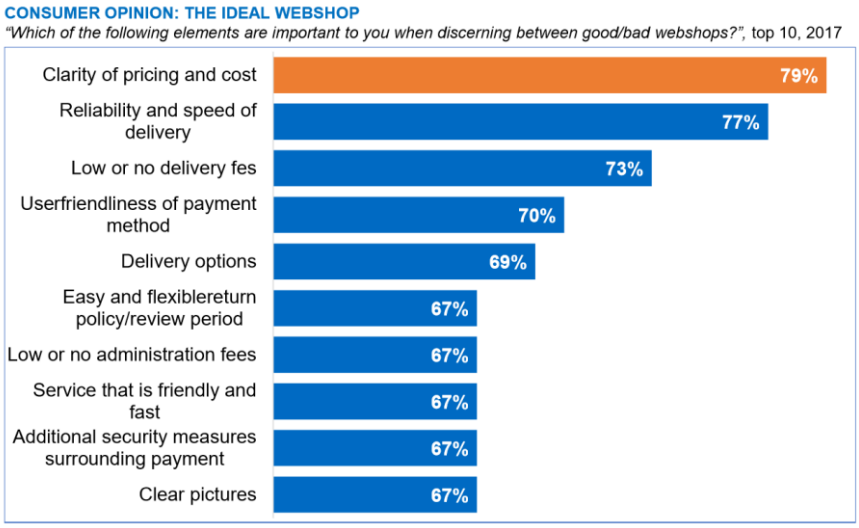


Graph 13: Belgian delivery preferences

Source: Ecommercefoundation, 2018

- Price sensitivity

Like in France, Belgian consumers are very price sensitive and put this dimension of the foreground, even if the contrast is less flagrant with other important factors. We see that the reliability and delivery speed is also a point of high importance for Belgian.



Graph 14: Belgian webshop preferences

Source: Ecommercefoundation, 2018

- Age

People aged 15-24 and 25 to 34 are the most active among Internet users (82%) and people with high education attain the highest score (79%) (MediaSpecs, 2016)

In 2016, the Belgium population was 11.3 million of habitant. As in Europe and France, the population in Belgium is aging. Indeed, in 2016, there was 1 person aged 67 or over against 4 individuals between 18 and 66 years old (StatBel, 2018).

- Smartphone penetration

Since 2013, when there was a smartphone penetration rate of 39%, Belgium has known a fabulous increase with nowadays a percentage that has reached 80%. The tablet penetration is also huge, with 81 %. This is important when you know that 16% of buyers in Belgium are using a smartphone or tablet when they shop online (Deloitte 2017).

4.7 The Carrefour omnichannel strategy in Belgium

4.7.1 Initial situation of the company

In 2017 Carrefour had 18.7% of the grocery market share (ms) in Belgium (Gondola, 2017). This figure is considerable even if the supermarket company is not number one in the country, since there is a rude competition, principally lead by Colruyt (26.6% ms), Delhaize (20% ms) and hard discounter (Gondola. 2017).

Belgium is part of the European countries with the biggest number of stores per habitant, with 240 stores per million of citizens. Carrefour is not left out in this area, with around 800 stores in Belgium (Interview). Even if Colruyt get most of the credit in Belgium for drive-in, it is Carrefour that has been the first actor to launch the drive concept in Belgium. This was in 2013. Since then, the company has continued to build drive-in attached to stores.

4.7.2 Omnichannel supply chain strategy of Carrefour in Belgium

- Distribution services

Currently, Carrefour Group propose a panel of different possibilities to its customers to deliver them the groceries they bought. Their propositions are -like in France- differentiated according to the localization but at a much smaller level.

- In nearly all the country, Carrefour propose a pickup and drive-in service. There was about 170 points of drive in 2017 and the objective of 2018 is to increase this number to 250 (Carrefour, 2108c).
- Next to this, Carrefour propose a home delivery service in some region like Brussels, the Walloon and Flemish Brabant, the West and East Flanders, Antwerp and Limbourg. Carrefour is not managing all the distribution on its own. Indeed, a part for its home delivery service is done by Bpost through a partnership and the rest is mostly handle by the Cargoville DC of Carrefour (Carrefour website).

Recently Carrefour has also launched a project called "Parcify". Customers will get the opportunity to get home delivered from their nearby convenience store at a precise time of the day. This project is just at a prototype level and is only available in Brussels.

- Inventory

Carrefour defensive strategy of building drive point always attached to its store is also applicated in Belgium. The situation is similar with a tremendous park composed of different type of markets and convenience stores. The company is taking this as an advantage and using these shops inventories. However, in Belgium, the proportion of big hypermarkets and supermarkets is much lower compared to France (see: Interview). This means that there is clearly not the same opportunity to use stores' inventory to handle increasing sales.

Next to its stores, Carrefour has one DTC allocated to online sales in Cargoville. The problem lies in its limited capacity of fulfillment due to its size but also to its coverage area. These restrictions are certainly one of the reasons hidden behind this need of partnership with Bpost. While speaking with Gilles Ballot, he told us that the group was thinking about the PPC concept for the future of the company's business in Belgium. So, actually most of the pickup, drive-in and the home service are delivered by the store and their limited inventory.

- Break-open point

For most of the services provided, Carrefour is using its network structures and the flow of pallets between its warehouses and stores to fill the online orders. This

means that the drive-in orders are filled from the stores' shelves as well as for the home delivery orders.

For the moment, Carrefour is therefore managing all its online orders from the stores and from Cargoville. In fact, Gilles Ballot told us that the market was still not mature enough to go to the next step in term of logistic. But he believes that the transition will come soon with the augmentation of the offer from the different actors.

- Number of nodes

Actually, the network used by Carrefour is quite simple in Belgium, with an integrated system putting most of the online sales pressure on store. Like in France, Carrefour Belgium is counting on its large convenient store network to reach their clients and even removing the last mile and delivery widow problem by delivering to customer's closest store.

4.8 Link between Carrefour omnichannel strategy in Belgium and our framework

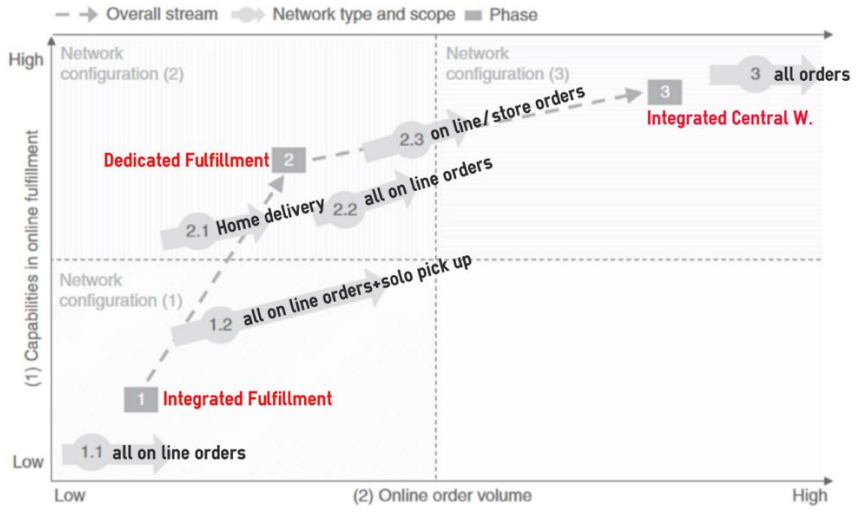


Figure 11: Evolution of the Fulfillment's structure of a retailer

Source: Adapted from Lim et al., 2018, p. 316

4.8.1 Description of the situation through the framework

The grocery online sales of Carrefour in Belgium have already reached a certain online sales amount, but the situation is still much less developed than in France (Interview). We still expect Carrefour to propose several fulfilment and delivery options, although at a smaller level than their French 'business.

- Since most of online sales are made in cities (Interview), Carrefour does not provide home delivery in region low in density. According to Gilles Ballot (Interview), the first factor considered for implementing this type of service is the demand, that you find in big cities and that provide logistics efficiency. Due to low online demand and a threshold that is not reached in most part of the country, Carrefour is partly making home deliveries from its stores, supply by its Cargoville DC, while working in partnership with Bpost for the rest. This situation has been highlighted before at the point 3.2.2.1 "First limit: the online sales threshold", where companies with small online sales are recommended to use their own assets or to contract a part of their online order delivery.

- Like in France, Carrefour Belgium can also count on a well-developed initial network of stores. Most of Carrefour fulfilment structure in Belgium is situated at the point 1.1 (integrated fulfilment) on the graph above, and this time rather on **the middle of the arrow**. Indeed, the tremendous proportion of hyper and supermarkets is linked with French history and is not as significative in Belgium. The global inventory of the stores 'network in Belgium represents therefore a smallest opportunity. Even though, due to the present low online demand and thanks to its store network in Belgium, Carrefour 'stores are totally able to handle all the pickup online sales.
- Carrefour is considering improving its home delivery service through its Parcify project. The project is comparable to France fast delivery project, where Carrefour use its convenience stores network to provide fast deliveries. In this case convenience store are not supplied by a DTC but, from stores shelves. So, it stays an integrated fulfillment model, but nearest to the client.

- Following these points, we can notice that Carrefour is considering contingent variable linked with its Belgian clients and market simultaneously, but these do

not always match. Since Belgian do prefer homedelivery relatively to pick up services, nevertheless low online market size and population density do not permit Carrefour to reach a sufficient threshold to arrive at a profitable situation everywhere.

- Finally, Carrefour has well understood the price sensitivity of Belgian consumers by offering free delivery services at a certain basket value (the only negative point that we could mention is that the publicity on the website regarding the absence of delivery fees is totally absent).

4.8.2 Description of possible changes through the framework

Thanks to our framework, we have been able to analyze several decisions that Carrefour has taken in Belgium in the implementation of its supply chain omni-channel strategy. We are now going to analyze, with our framework, in which direction Carrefour should go to optimize what the company has already undertaken.

- Carrefour is considering improving its home delivery service through its Parcify project. But to support a sustainable growth in the future as in France, the management must think about bigger investments, since convenience store inventory are quite small to fulfill online and offline demand. The implementation of a specific DTC as in the point 3.2.3 “the integrated central warehouse” could sustain this possible growth. But one issue remains associated with this kind of DTC: the need of high initial investments resulting that a certain number of online sales has to be reach before the implementation.
- Moreover, Carrefour has launched this DTC/PPC concept in France with a main focus on drive-in and does not even consider home delivery at the beginning of the PPC project. However, the drive concept it is not taking the same broadness in Belgium and thus, it does not bring the same value to a new PPC. These issues lead to a situation where Carrefour does not intend to invest a lot in Belgium and rely mainly on its actual assets to provide different services.

Chapter 5 : Conclusion

5.1 Summary of the case analysis and managerial implications of the study

Grocery retailers have moved in a short period of time from a single-channel to a multi-channel model. Now, all companies recognize the importance of the omni-channel model but the organization/strategy they have to put in place is not yet well defined.

The main objective of this thesis was to highlight the different possible variations of the network structure supporting the supply chain of a grocery retailer that implements an omni-channel strategy and to see the variables that influence this structure. The ultimate goal was to create an analysis framework that allows players in this market to orient their present and future omni-channel strategy.

At the end of this document, we were able to assert, through a case study of the Carrefour Group's strategy in two different markets, that its omni-channel strategy and its decisions were strongly linked to the various variables identified during our review of literature. Confronting our framework to a real case study, has permitted us to prove that our researches were highlighting concepts totally valued on the field by a company like Carrefour. Moreover, our framework was also able to predict in which directions Carrefour strategy was aiming for the future and was supported by future projects planned by the company (Interview).

Indeed, Carrefour is developing its logistics in several ways depending on its initial assets and especially the region in which the Group operates. We noted that the cornerstone around which Carrefour's strategy turns, is its online sales by region. They are the priority that will force the company to consider new investments to support the demand. Thanks to our framework and the explanations of the different network structures possible for a grocery retailer, we have been able to identify the advantages and disadvantages of possible variations of Carrefour’s supply chain. We have also been able to identify the improvement points for Carrefour. Since we noticed that Carrefour

has developed its supply chain with assets like its PPC but nevertheless, the company is still not using these at their full potential.

Finally, our analysis has permitted to underline the link made between the market, the customers' demands, and the kind of response adapted to customer's expectations.

5.2 Limitations and suggestions for further research's

While conducting this study, we have left apart various points in order to remain focused on our top priorities. We have chosen to address the supply chain problem on a rather classic way considering for example traditional means and assets to fulfil customer demands. We are certainly going to see other drastic change in this domain in the near future.

The framework we have built and the variables we found, have for objective to guide companies in the design of their network structure (with a supply chain point of view) when implementing an omni-channel strategy. Omni-channel is a recent concept in development, therefore we have considered a qualitative analysis, since there does not exist any precise example of perfection in this area. But further analysis on the evolution of consumer's behaviour are going to be necessary for a better focus of grocer's strategy.

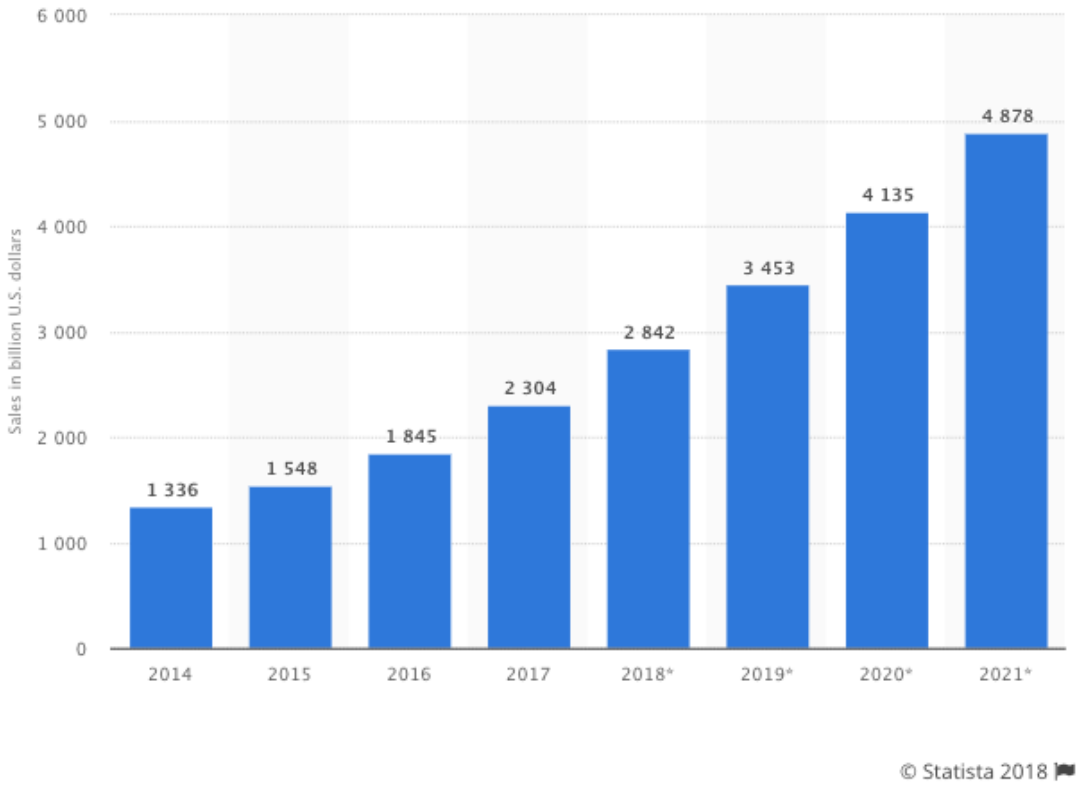
For the future, looking for new supply chain possibilities and technologies improvement is going to be mandatory. For instance, new phenomenon like the "uberisation" by which a new economic model is brought by the digital economy are going to quickly challenge the old model of the "traditional" economy.

Next to this, grocery retailer strategy will change, and their supply chain will need to follow. For example, home delivery of ready-made meals or ingredients required for recipes, are already removing fresh produce from department stores. However, it is the fresh products that constitute one of the key attractions of the stores for their customers. Finally, direct sales by powerful suppliers to customers are not excluded.

Chapter 6 : Annex

6.1 Graphs, tables and figures

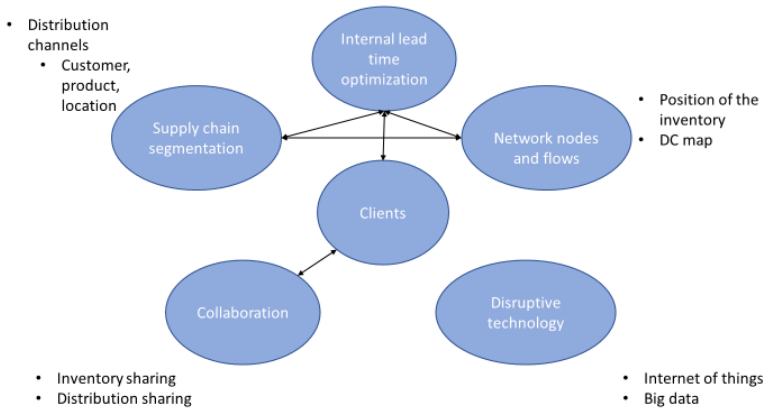
- Annex 1



Title: Retail e-commerce sales worldwide from 2014 to 2021 (in billion U.S. dollars)

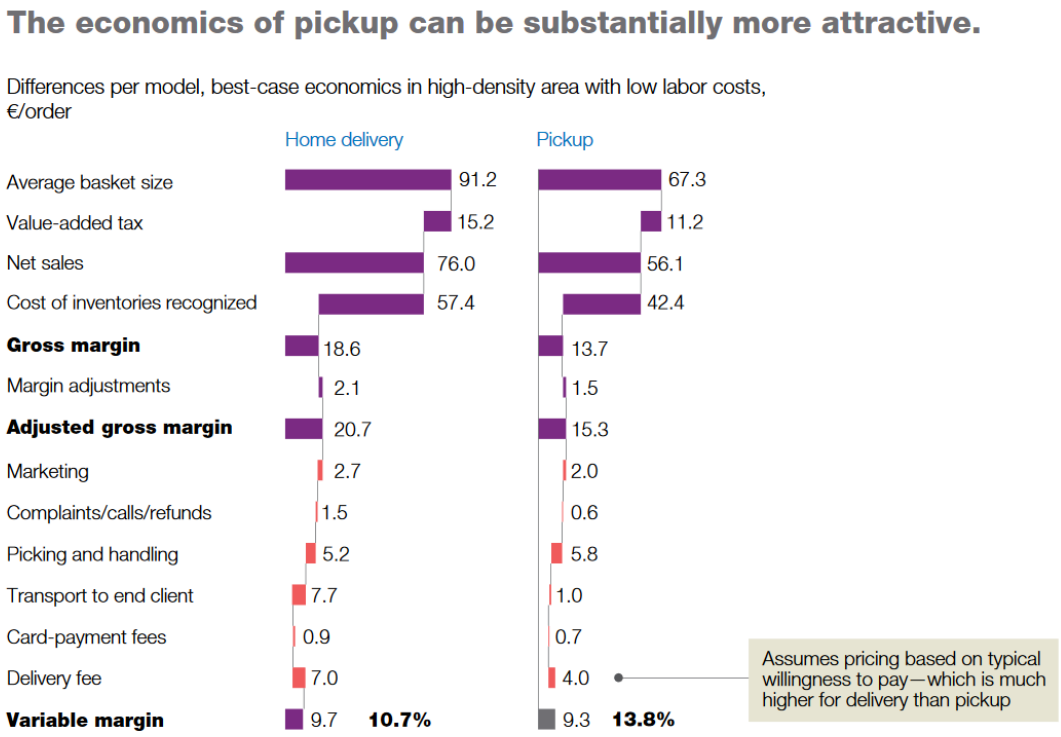
Source: Statista. 2018b

- Annex 2



Source: Adapted from Kumar, R., & al., 2017

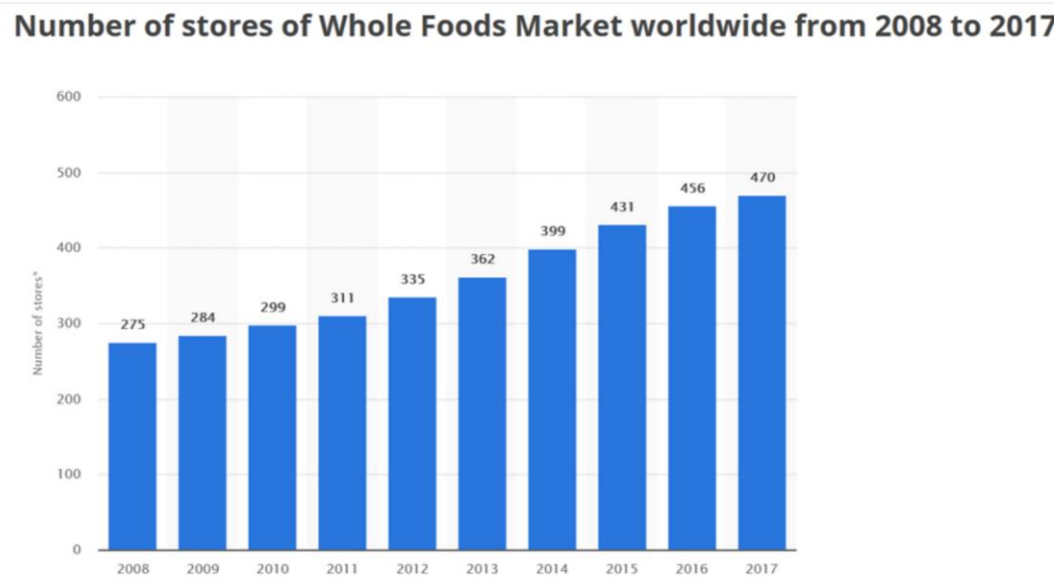
- Annex 3



Title: Economics of pickup and home delivery

Source: McKinsey, 2013

- Annex 4



Title: Number of stores of whole Foods Market wordwide

Source: https://www.statista.com/statistics/258682/whole-foods-markets-number-of-stores-worldwide/

- Annex 5

Title: Consumers expectations for online available products

Source: Accenture, 2014

- Annex 6

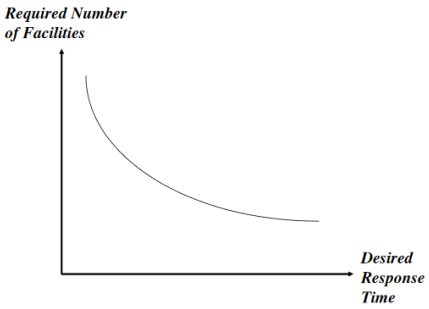


Fig. 1. Relationship between desired response time and number of facilities.

Title: Relationship between desired response time and number of facilities

Source: Chopra, 2003

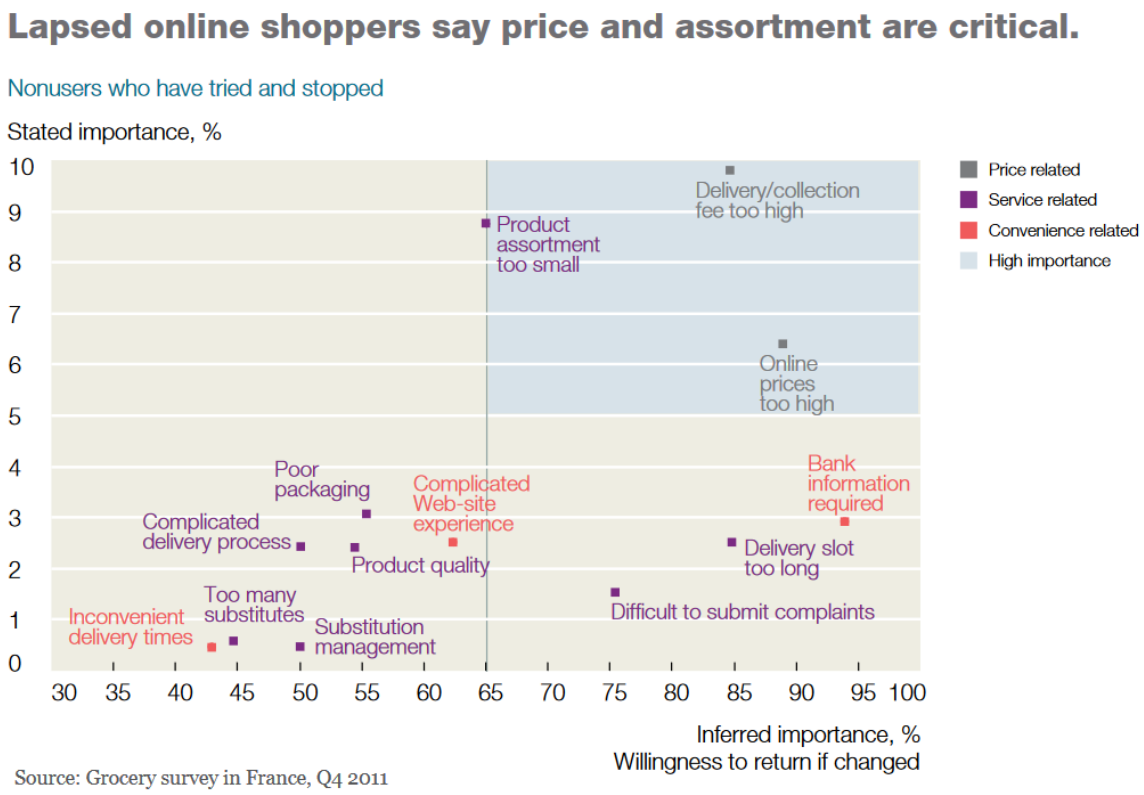
- Annex 7

	Under 50K	50K-100K	100K-150K	>150K
U.S. Adult Online Shoppers (Verto Data)	41%	32%	19%	8%

Title: The e-commerce: the state of cross device digital shopping

Source:Verto Analytics, 2018

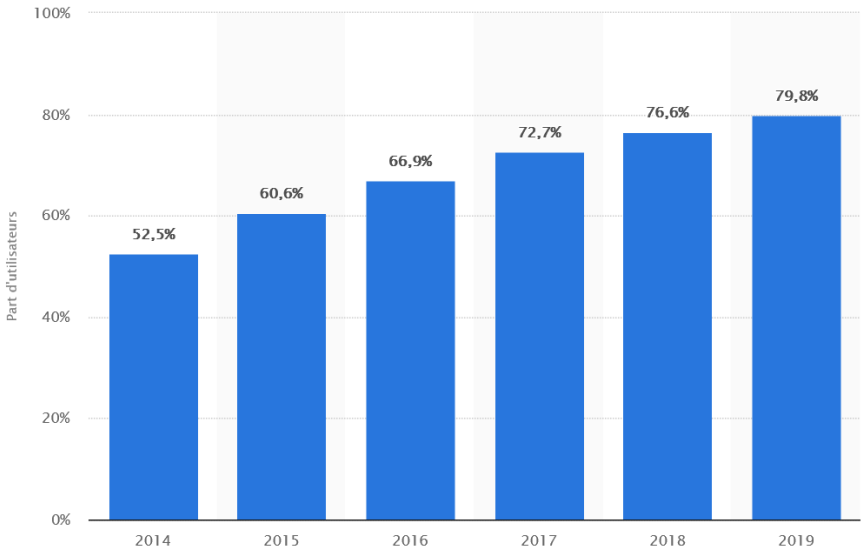
- Annex 8



Title: Lapsed online shoppers say price and assortment are critical

Source: McKinsey, 2013

- Annex 9



Title: Smartphone penetration France

Source: Statista, 2017

6.2 Interview of Gilles Ballot (Carrefour)

- *Question: What do you think about the current situation of e-commerce in Belgium? If we compare to a country like France where you have the majority of your business?*

  I think that the Belgian market is probably a little less mature than that of its French, Dutch or German neighbors. However, I think it will accelerate from the moment the offer is available. For example, if we take the French market, the drive is what has the most breakthrough.

  For me the drive is a short-term solution and in the long term we are leaning more on a home delivery system and withdrawal points. Because in the end, the problem of drive is to ask the customer to make the effort to go to the store but without getting him to go in the store. The drive represents a paradox of cost for the company, because it is not optimal in number of transports and transactions for a service that does not reach the customer directly. With a certain market maturity, a sufficient demand, the homedelivery will be more competitive in terms of cost for a service rendered to the customer.

- *Question: At the same time, you invest in France in big PPC (darkstore) which will be entirely dedicated to the delivery of drive point.*

  There are significant risks associated with these investments. Today these warehouses are only making preparations for drive, but tomorrow I think they will be multifunctional and therefore deliver directly to homes. These are very well sized buildings, with a long-term optimization plan including robotization for certain categories of products.

  Today, these warehouses allow in the short term to increase the sales of the drives, by eliminating our problems of break-out. We know that since the implementation of the new PPC at Aulnay-sous-Bois, we have a growth in the drive concerned to several tens of percent. PPC helps reduce break-out because

attached drives quickly experience this problem. A PPC makes it possible to have no more limit in the number of people passing in a drive per day. Secondly, the stores are limiting themselves willingly in practice due to pickers constraints, in the number of drives they can handle per day.

- *Question: Could you have developed another model?*

  We have 230 Carrefour hypermarkets in France and the idea could be to consider them all as warehouses. This would be the optimal cost solution for not having to build new DCs. For example, in the case of the Aulnay-sous-Bois CPP, there is a hypermarket next door that is 10,000 square meters.

- *Question: A model with PPC on the one hand and hypermarkets on the other, that increase their storage space, would be the future?*

  I do not think it is the reconversion that the hypermarket will have, which represents a huge park in France. The problem of the hypermarket comes from the moment when one reaches surfaces of 8000 to 10 000 square meters where to be relevant it is necessary to propose a model multi-specialist. The idea is to bring experts from certain professions where we do not have the expertise. For me the reconversion of hypermarkets must be done into commercial space. But yes, in some hyper, new features like destocking or outlet are possible.

- *Question: Where are you in term of logistic integration in Belgium?*

  We have our food and non-food depot in Cargoville that does not serve 100% of the country and our partnership with Bpost. But our warehouse is already able to serve Brussels for home deliveries. A PPC is not yet on the agenda, even if we have it in mind.

  A PPC can only be considered in a small area. Maybe for example a PPC for Brussels could also provide Ghent at first, considering taking larger transport loads at the beginning in order to ramp up, to justify the fixed costs.

- *Question: What is the most effective way today to prepare your online orders?*

  Currently we know that the PPC is the ideal tool to fulfill this task. The most optimal is to have a remote preparation, but close to the store so at a city level. For the models of the future, the ideal would be to uberise the delivery. We started this project with ShiTo, where you have a personal shopper, who will do your online shopping for you and bring them to your home. I believe that tomorrow, there will be a new creation of professions that will be made, and models will emerge. The partnership that I would have liked to see, would have been with Uber, to outsource the problem of the last km.

- *Question: How can you evolve to this ideal home delivery model?*

  We have 800 stores in Belgium and delivering an Express next to the customer is almost home delivery and is sometimes even more ideal for the customer, as this eliminates the problem of the delivery schedule. After you have to find the economic model, the owners of Carrefour Express are independent franchisee. I spoke with an express manager in Paris, part of the pilot project where he is delivered by the PPC of Aulnay and it is very positive. Its constraint is the size of the reserve and therefore the number of online orders it can deliver. Actually, there was some cannibalization negative effects, but on the other side it procures him extra traffic in his store. Moreover, if it takes off, he would almost have to revisit the concept of his store to steer him more on fresh produce and ready to eat, in order to have a complementary offer.

- *Question: Do PPC deliver fresh food?*

  In part, but in the purchase of fresh food, there is a dimension of pleasure and it is also the type of product which by essence will remain the longest in store, as the prepared meals.
  I think this model will take off and will impact the conception of the Carrefour Express.

- *Question: What criteria do you consider when deciding to provide a specific delivery service in a geographical area?*

  Today it is a logistical constraint compared to the carrier. For the moment we have a strong growth, but it remains low compared to what the market can represent. We will first tackle the big cities, where the demand and logistical saturation are permitting to optimize the number of deliveries on a conventional carrier route. Moreover, at the level of our e-commerce sales in Belgium, Brussels and the other big cities have a dominating weight. The population is also often younger in the city center.

- *Question: How do you take into account the problem of speed delivery?*

  I especially find that in France or in the United States, many retailers have focused on advertising the speed of their delivery. For me, what is important for most customers is the accuracy of the delivery window and the quality of service more than the speed. However, it is very difficult to achieve, especially in Belgium and Brussels following the worsening of the fluidity of transport. A new type of vehicle can be considered to have the right solution of urban transport.

- *Question: What do you think of the concept of merged DC?*

  We intend to do it, at least for all the slow moover, we must have a unique B2B and B2C logistic. Today we have already started this system by offering the convenient stores to be delivered at the customer size product from our new DC dedicated to fresh food. In this DC, the products are stored on a parcel slot to be sent in boxes or even at customer size level. I imagine that much of our logistic model of tomorrow will be based on this model for the slow mover.

6.3 Abbreviations

- OC: Omni-Channel
- MC: Multi-Channel
- DC: Distribution centre
- DTC: Dedicated Distribution Centre
- CPG: Consumer-Packaged-Goods
- 3PL: Third-party logistic
- FMCG: Fast moving consumer goods
- PPC: Point de préparations de commande/ Point of command preparation

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