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EFFICIENCY OF E-GROCERY: CHALLENGES AND SUGGESTIONS

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IN EPIC PROGRAMME

MASTER'S THESIS

Efficiency of e-grocery: challenges and suggestions

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SUMMARY

Buying food online has been an emerging trend in the later years. There is a high demand from customers on this service. However, the e-grocers are losing money and goes out of business. The reason for that is low margins and customer's unwillingness to pay extra for this service. In this thesis we have mapped out the different factors (or challenges) that e-grocers face. In turn we have found optimization solutions for said challenges. Important factors are for example customer behavior and expectations, picking efficiency, packing, and final delivery.

Most of previous studies focuses only on analyzing each individual part of the supply chain of e-grocery. Therefore, in this thesis, we would like to bring a comprehensive view that covers the whole process of order fulfillment by pointing out major challenges in each step and suggesting some solutions based on both theoretical and practical analysis. Readers cannot have complete insight from the beginning to the end of the process, and to understand the work of improvements that is needed to contribute to the success of the e-grocery business.

Revising other researcher's works and carrying out some analysis, we find that there are rooms for improvement in each activity of e-grocers. For example, warehouse-based picking is most applicable in dealing with a growing market, as it can handle orders much more efficiently, handle more orders, bigger room for growth, and higher overall capacity. More detailed challenges and solutions will be presented in this thesis with the purpose of optimizing the efficiency of retailers in terms of costs, revenue and customers satisfaction.

The authors find that for e-grocers to be profitable, there needs to be major efficiency improvements made. The improvements must be made in every single step, synchronizing together, from the customer placing the order till final delivery. Those solutions suggest that investment in new methods, new technology and innovations is needed. It could increase the costs of e-grocers at first, however, it will result in an increasing sales and better customers services. Therefore, overall the business will be more efficient if right solutions could be implemented at the right time.

FOREWORD

This thesis completes our Master of Science in Business Administration at the University of Stavanger (UiS). Our topic on e-grocery was brought to us by the international collaboration program EPIC from Erasmus, and professor Jan Frick at UiS. E-grocery is a new market segment and completely alters the way be buy our groceries. Our hope is that this thesis will be of help to e-grocers and help them to understand what challenges arise and what available options to solve them.

Writing this thesis has been extremely difficult due to lack of prior knowledge, and e-grocers reluctance to give insight to their way of business. However, through writing this thesis we have developed knowledge and gained some insight into how this sector operates. Our thesis is built on our understanding of e-grocery, documented publications, and help from our professor Jan Frick and Jacob Beer in SSI Shäffer.

We would like to use this opportunity to extend our gratitude towards professor Jan Frick for making this thesis possible. Professor Frick has been a valuable source of both guidance and motivation through the process of writing this thesis. We would also like to extend our gratitude towards Jacob Beer at SSI Shäffer. Beer have given us much valuable information about the inner workings of e-grocery from his many years of experience. At last, but not least, we will thank the EPIC project. This project has given us the opportunity to meet and talk to students and professors from several European countries and allowed the writers of this thesis to meet as well. Through this project we also met Ibrahim Apena who is also writing a thesis about e-grocery. Apena has helped us a lot regarding EPICs demands and quality meetings.

Finally, we would like to dedicate this whole journey of following master's degree in Norway to our family, our lovers and our friends, who always give us strengths and motivation to complete our study and this thesis in particular.

Best regards,

Van Chuyen Do

Kristian Omdahl

Stavanger 15.06.201

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1 Introduction

Online shopping has nothing but grown over the years, we see that physical stores in certain segments are going on a downward trend. More customers are turning towards buying their goods online, however, the grocery market has been lagging behind. Online grocers must understand what factors are influencing customers to adopt to an online channel, and the relationship between an online shopping experience and the adoption process (C. Hand, F. D. Riley, P. Harris, J. Singh, R. Rettie, 2009). As of now, this has not been properly addressed resulting in poor supply, which again turns into poor demand (Nicolò Galante, Enrique García López, Sarah Monroe , 2013).

It can be shown that uncertainty and risk are high when the physical and temporal distance between the supplier and buyer in an e-commerce market exists (Kim H. W.; Xu Y.; Gupta S. , 2001). This notion is particularly applicable for the e-grocery market. Food/product quality remains as one of the most important factors for customers when purchasing food on an online platform. Being able to deliver food with high quality in a short time span when customers are not willing to pay more is a logistical issue for most e-grocers. The cost of picking, packing, and final delivery is extremely high, and when the profit margin on the goods accounts for 2-3%, it becomes difficult to cover these costs. Failure of containing these costs with no additional revenue is the main reason for e-grocers going out of business.

However, customers are getting accustomed to buying more and more goods online instead of going to physical stores. The demand for buying food online is also increasing as an increasing number of customers are turning towards this platform. Grocers should pick up on this trend sooner rather than later. Being proactive rather than reactive is extremely important when adapting to a changing market structure. Kodak and Blockbusters are two great examples on how important this is. Market surveys and forecasts show that there is a latent demand for ordering food online, if one e-grocer can capitalize on this and create a service with outstanding quality at a low cost, there is a big potential for exponential growth. The first mover advantage can be of great importance when entering a new market platform, take Amazon and Netflix for an example.

1.1 Background

E-grocery lets the customers to use their online devices (such as smart phones, tablet, notebooks, etc.) to buy groceries. That means that the retailer will do certain tasks that have previously been undertaken by the customers themselves. These will be tasks like picking, packing, and delivery. All these extra tasks that the retailer will now do on behalf of the customer will add more costs to an already low margin business. In 2017, Brødboksen (delivered fresh bread and breakfast products) and Marked.no (e-grocer) went out of business in Norway. The reason is that they were not able to keep up with the cost of service and did not manage to become profitable.

Even though demand is in place, the existing e-grocers have failed to deliver a good enough product to retain customers. According to the report of McKinsey 2013, in France, 75% of e-grocery customers turns back to use the supermarkets instead, the reasons for this is reduced assortment, higher prices, and additional fees (Nicolò Galante, Enrique García López, Sarah Monroe , 2013). This problem adds to the complexity of how grocers shall invest their money. Therefore, retailers must find a balance between the online and offline investment.

E-commerce shopping is increasing with each year that passes by. According to Statistics Norway, e-commerce sales have increased by 13.5% in mid-2017 compared to mid-2016. The increase is mostly due to sales of electronic products and specialized assortment, also increased sales of food online contribute to these statistics.

Changing food shopping habits to an online platform involves some significant alterations to the customers behavior, as food will be chosen from an online click and browse system instead of physically visiting a store and selecting products from shelves (Hand, Riley, Harris, Singh, & Rettie, 2009). Fresh and fragile food is especially influenced by this. Customers will not risk getting bruised or bad fruits, and want meat and fish with low levels of fat etc. By ordering online, they will not be able to evaluate the food before buying it. In addition, McKinsey's report shows that the most critical factors for a customer to shop food online are convenience and saving time.

Optimizing the logistics chain for this kind of business is incredibly hard for the e-grocers. Low margin products do not cover the extra cost of added services. Customers are also likely to not want to pay much extra for these services as well. If customers receive low quality goods, or the delivery does not match the order, retailers will suffer in terms of more added costs and loss in

reputation. This results in a sort of catch 22 scenarios for the e-grocer; if pickers shall pick with high efficiency, the time for evaluation of the food will delay delivery (causing increased lead time), however if the food is not of high enough quality, the customer experience will be worse.

1.2 Research question and purpose of the thesis

The title of the thesis is ***Efficiency of e-grocery: Challenges and Solutions***. The thesis' purpose is to investigate challenges in the e-grocery market and propose some possible solutions. The aim for the thesis is to determine efficiency factors in e-grocery, identify the challenges being faced, and come with potential solutions. Time management and logistics improvements are essential for making e-grocery work out. Customers are not willing for long waits, so delivering in a reasonable time-frame, and be precise is heavily dependent on efficiency across the different activities needed to deliver. Logistics improvements are considered essential to attain the efficiency needed to deliver e-grocery to many customers at the time. This thesis will explore every step in the order fulfillment process.

The research question has been prompted by SSI Shäffer in conjunction with the EPIC project by Erasmus. The purpose of the thesis is to map out the challenges that hinder the efficiency in the e-grocery market. The solutions presented are based on empirical work and the authors' understanding of the underlying issues.

2 Literature Review

2.1 Lean management

2.1.1 Lean management

Along with the emergence of various management principles, Lean Management is widely deemed as one preferred approach for modern businesses and has been adopted by numerous contemporary practitioners. Rooted from Toyota Production System and later made popular by Womack, Jones and Ross (1991), lean management refers to the core objectives of waste reduction; processes variations; added values for customers; and improved operational performance. Research conducted by (G. Marodin & T. Saurin , 2013) and (Rezende, 2016) signify the positive association between the adoption of lean management and the significant improvement in operation performance. Though lean management was originally developed for manufacturing industry, new frontiers of research on lean were introduced, especially regarding the understanding of customer

and suppliers within the context of supply chain management (Moyano-Fuentes & Sacristan-Díaz, 2012) (Bhamu & Singh Sangwan, 2014) (Jasti & Kodali, 2014). Due to this modern linkage, lean management has become an important approach for improving supply chain management in many organizations. Studies by Lewis (2006) and Blanchard (2010) have addressed the application of lean principles into the empirical practices of supply chain management that demonstrates improved organizational outputs. However, while various scholars deem it as a natural fit, this integration is still widely perceived as a complicated process that seeks deeper levels of adaptation. Anand and Kodali (2008) have identified the issues hindering a possible adoption of lean management into supply chain management. The first reason is that waste is not easily spotted in supply chain. Second, while production systems can be controlled by top management, management of supply chain goes much further than that, when it requires attention to the entire chain.

Womack, Jones and Ross (1991) also mentioned five principles of Lean:

Table 1: Lean's five principles (source: Womack, Jones and Ross, 1991)

NO.	PRINCIPLES	EXPLANATION
1	Defining value	Defining value based on end customers' point of view by product family.
2	Mapping value streams	Identifying activities and steps in the value stream to recognize which add value and those do not. Eliminate waste that does not create value.
3	Creating flows	Create and remain the consistent flow of valuable steps and activities and make them integrated sequence.
4	Establishing a pull system	Following the introduced flow and reacting to the customer which means letting them pull value; and keeping supply upon demand.
5	Seeking perfection (Kaizen)	Along with a specified value, mapped value streams, removed waste, created pull system, the perfection is to have continuous process and improvements.

Within the context of supply chain management, confronting the modern challenges in the industry does resonate principles of lean management. As supply chain management matures, a smooth flow with minimum lead time is desired, which aligns with the principle of mapping value streams for elimination of waste. This was addressed by Goldsby et al (2006) and Wee and Wu (2009), which claims that a lean supply chain is one that allows a flow of goods, services and technology from suppliers to customers with no waste. The principle for creation of flows from lean practices also addresses the importance of maintaining an integrated sequence of activities, resembling the various steps contributing to a supply chain circle. Therefore, tackling the issues related to different components of a supply chain can be done by adopting suitable principles of lean management. A lean approach, despite its complexity in adaptation, can solve various challenges if properly integrated.

2.2 E-grocery

2.2.1 The development of E-grocery

E-grocery, interchangeably referred to as online grocery shopping, is known as a rapidly growing business in the information age. Online grocery stores were considered one of the first start-ups that leverage the Internet booming which dated back in the late 1990's. As mutually coined by various scholars, the evolution of grocery shopping from traditional stores into e-grocery framework was the result of two main factors: consumers' need for more oriented services which can saves their time (Hand, Riley, Harris, Singh, & Rettie, 2009); and the fostering of feasibility thanks to the Internet in general and for e-commerce in particular (Demangeot & Broderick, 2006).

Regarding the traditional mechanism of grocery shopping, brick and mortal remained the sole method for a long time. With the passage of time in accordance with the development of the modern society, the grocery consumers' needs are increasing, thus the traditional approach became a tedious task for them. Liebmann (1998) managed to identify the trends emerging among customers at the transition phase, which asserted that customers were becoming more and more demanding when it comes to opting for value-added services to save time on grocery shopping. Convenience was a big concern at that time, rooting from various supporting factors: greater labor-force participation by women, significant increase in household income, and a huge rise in the number of dual-income families in the society (Morganosky & Cude, 2000). Those factors led to the creation of more constraints for resource to carry out grocery shopping tasks. Given how

convenience became a central concern for improving traditional grocery shopping, research has been conducted to define possible approaches for retailers to enhance this element through two dimensions of convenience. First, a retailer could enhance the extent of convenience by helping consumers accomplish more tasks within a trip to the grocery store. This was conducted by including more services located within or nearby the premises of the store, such as cleaning, floral shop or bakery. Second, another dimension of convenience was also triggered by helping consumers cut down on their grocery shopping time. Example measures can be named to the introduction of fast checkout lanes in the store or drive-up services that allows consumers to quickly pick up their groceries. Though these approaches for enhancing convenience proved to be more efficient, its full potential was not maximized until the boom of Internet and the emergence of online grocery shopping – e-grocery.

Regarding the popularity of the Internet, various scholars and practitioners have deemed the Internet as the breakthrough approach that helps grocery shopping attain its most advanced form to date (Morganosky & Cude, 2000). The introduction of online grocery shopping has addressed the second dimension of convenience that retailers seek – time-saving virtue. In its most generic sense, e-grocery is perceived as the use of retailers' websites by consumers to buy groceries that will be delivered to them, without having to be physically present in retailing stores to make the purchases. This has been abled thanks to the widespread of internet access in most countries in the world. Internet emerges and foster easier communication between people, and then later was widely adopted for online businesses. The internet has developed at a fast pace, especially along with the expansion of smartphone usage, which enhanced accessibility to the largest extent. The development of online grocery shopping was marked at around year 2000 in Europe, with the UK being considered the pioneer in e-grocery when Ocado and Tesco first introduced e-groceries in the country.

2.3 Logistics activities

2.3.1 Logistics & supply chain in e-grocery

Emerged from the 1950s as a concept used in military that dealt with procurement, maintenance and transportation, logistics in its initial nature was perceived as one highly fragmented process that demonstrated little linkage between three core business functions: marketing, finance and production (Converse, 2012). While supply chain management surfaced as the advanced state that

evolved from individually managed activities within the scope of product-flow towards an integrated set of processes in the whole supply chain (Fawcett & Magnan, 2002). Under the modern perspective, supply chain management involves the planning and management of activities associated with sourcing, procurement, conversion and all logistical activities. Ellram, 1991, stated that supply chain is a network of firms working together to deliver products and services to end-customers, connecting flows of information and inventory (Ellram, 1991). Therefore, Ballou (2007), considered logistics management as part of supply chain management which controls the flow of goods, services and information in the whole process to satisfy customer's requirements (Ballou, 2007).

In e-grocery business, the process to provide food from its raw materials to final consumers or households is integrated in a supply chain network. Logistics activities play an important role to e-grocery success when they are needed to handle materials, store products, picking and packing activities, and delivering to end customers (Murphy, 2003). Murphy also concludes that regardless of any models of e-commerce for foods (stored based or central distribution based), effective logistical activities are the key to maintain the smooth flow of goods from suppliers, through grocery, to buyers. However, studying the differences between store-based and distribution center-based when making strategic decisions in retailing business also needs to be considered to apply them in empirical cases (Boyer K.K; Hult G.T.M, 2006). The detail of each process in supply chain management for e-grocery is shown in the figure below (Sameer Kumar, Maryellen Tiffany & Salil Vaidya, 2014):

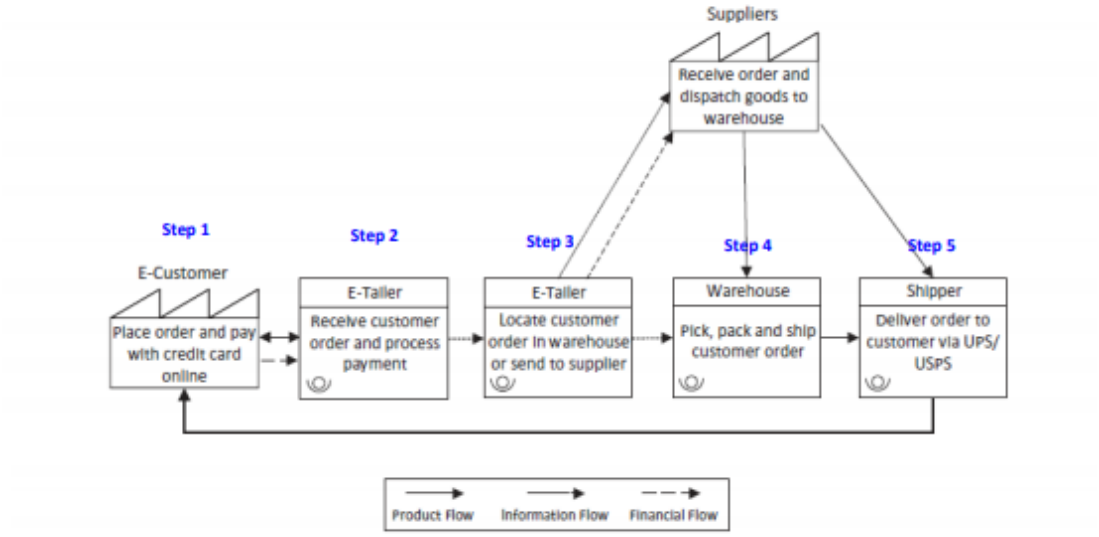

Figure 1: E-grocery supply chain (Source: Sameer Kumar, 2014.)

2.3.2 Inventory storage

In supply chain management, inventory storage plays an important role to stock the raw materials, semi-finished goods and finished goods. Inventory management will help businesses make sure the number of items or products or materials needed for production and meeting customer's orders is in place, therefore, an effective inventory policy will contribute to the success of a business (Bujak, 2014). Normally, warehouses can be used to fulfill this need for storage. In production, usually raw materials will be stored and processed through a series of steps which can be performed in more than one inventory storage. In distribution, sometimes, there is no storage needed if businesses can apply direct flow from material to shipping docks without processing and buffering in between, however, it requires much work in planning and operating. A warehouse adds value to supply chain by storage – which contains materials and products; and transporting economies – where products can be packed, sorted and distributed. It can be privately owned or rented by an individual or company which store items in and bear responsibility of the operating cost and management of the warehouse, in some case, a warehouse could be used as a public one (Kay, 2015).

The items in inventory management are normally managed by SKU – stock-keeping unit with defense in term of size, characteristics, styles assigned. Units of each item are kept in storage location – slots – which have capacity to store a specific number of units of the item. Slots in

warehouse are designed differently for different storage units such as: pallet racks, shelves, stacking, drawers, etc.

In e-grocery business, the finished products or goods are often stocked in retailing stores or central warehouse (dark stores). In a retailing store, it can be types of any physical structure or space where grocery products are kept or displayed for purchases. It can be seen easily as a local shop, hypermarket or a supermarket. There are three main purposes of this retail store. The first one is a market place for end customers to go shopping and select the goods to buy. The second purpose is a place to keep the goods for some retailers who sell in open space store the goods at a different place and it also serves as an intermediary point between manufacturers and consumer. Most traditional supermarkets are using this type of storage.

Meanwhile, dark store is also known as dedicated distribution center. This type of infrastructure refers to a retail outlet that only caters for online shoppers, therefore, it is not open to the public. This is usually a large organized warehouse with structured shelves and aisles which contain groceries and other items, but functions as a "Click and Collect" service. The higher efficiency of dedicated warehouse might be possible because of its dedicated characteristics and capacity of applying automated technology. For example, the warehouse layout will be designed to reach a best-allocated goods or products within the shortest distance and time. From here, the orders could be fulfilled and delivered to the household or end-customer's wanted places.

2.3.3 Ordering

Within the e-grocery circumstance, when consumers would like to place an order, they do not need to go the stores or a market place. Instead, they use the website of grocers or mobile application to place their order. After the selecting their products, consumers need to select the pick-up-time and method of delivery, then enter the home postcode or intended delivery address. Normally, if the area is covered by the e-grocer's service zone, customers could register or login to their online e-grocery account and request the order.

Freeman, 2003, introduced a set of ten advices for online shopping experience of customers, as follows: (Freeman, 2003)

- An informative homepage
- Organizing the page as a left to right path

- Easily noticeable and usable search
- Multiple columns searching capacity
- Logical results after selection
- Description in separated column
- Well-designed and colored row of results
- Clear quantity and price
- Differentiating between buttons, text paragraphs and graphics
- Simple instructions.

Online shopping experience is potential to improve its features such as time-saving, user-friendly and more convenient for customers. Bellman et al, 1999 has studies which show that customers prefer convenience over time-saving feature (S. Bellman; GL . Lohse; EJ Johnson, 1999). That is why more vendors are focusing on enhancing consumer experience on their site. Most of the websites have a virtual cart (as a shopping trolley), product description by text, images and videos, availability of reading comments, and ratings (Bannister, 2002). Some of e-grocers now equip an interactive website with AR technology to enhance their consumers' shopping experience.

2.3.4 Picking

Picking could be understood as the order fulfillment step where e-grocers pick up the goods and products based on what customers ordered online. The problem with the traditional methods of picking is that it is labor and time-consuming, which leads to a high cost of operation. Research shows that this cost increases even faster than the revenue generated from sales. This has addressed how picking efficiency is of crucial pivotal for e-grocery profit.

There are several studies exploring which picking models should be carried out for modern e-grocers. Cuglielmo (2000) stated that in order to improve the picking efficiency, e-grocers should utilize a highly automated distribution center. The conventional method of picking from local stores or supermarkets is suggested to be abandoned because of its high operation costs. He also mentioned that in supermarket, the design of store layout with aisles and shelves is only suitable for displaying and for customer’s physical shopping, it is not meant for picking activities (Cuglielmo, 2000). Meanwhile, investing in a dedicated warehouse for picking process requires a big amount of investment for space utilization demand, automation technology and infrastructure (Kämäräinen, 2003). In practice, many retailers have followed this method but still struggle with

lack of profit. Due to the high cost of this picking step, some e-grocers could not be competitive in terms of price and losing out on customers and money. This is one of the main issues for e-grocery businesses who is trying to claim profitable.

2.3.5 Packaging

Packaging refers to all activities involved in the container for a product. Nowadays, because of its essential role, it is hard to find any goods or products without packaging (Saghir, 2004). Paine (1990) has defined the function of packaging with "the initiate purpose of protecting, collecting and providing information about the content".

In today's business, many companies are using packaging as a self-service to sell the product. Products with outstanding packaging on shelves will promise to bring more sales than other products of similar quality with poor package. Packaging adds value to the product itself as it helps to increase brand awareness and build trust for customers. Customers are even willing to pay more for products with better packaging. Saghir (2004) added the roles of packaging as a system of providing goods and products for safe, optimizing handling and transporting, storage, consumption, and re-usage; together with enhancing sales and profit. It has been become a competitive factor for companies (Saghir, 2004).

In supply chain activity, packaging plays an important role in many ways. Better packaging would help optimize transportation, handle products easily, protect the goods from damage and reduce the costs and the waste at the same time (Paine, 1990). Therefore, it is clear that packaging adds move values for supply chain activities and to end customers.

Packaging is often divided into three categories: primary, secondary and tertiary (Jönson, 2000). The first one, primary packaging, contains the product individually ready for the end customer. The second packaging is mainly for protection during transportation because it contains a bundle of primary packaging. Tertiary packaging is mostly for logistics activities such as storage transporting, especially when working with pallets and containers inside a warehouse (Hellstrom D., Saghir M., 2006).

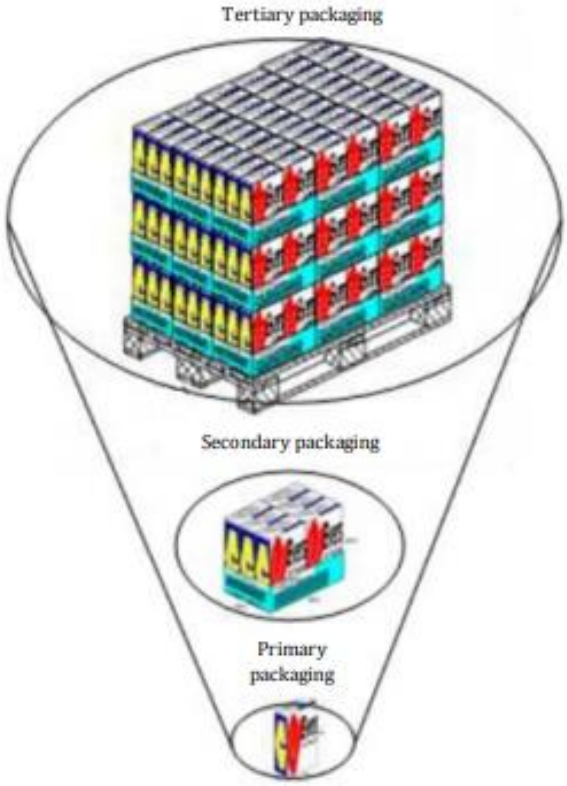

Figure 2:The packaging system (Source: Hellstrom and Saghir 2006)

2.3.6 Delivering

Delivery is the last step to bring products and goods to customers which requires a lot of improvements in online grocery business. There are some listed issues that has been studied by researchers. Bergelia, 2009, states that the high failure percentage of delivery due to unsigned packages caused a big loss when they have to be returned to grocers or food providers (Gerardo Berbeglia; Jean-Fran¸cois Cordeau, Gilbert Laporte, 2009). He classified three types of problem for one-to-one pickup and delivery. The first one is "dynamic vehicle routing problem" about the routes construction in delivery. The second one is called "dynamic stacker crane problem" when the transporting vehicles could respond for request one by one. And the third one is "dynamic dial-a-ride problem" which relates to the transportation orders with passenger's issues. To cope with these dynamic problems, Bergelia et al., 2009 suggested adapting an algorithm to make the static version clear. There are two ways to approach this issue. First, whenever new information comes in such as an order or denial, a solving a static problem needs to be performed to propose a best feasible solution regards to the past one then updated with heuristic methods. The second approach

is that algorithm will be applied at the very first step of planning, before the problem occurs, with current available information, by using robust optimization methods (Gerardo Berbeglia; Jean-Fran¸cois Cordeau, Gilbert Laporte, 2009, pp. 2-5).

About the security of delivery process, Ferine and McKinnon (2004) referred to two types of delivery: secured and unsecured. Unsecured delivery could be done by leaving the parcel outside of the door of receivers. This "door stepping" currently faces many risk of stolen or damaged packages. So Ferine and McKinnon offers four methods to increase level of security:

- Allow the deliveryman to enter the house or outbuilding
- Set up a home-based reception box
- Send parcels to local stores/collection points
- Deliver to local storage and bring to customers when they are home.

Metters & Walton, 2007, approached the problem in a more general way, optimizing for both picking and delivery processes. There are two models that could be applied for e-grocers is to build a centralized and decentralized network. In the first network, a main distribution central is focused where packing and picking activities happens and later delivering to customer by trucks or vans. Amazon is a popular example for this central distribution, with the success of meeting customers' requirements. They use labor with a well-designed warehouse with aisles and short shelves to optimize the time of pick and pack process. (Metter. R; Walton. S, 2007)

The decentralized network is quite related to traditional method, which these activities of picking packing and latter shipping to customers based on retail stores. Instead of one centralized warehouse, there are several stores located spready to serve local areas. This has some disadvantages of spaces and labors cost but could take advantage of omnichannel to give customer's convenience in terms of choosing and exchanging items. The delivery job also can be outsourced to a third party and the cost of transportation can be saved. (Metter. R; Walton. S, 2007)

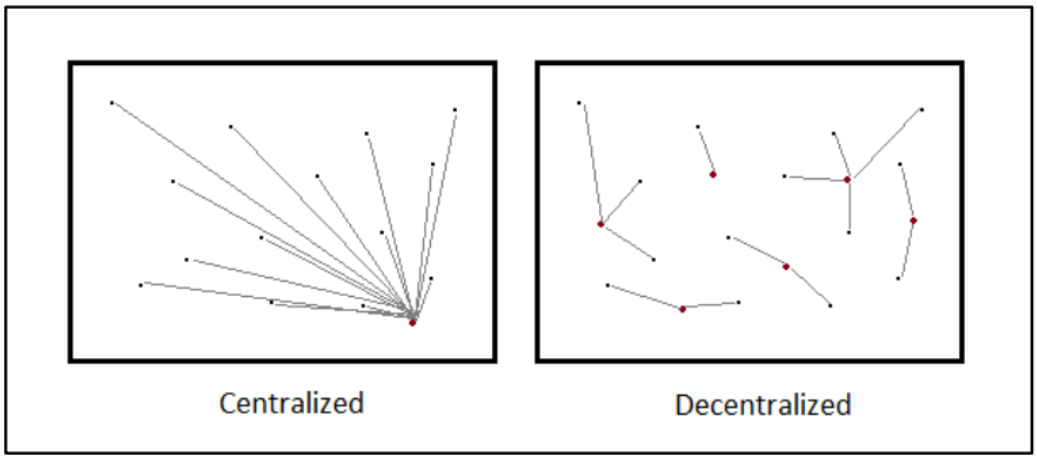

Figure 3: Two types of network for picking and delivering (source: Metter, 2007)

After completing review some literature, the next chapter of thesis will discuss how to carry out our analysis by presenting methodology and a detailed structure of the thesis.

3 Methodology

This chapter explains the underlying theories, data, and methods that have been used in this thesis. It will take for it how theories, data, and methods have been gathered, used, and applied. It should be said that the market for e-grocery is in its birth and the e-grocers will not let out much info on how the business is conducted. Therefore, we have tried to gather as much data as possible from this field and mixed in theory and methods from related areas.

3.1 Gathering data

The research conducted in this thesis is mostly based on quantitative data available online and in research papers. Some qualitative data from interviews with SSI Shäffer's Director for Business Development Food Retail, Jacob Beer will also be considered and applied. We see that e-grocery is divided into three separate processes for the grocer; picking, packing, and delivering. In addition, there is the ordering system which connects and makes it possible for the customer to use service.

Quantitative data from published work reviewed in this thesis reveals information about different practices used in e-grocery. Also, underlying theories about lean management, logistics, supply chain, and e-commerce have been analyzed. This data has been collected form the UiS library, Google Scholar, and other online available sources like news sites and market forecasts. In order to reach relevant published work, we used key-words like in-store picking, warehouse picking, e-

grocery, etc. in the search for articles. In addition, we examined some of the sources quoted in found articles and relevant master thesis found online. Data found from these articles was used to gain a better understanding of the inner workings in e-grocery, mainly concerning the supply side of the operation. The data was used to come up with different ideas for potential solutions that can help to bring profit to this market segment.

Other quantitative data applied comes from surveys conducted by consulting companies (for example McKinsey) to analyze the market situation and future outlook. This data has been used to understand the market with a focus on the customer. The surveys used has been undertaken by trustworthy consulting companies and state-run statistical services. This data yields good information about the customers, potential customers, and the market as a whole.

Qualitative data has been collected from interviews with Jacob Beer (Director for Business Development Food Retail, for SSI Shäffer). Beer works with developing warehouse solutions for e-grocers in Europe and has provided much relevant information. Information like efficiency of warehouses vs in-store (in units picked per hour), market practices, criteria for getting profitable, etc.

3.2 Reviewing and analyzing the data

Reviewing the data collected has reviled certain practices and models has been further analyzed. There are several ways to approach the steps needed to deliver food from an online platform, the most used methods are mainly divided into two areas; in-store solution and dedicated warehouse solution. The in-store solution will leverage stores that are already in place to conduct picking, packing, and delivery activities. The warehouse solution builds around dedicated solutions optimized for e-commerce. Both solutions have much in common, but the efficiency and cost structure vary between them. They're strengths and weaknesses will be assessed in the discussion section of the thesis together with suggestions on to which to use under different circumstances.

In accordance with one of the core principles in lean management, we will also analyze the customer demand's and preferences to e-grocery. This will be done by analyzing the market situation and mapping the customers criteria/value proposition for shopping food online. We find that building up a business in e-grocery can be considered equal or carries many similarities to entrepreneurship. Entrepreneurship is defined as the process of designing, launching and running

a new business. Since there are a small number of e-grocers (in Norway only one), we consider building up an e-grocery business is aligned with this definition.

In order to build up an understanding of the market for e-grocery and the customer, we will use Bill Aulet's "Disciplined Entrepreneurship" as a method. Disciplined entrepreneurship is divided into six themes with a total of 24 steps (Aulet, 2013) . According to the author, Disciplined entrepreneurship is meant to be a toolbox on which to build a new startup on. We think that correlates well with what an e-commerce food retailer aim to do, such that this is also a feasible toolbox to be used here as well. We do not make a comment on each step, instead we will use the model as a guideline on how to evaluate the market, and how to acquire paying customers.

Figure 4: 24 steps of the disciplined entrepreneurship model (source: Disciplined Entrepreneurship by Bil Aulet, 2013).

The figure shows the six themes and 24 steps in Bill Aulet's "Disciplined Entrepreneurship" model. - A guide to successful start-ups and enterprises.

After laying the ground for the market situation and evaluate the customer needs, we will apply the same model to come with suggestions on how to build up a proper ordering system. Our

Approach will mostly be customer centric and have an emphasis on the online functionality of the webpage. The webpage will be the only connection the customer has with the service, so getting this correct is of high importance. Each of the six themes will be analyzed and discussed in the analysis part of the thesis.

3.3 Structure of the thesis

When analyzing the data, we have divided the e-grocers activities into three different processes:

1. (Customer) Ordering process
2. Inventory control
3. Order fulfillment process
    a. Picking
    b. Packing
    c. Delivery

As stated above, Disciplined Entrepreneur ship (Aulet, 2013) will be used to assess the market and the customer. That information will be used to lay the grounds for an ordering system with the customer at the core. The analysis of this can be found in section 5.2 and 5.4 in the analysis.

After laying the grounds for the market and the customer, the analysis will dive into the supply side, for example: the grocers' optimization process. The thesis will start taking for it the inventory management needed to always have goods available and show the correct information to the customer. Inventory control and suggestions can be found in section 5.3 in the analysis.

The order fulfillment process is divided into three; picking, packing, and delivery. These are the steps that are required from the e-grocer to fulfill the customer's order. Herein lies the different methods the grocers can choose from. Each of these steps will be analyzed with regards to pros and cons. From hereon we will make suggestions on under which circumstances each of the methods fits best. In this section the main focus will on picking. There is not much research as of today on how this should be conducted in an efficient manner, which is precisely why this is the most interesting area to dive into. To make our findings more applicable to most of the e-grocery market we will elaborate on two different solutions, and where these solutions might be best suited. These solutions are in-store picking and warehouse picking (dark-store).

After all the processes has been discussed, there will be presented a summary with some calculations regarding marginal costs and marginal revenue. All the numbers presented is from secondary sources (mostly from Jackob Beer) and may not reflect real numbers. It is meant as a guideline and not as an absolute proof.

Validation will follow the summary. Here we will take a critical view on the analysis, presenting short cummings and potential flaws. The validation will also take for it the limitations of the research committed in this thesis.

Based on the summary and validation process we will make some conclusive remarks regarding the e-grocery market. Since prices are regulated by the market, we do not see that e-grocers may affect this aspect, however they can optimize the cost structure. Therefore, these remarks will mainly be focused on how to conduct business in e-grocery in a most cost-effective way to turn a profit.

3.4 E-grocery as a service

We see that the development of online grocery (food e-commerce) is an incremental innovation on already available supermarkets. In other words, it is the same market, but another product or service. Since e-commerce in the food market does not bring in any new physical products, we see that e-commerce part is as an added service to an already existing product. This service will consist of picking, packing, and deliver an order accustomed to one individual customer.

When dealing with services, additional sales might not necessarily mean an increase in profit margins. Additional sales will carry with it more costs, especially in the case for e-commerce for food. More orders will mean more picking, more packing, and more deliveries. In turn that means more employees, resulting in higher costs. In addition, if you can’t hold your promise on a service, the customer will not return. So, for example if your delivery is late, the customer might not return at all. To avoid this from happening there must always be enough capacity ready to handle incoming orders.

4 Analysis

4.1 Introduction

Current e-grocery models are trying to deliver more convenient to customers from the first step of online purchase to the final step of receiving the order. However, there are many opportunities and innovative ideas to increase the efficiency for each step in the process. To maintain sustainability of e-grocery model, retailers must be able to remain profitable while still improve their customers' satisfaction. A general flow of e-grocery products could be as follows to make a completed order fulfilment process:

- Inventory control
- Ordering
- Picking
- Packing
- Delivery

Clearly, this is a connected process where each step will have its impacts on the following one. The purpose of online purchase could not be completed if any of steps are missing. Understanding the whole process is of pivotal importance for retailers and grocers. They need to comprehend every single part, to spot the problems or issues and then find the solution to improve or resolve them. This part of the report will focus on giving different options on how to improve these activities for e-grocers, first by presenting the customers insights (market analysis) and go into details of each step to figure the way to remain customer's satisfaction, while having a positive marginal income and controlling marginal costs.

4.2 Market assumptions

4.2.1 Who is the customer and what can you do?

The customer for online food shopping can be many. Everyone will need food; thus, the market is big in this segment. According to a survey conducted by McKinsey in 2013 of 4.500 EU residents, there is a substantial latent demand for food e-commerce. With as many as 33% of the surveyed in France said they would try out the service if it came available in their area, and in Spain 49% would try it out. The following paragraphs will have a customer focus, on customer behavior mainly based on these surveys

The demand is most certainly in place to conduct e-commerce for food in Europe, now the actors need to act accordingly to attract customers. To attract customers the actors must employ a customer-driven approach by finding an unmet need in the market and build the business around that (Aulet, 2013). The unmet need in question is twofold; first, there has been a lack of any serious market actors which have resulted in poor supply (Nicolò Galante, Enrique García López, Sarah Monroe , 2013). With poor supply comes low demands, which again results in poor supply. The other unmet need is customer skepticism. Of those who still have not tried e-commerce for food, the biggest concern was that they could not quality check their goods. This quality check comes down to some certain groups of products; mainly fresh goods like fruits and vegetables that goes bad.

The issue of customer skepticism is further emphasized in a survey conducted in the US by UNATA in cooperation with ShopperKit. 1000 US residents where surveyed on the topic of buying food online. According to this survey 33% of the non-users did not use online services since they did not trust anyone else to pick their goods. Further on, 36% of non-users did not wanted to pay extra for this service (Utana, 2018).

However, both the survey conducted by UNATA and McKinsey shows that there is a growing demand for e-commerce for food. As stated above, 33% in France will try buying food online if it came available, 49% in Spain, according to the report of McKinsey, 2013. As for the US, the market is forecasted to grow from 22% in 2017 till 36% in 2018 (Utana, 2018).According to these surveys, e-grocery customers are after added convenience, but quality, assortment, and price is also highly important.

Added convenience is stated as the most important customer need in e-grocery (Nicolò Galante, Enrique García López, Sarah Monroe , 2013). The added convenience for the customer will be the time they save by not shopping themselves. Therefore, it is extremely important to deliver on time when promised such that the customer does not suffer any inconvenience with the service. Any actor in the e-grocery market should therefor think hard about which timeframe they are promising their customers. If that can't deliver in time, they may lose the customer for good.

Added convenience may also cover lack of food quality for the customer, the food quality may also be categorized. For example, e-grocery can deliver fresh food that is untouched and offer

guaranties for the freshness of the goods. This categorization is done by professional pickers. Old food that is on the brink of expiration, but not yet expired can be offered on a discount.

Environmental organizations are now fighting for less food waste and tries to appeal to both customers and governments to do something about this. Pollution is escalating in accord with the development of society and trends. There is evidence for that customers buying habits are influenced by these trends in society. For example, ecological food, short-traveled food, finer food, new types of food (such as: powder food, vegan food, insects etc.), and food cultures. All this can lead to more accept among customers to food of lower quality, since the environmental benefit is greater. In the past, food has been infused or treated with chemicals to either increase longevity or improve the look of the food. This have later been regulated by the government. This trend might accelerate as fast as other trends in the society. These are trends like weight diets, food recipes, workout diets and so on.

Quality assurance is still something that holds a proportion of food customers from dealing with e-grocery (Utana, 2018). If fresh and fragile goods shall be an option to order online, there must be a certain check in place to ensure and grade the quality. This line of goods tends to be more problematic for an e-commerce actor, as they can be difficult to store after picking and during delivery.

Assortment and price holds a big factor when it comes to retaining customers. Most of the non-returning customers hold assortment and price as the main reason they stopped using the service (Nicolò Galante, Enrique García López, Sarah Monroe , 2013). Several of those surveyed would return of this should be improved. The table below shows how non-returning customers value different aspects of buying groceries online, and how likely they are to come back if they are changed.

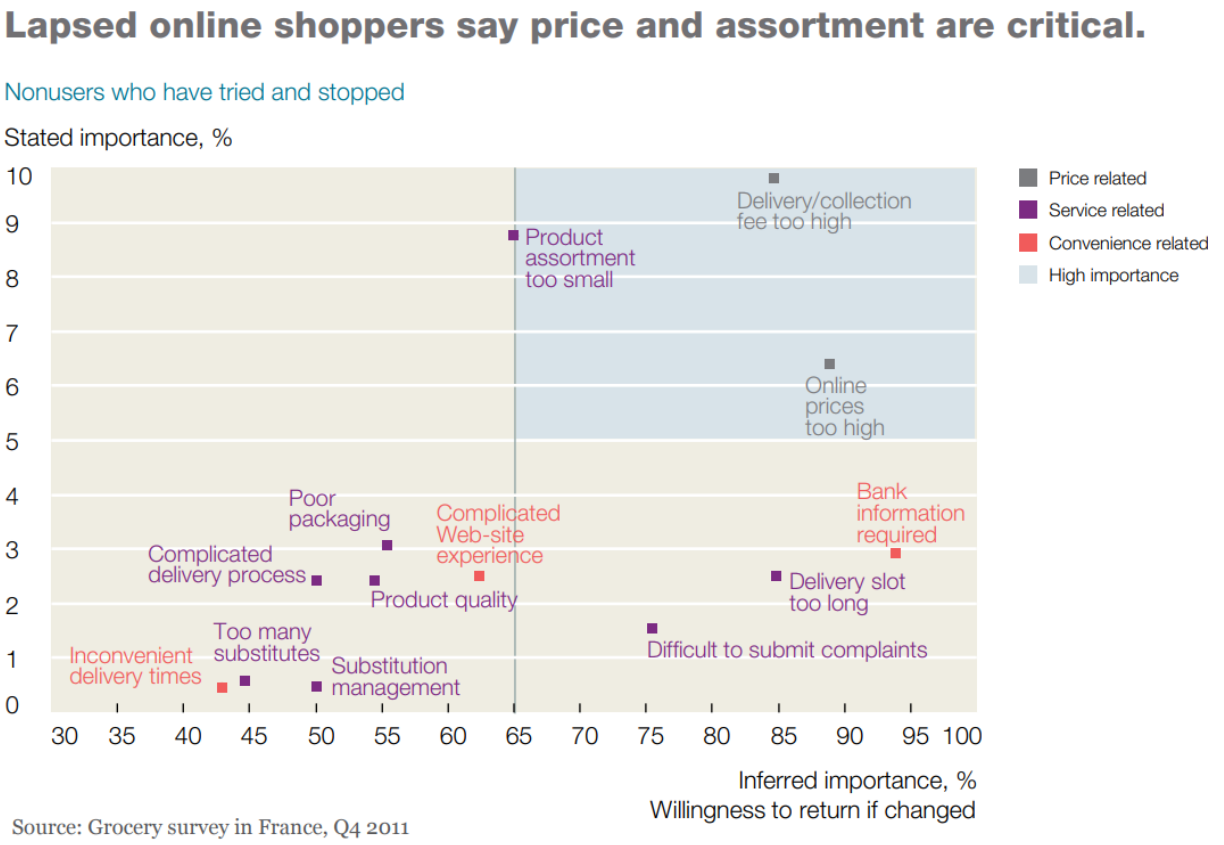

Figure 5: Reaction of non-returning customer on buying groceries online (source: McKinsey, 2013).

The data plot in figure 5 shows the reason why lapsed customers do not return to e-grocery. The Y-axis shows the stated importance in percentages, and the X-axis shows the willingness to return if certain aspects of e-grocery changes. Note that delivery/collection fee and product assortment is the main points to address for re attaining customers.

All this data is yielding good information as to who the target customers should be, and how e-grocery actors must conduct their business. The market opportunity is to deliver on convenience, quality, assortment, and price. Since the actors are operating in the service industry it is important to maintain quality in each of these areas, as an unsatisfied customer will change grocer or outright stop buying food online. It shows that 76% will change their online grocer if another actor is offering a better online shopping experience (Utana, 2018).

To not be subsidized by a competitor or to lose paying customers the e-commerce actor must be excelling in its market segment or segments (Aulet, 2013). It is extremely important to deliver on time with the right order, and with no lack in quality. Costs and prices are as mentioned both

critical factors to retain customers and add to the importance of added customer perceived value. If the customers are going to pay more, they need to get value for their investment. Such added services can include less food waste, other actors' services, trial goods, coupons, and advantages that retains customers.

4.2.2 Building the product

As previously stated we see that e-grocery is a service that builds on already existing products. When developing e-grocery as a full package to a paying customer, one must tailor it to the customers' needs. As costs is a limiting factor, this must come in at the lowest possible cost for each step in the process. This includes picking, packing, and delivery.

When it comes to picking and packing, there is two ways of doing this as of now; picking in-store and use dedicated warehouses. Which of these methods that is best will depend on the customers, location, order density, and order volatility.

Order density and volatility will be a deciding factor on which method should be used to have the right order fulfillment capacity, at the lowest cost. When dealing with a high order density it will take longer to pick, since there can be a backlog of orders. Picking in-store can be cheaper but will not operate at near the same efficiency as a dedicated warehouse. In smaller markets, rural areas, the order density is most likely lower, thus picking in-store will be the better option. In bigger markets, for example: in the cities, the order density may be higher, warranting a bigger dedicated warehouse to keep up.

However, volatility in orders will work the other way. In-store picking is more dynamic in maneuvering order volatility (when there is a small amount of orders), if the is little orders you don't need as many pickers and you will still generate revenue from store visiting customers. A dedicated warehouse does have higher fixed cost and carries higher risk to be unprofitable if orders are to decline.

4.3 Inventory control

4.3.1 Challenges of inventory control

Inventory control is an essential activity for not only manufacturers, but also distribution businesses such as grocers and retailers. This type of business relies on their capacity of satisfying customer needs, by providing them with the right products, at the right time, and at right place.

Retailers must operate inventory with balance of benefits (product availability and service level) and costs (warehousing area, working capital and risk of obsolescence). The gap between demand side and supply side is a real problem in inventory control.

On the supply side, retailers have to hold some needed materials due to lead time delay. On the demand side, forecast cannot be 100% correct, that why retailers need to hold inventory that is ready to handle fluctuation of customer orders, to remain at a certain service level. In both cases, holding inventory would cause costs. Therefore, optimizing inventory level will make the company working more efficient.

Inventory control could be divided into three categories:

- Basic stock: quantity to satisfy demand from customer
- Seasonal stock: quantity saved for a projected change (increase) in demand at a certain point of time of the year.
- Safety stock – A quantity added to basic stock to control for uncertainty

Main challenges for inventory control:

- What should the amount of basic stock be
- Forecast the needed seasonal stock
- Maintain a proper amount of safety stock.

4.3.2 Handle basic stock and seasonal stock in e-grocery

In order to maintain a smooth flow of products and goods, supply chain system should ensure that inventory is well-controlled. It is easy to recognize that aligning online and traditional inventory of retailer with demand level of customers is challenging.

Running out of stock is a real problem not only for traditional retailing businesses, but also for online grocers. If the consumers experience insufficiency of inventory regularly that they could not order what they would like to buy, they will definitely consider leaving for other retailers. Revenue of online stores will go down. Other than that, the fame of the online site can also be affected in terms of ranking and reviews from customers. This could seriously damage the business if inventory management system is running wrong for a longer period of time.

On another hand, in case of excessive inventory, retailers will suffer a situation of dead capital and lose money because of stocking costs.

There are several explanations for inefficiently or restocking problem. Those reasons might be a poor logistical management (supplying side); and a poor font-sales management (demand side). The first one could come from a supplier who is having trouble with meeting standard requirements or commitments. It also could come from the process of supply chain with lack of control or operation at some points of the chain. Without a proper supply, lack of inventory, or excessive inventory can easily happen. Another point is that grocers must define which SKU's is going to be available for online for purchase. If consumers cannot find one item they would like to buy online (not entire order could be fulfilled), they need to come to the store for that. According to the report of McKinsey in 2013, lack of assortment online is also a big reason for lapsed online customers. Therefore, SKU's need to be carefully organized to be suitable with retailer's capacity and customer's requirements.

The same things would occur because of an incompetent front-sales operations. Controlling demands by sales velocity is as important as controlling inventory. A regular review is needed to understand the circle of inventory and sales. Sometimes, some trendy products are also easily running out of stock because of high demands. While, some mistakes of wrong pricing policy or wrong marketing campaign could influence on the sales and thus, effect on inventory eventually.

One way for better inventory management is to calculate the economic order quantity (EOQ), based on the inventory management model to minimize the total costs of the year. With the assumptions that given known demand and fixed product cost and constant lead time, the total costs of warehouse will be the sum of holding cost and ordering cost. (Cooper, Donald J Bowersox · David J Closs · M Bixby, 2012).

$$\boldsymbol{Total\ Cost\ (TC)} = \frac{\boldsymbol{Q}}{\boldsymbol{2}} * \boldsymbol{Ch} + \frac{\boldsymbol{D}}{\boldsymbol{Q}} * \boldsymbol{Cp}$$

Where:

- Q = Order quantity
- D = Yearly demand
- Cp = Order cost per time

- Ch = Yearly holding cost

To minimize costs, retailers must choose the optimal order quantity. This number could be found by using the graph below or by calculating the deviation of total cost should be equal to zero:

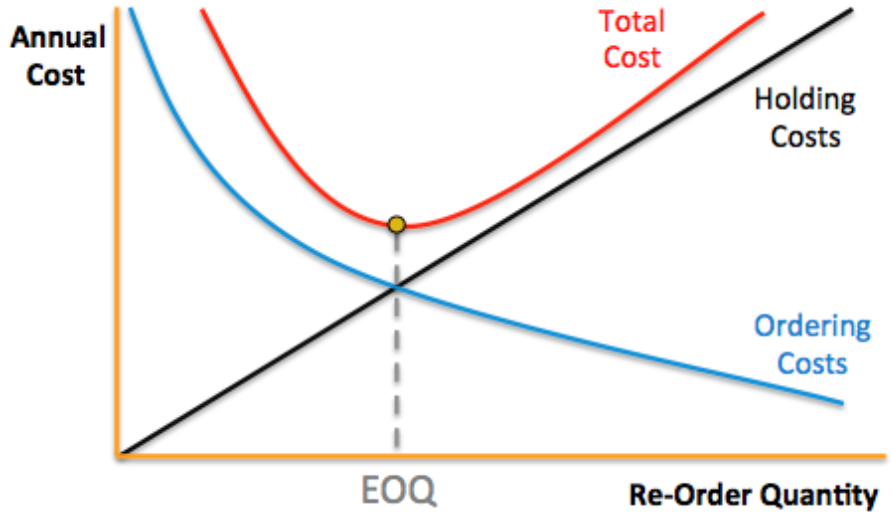

Figure 6: Total cost in Inventory control (Source: Bowsersox, Donald J - Supply Chain Management, 2012)

Therefore, the economic order quantity (EOQ) (optimal quantity) would be calculated by:

$$EOQ = \sqrt{\frac{2 * D * Cp}{Ch}}$$

4.3.3 Handle safety stock in e-grocery

With above-mentioned uncertainty of e-grocery business, firms often must plan a certain safety stock in their warehouse. Safety stock is to balance the overall stock under conditions of demand uncertainty and performance cycle which is defined as inventory to assure these changes. Therefore, safety stock is a way to prevent stock outs.

A term relates directly to safety stock level is service level (SL). Service level can be defined as the probability of not having stock outs during the lead time (Hopp, 2001). A higher SL, for example 99%, would expect fewer out of stock occasion. Service level somehow represents level of customer service.

Adding inventory as safety stock will definitely increase the holding costs, however, it will increase the product availability to get more sales and satisfy customers orders. Safety stock refers directly to the service level of products. Therefore, this tradeoff need to be handle carefully to find out the right amount of safety stock (Sunil Chopra, 2013).

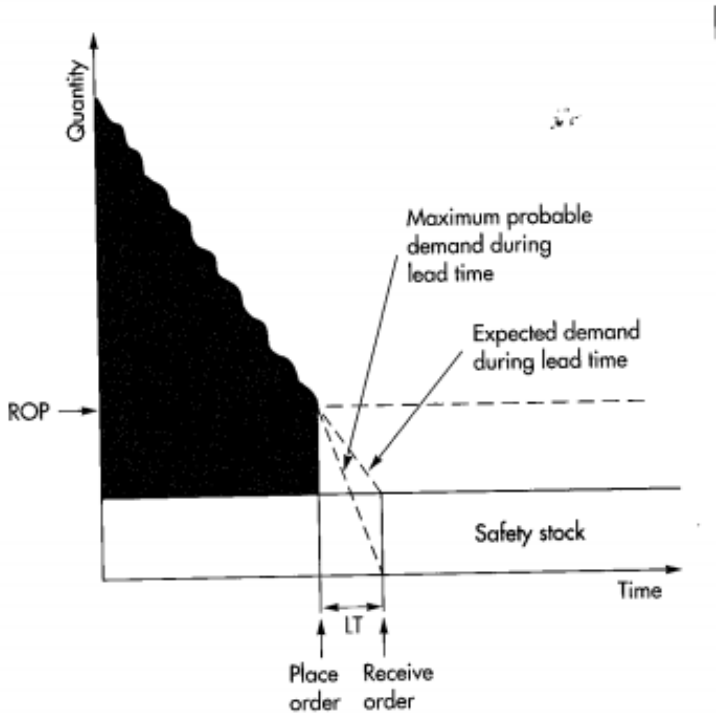

Figure 7: Illustration how safety stock could reduce the risk of a stock out during lead time (Source: Operation Management – Pearson's book)

In inventory management, variability in demand and lead time is inevitable in many ways. It is hard to keep away customer demand fluctuation, wrong forecasting work, and changes in lead times of raw materials. So, safety stock planning is carried out to prevent such cases. The problem is safety stock causes cost. Therefore, the retailer need to acknowledge and understand how to decide between cost vs safety stock (SS). In earlier chapter, we were talking about the costs of warehouse operations includes holding cost and ordering cost, where the actual holding cost can be calculated as follows:

$$\boldsymbol{Average\ inventory} = \left(\frac{\boldsymbol{Q}}{\boldsymbol{2}} + \boldsymbol{SS}\right)$$

$$\boldsymbol{Total\ \ Holding\ Cost\ (TCh)} = \left(\frac{\boldsymbol{Q}}{\boldsymbol{2}} + \boldsymbol{SS}\right) * \boldsymbol{Ch}$$

Where:

- Q = order quantity
- SS = Safety stock needed
- Ch = Holding cost per item

Therefore, it is clear that increasing safety stock will cause an increase in total cost of warehouse.

As discussed, safety stock (SS) relates directly to service level (SL). Service level by:

$$\boldsymbol{SL = 1 - \left(\frac{f(k) * \delta C}{Q}\right)}$$

=> Safety stock can be found by: **SS = k * δC** (Cooper, Donald J Bowersox · David J Closs · M Bixby, 2012)

Where:

- Q = order quantity
- ΔC = combined standard deviation of lead time and demand. $\boldsymbol{\Delta C = \sqrt{T * \delta D + D^2 * \delta T}}$

  Where:

  - T = Days of lead time
  - ΔT = standard deviation of lead time
  - D = Daily demand
  - ΔD = standard deviation of demand
- **f(k)** is the function of the normal loss curve providing the area in a right tail of a normal distribution; k is the factor that corresponds to f(k) for a specific fill rate and order policy.

Calculating the right amount of safety stock in inventory control can help to balance between the inventory costs added and the service level to customers. The following parts will introduce some suggestion on how to manage inventory more efficiently.

4.3.4 Suggested solutions for Inventory control

4.3.4.1 Improve suppliers' side

To cope with the problems of restocking and safety stock control, e-grocers need to optimize their supply chain management. Choosing suitable suppliers not only based on the price offering or the

quality, but also based on their transparent process and reliable commitment. These factors can ensure having a good coordination between suppliers and retailers. Other than suppliers, other partners in the flow of providing goods and products are also needed to review and select the most suitable ones. This would help to reduce the risk of delay, cancel or quality-inadequate inventory of e-grocery business.

E-grocers should list out their requirements for suppliers and use it as a filter to always review and evaluate their partners.

4.3.4.2 Calculate optimal order quantity and safety stock

By using the above introduced formula for economic order quantity (EOQ), the warehouse manager of retailers could have an idea how much to order each time to save costs. Even if not all factors of assumptions could be exact in reality, this method still provides an approximate way for order plan. For example, a yearly demand for an item of grocery (toothpaste – Colgate) in Paisley, Scotland is 360,000 units. Each unit will cost 0.25 pound of holding cost every year, and the ordering cost (per order) is around 50 pounds.

Apply the formula of Bowsersox, 2012, to minimize the total costs, economic order quantity should be:

$$\boldsymbol{EOQ} = \sqrt{\frac{\boldsymbol{2*D*Cp}}{\boldsymbol{Ch}}} = \sqrt{\frac{\boldsymbol{2*360000*50}}{\boldsymbol{0.25}}} = 12{,}000 \text{ units per order.}$$

For safety stock, applying given formula could help retailers make proper decisions for considering the trade-off between costs and customer satisfaction. For example, when e-grocers would like to increase the availability of products from SL = 95% to SL = 99%, it means the SS must increase and the cost will increase. If the order quantity, Q = 1,000 units, $\delta C = 170$, holding cost per item is 4 pounds per year, then the safety stock must be changed for example from 26 to 179 units, the cost will increase from **2340 pounds to 3212 pounds**. It means that the cost needed to add when changing service level is about **872 pounds**. (Calculation made based one the given formula on earlier parts).

This is a simple way to calculate the trade-off when making decision for warehouse management. E-grocers are highly recommended to apply this method to figure out how much they need to pay for their changes in inventory policy and make the best decision eventually.

4.3.4.3 Adjust sales

Optimizing sales based on inventory status and vice versa. Sales can be adjusted in many ways. If retailers realize they are running low on stock, an action to reduce demand is needed. E-grocers could change their marketing campaign, such as: temporarily cease the promotion program for low-stock items, increase advertising for current items which has a large number in the warehouse. Price is also a helpful factor to control the customer's buying behavior.

4.3.4.4 Plan and forecast

Besides, a well-planned strategy for sales and inventory needs to be carried out. Seasonal sales forecast or low season of some specific items are very important to understand when projecting upcoming sales. The more information that is available of the customers' buying habits, the more optimized inventory a retailer can get. An automated system for forecast would be helpful, integrated with the inventory management software would be a good way to keep everything under control.

Many retailers nowadays use ERP systems (Enterprise Resource Planning) which allows them to integrate many applications to manage business's processes. An automated system which gives insights about the back-office functions will improve the efficiency of inventory control. Additionally, by using an automated system, the ability of tracking online and in-store purchases will help the retailer improve their replenishment activity and yield better demand prediction.

4.3.4.5 Apply lean principles into inventory control and fulfillment stream.

The goal of warehouse and inventory control is to be more efficient in terms of cost saving and service improving. In these activities, we can relate their objectives of lean management to apply for warehouse and inventory control's purposes. Warehouse managers would like to reduce waste (variations and complexion), reduce the operation costs and continuously improve value-adding activities into their process of providing goods and service to customers. Based on lean principles that has been introduced in Literature review part, warehouse manager could apply this into their management activities to create a lean fulfillment flow, to reduce the waste and bring more value to customers.

Suggested lean fulfillment stream from Leancor, a supply chain group, would be a good option to follow, in order to maximize customer value creation and minimize waste throughout the stream. The seven lean fulfillments principles applied and modified the five lean principles, but the main

points remain intact it. Starting from demand reviews, identifying the value-added and non-value-added steps, then creating the flow, improving the collaborations to makes right decisions and be productive.

Table 2: Seven lean fulfillment flow principles (source: Leancore)

NO.	LEAN FULFILLMENT PRINCIPLES
1	Always review past demands, forecasted demands throughout the fulfillment process.
2	Identifying reducing lead time will lead to inventory reduction.
3	Create a flow to reduce variation and remain stability
4	Use pull systems to reduce complexity and over production
5	Increase velocity to become more flexible, to meet consumer's demands
6	Collaborate and follow the guided discipline
7	Make decisions based on total cost of fulfillment

After considering the strategies for inventory control which will support for the whole process of order fulfillment, the first step which interacts with customers is to create an online ordering system. By analyzing the customers' characteristics, demand requirements and retailer's capability, the next chapter will discuss how to win more customers and bring their the most convenience.

4.4 Online ordering system

As earlier described the e-commerce for food market does not bring in any new physical products, we see that e-commerce part is as an added service to an already existing product. Utilizing an online ordering system for already existing stores might be a necessary evil for maintaining relevance in the food market. The reason for that is because it sets high demands to the stores ability to adapt, change, and invest with uncertain gains. E-commerce opens for a lot of possibilities, but also put a risk on uncertainty and profit. Online ordering makes it possible for customers to plan, register, and shop digitally without pay a visit to a physical store. When this trade becomes digital, there is an unlimited array of possibilities one can build the system on. Traditionally, stores have presented the food for the customers and customers are used too this setup. Therefore, it is critical how the food will be presented on an online platform. It must be easier and more convenient for the customer, but it is difficult to change the customers habits and

preferences. New knowledge must be obtained, and the online ordering system must be familiar such that it becomes internalized and natural for the customers. The choices must be easy, and the response time must be fast, this calls for an online ordering system that is easy to navigate. The dilemma this brings is when unlimited possibilities opens, it is more difficult to make the system easy to use. The ramification and possibilities that should be included in the online ordering system must therefore be mapped out, with emphasis on development costs, future operations, further development, effective order handling, safety, and customer service. The ordering system is an essential part for every e-commerce actor, and if it does not work efficiently, it might be perceived as a "closed store" and customers will visit your competitor instead. There is a big variation when considering online customers, that will also add to the complexity to the usability of the online ordering system.

The ordering system will therefore be an essential success factor, and in the mapping of the process we can use "Disciplined Entrepreneurship" (Aulet, 2013) as a base.

4.4.1 Who is the customer

The market segmentation can be wide and difficult to define. Customers comes with different age, demands, preferences, salary, demography, and knowledge. Therefore, it is important to define the customers according to step 1 and 2 before moving onto step 3 (Build an End User Profile) in disciplined entrepreneurship (Aulet, 2013). Most online ordering system uses a point-and-click structure with menu-based choices. For experienced online shoppers this may be too simple and slow, thereby less efficient. The number of clicks and how fast is to maneuver the system can be a challenge to adapt to different customers. A possible solution for this is to build a user dashboard for the different segments of customers that will use the service. The different customer segments may have a different layout and functionality. Elderly people might think it is easier to make a shopping list on a note and be called up by customer service with suggestions on the screen if this is the goods she/he wants, or if she/he wants to adjust something. More experienced users might want to make his/her own personal dashboard, combining their most used menus and recipes such that is much easier and faster for them to navigate.

Figure 8: Who is your customer?

When the customers have been divided into segments with respect to aforementioned criteria's (age, demands, preferences, salary, demography, and knowledge), the Beachhead market can be defined, depending on target group, how much grasp the ordering should offer, and to who. It might not be profitable to be able to deliver too all customers, be it that they live too far away, or too old or incapable to use an online platform.

4.4.2 What can you do for your customer

Figure 9: What can you do for your customer?

Since online ordering opens unlimited possibilities it is important to map out what one can deliver to the customers, and to which time. Should the customers be able to change the order before packing and delivery, do we offer flexible delivery alternatives, should the customer be able to track the order? Different cases from different customer segments can declare what we want to offer or wish to offer with respect to development, and supply and demand. Since e-grocery is considered an add-on service to existing goods, it is important to keep focus on the core business, and how one should adapt to the future.

The ability to position oneself above the competition, and the ability to take care of existing customers is of great importance.

4.4.3 How does your customer acquire your product?

In step 1-11 there is a focus on the ordering system with regards to functionality, user specifications, and what the ability to deliver without sacrificing the core business is. There must be a focus on adapting the ordering system to the customers shopping pattern, or to the degree of influence needed to change this pattern if necessary, to make the customer adapt to the ordering system. Elderly customers are now making the transition to pay with cards/bank terminals instead of cash, will they still make the change to shop online? The numbers show that online shopping online is more widespread among youth, young adults and adults. See the figure below.

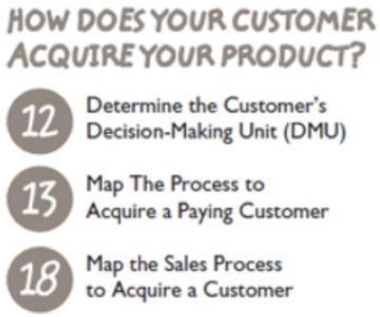

Figure 10: How does your customer acquire your product

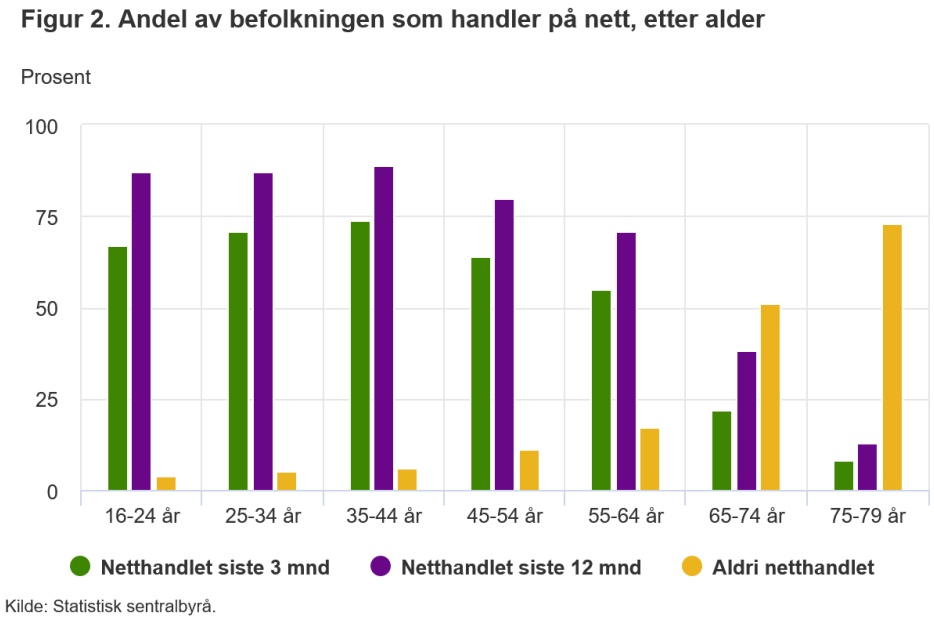

Figure 11: Respondents to online shopping

The figure shows the relationship between the frequency of online shopping and age. Note that the green bar (frequency of 3 months) is higher for the younger population. Source: Statics Norway.

The Y-axis of the model shows how many of the respondents in percentages use online shopping, the X-axis shows the age (16-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, 75-79 years). The green, purple, and orange bars show the frequency of ordering divided into; last 3 months, last 12 months, and never used, respectively. These numbers are coming from the Statistics Norway (SSB).

We can read from figure 11 that online shopping is much more widespread for those at age 16 till 54. Among the elderly, there is a big proportion of those who have never tried ordering online. When calculating the total addressable market and map out the process of acquiring them to your online store, this will be important information (Aulet, 2013). There is an extreme likelihood that the customers for e-grocery will be between the years of 16 and 54.

Most of the addressable market already have experience from shopping online and several shops online on a regular basis. However, buying food online is a new thing for most people which may cause skepticism among online shoppers. To avoid skepticism, the online navigation must be relatable to other popular web-based shops. Considering that 76% of e-grocery customers are willing to switch to another grocer if they offer a better online shopping experience (Unata, 2018).

Quality across the online platform is therefore of immense importance, both for attracting new customers and retaining customers.

In addition to offering a high quality online service, process mapping for orders and payment is important. The process mapping should take for it the most important activities that is associated with online ordering. For example, if one customer should have issues with paying before delivery, is there small improvements that may retain the customer? Do we need to offer price warranties on e-grocery or increase the access for coupons or other advantages with online shoppers? Process mapping can bring light on these issues in a sensible way.

It is important to keep in mind that time saving and make grocery shopping easier that makes the customers willing to change their routines for grocery shopping. It should be possible to order from anywhere the customer is located and to receive the order on several locations. Therefore, one should offer to place on order from several devices such as mobile phones, tablets, and laptops. There will be competition on best availability. The customers willingness to change is connected to the customers total experience. The one who provides the best total customer experience will retain the customer.

In the past and present, customers have written shopping notes or shopped on impulse, it must be as easy or easier to use the online service. Availability on several platforms becomes increasingly important. Digitization and development of the service is therefore a necessity of most importance. Digitization will also widen the volume of customers with for example the emergence of "internet of things" (IoT). With smart fridges the customers can see live what they have and get an app that tells them when things are getting old. Some goes as far as putting together menus that are based on products going bad soon. By connecting the e-grocery to these sort of products, there is a massive potential for autogenerated orders by smart things. Amazon Fresh is utilizing their smart speaker/assistant, Alexa, for order generations. With Alexa, customers can simply put an order together by speaking to their home speaker. This development is evolving a at massive pace and the possibilities are enormous. By making alliances with companies in the tech industry, e-grocers might "out-source" some of the development costs. It is certainly interesting to see such a cooperation in action.

4.4.4 How do you make money of your product?

Figure 12: How do you make money off your product?

Since the margins in the food industry is low (about 2%) and online availability is getting necessary to compete, a business plan must be made. When developing a new service there might be more needs and demands that arises from customers. These needs and demands should be mapped out in a business model such that the actor knows what to act on. In the case for e-grocers they must keep and/or increase their market share for continued growth. Too keep the profitability in moving over to e-grocery sales must increase since there is a lack in profit margins. It is assumed that these margins cannot be improved in the short run, so an increase in sales is therefore necessary. Loyalty programs, coupons, added bonuses etc. may be a way to keep customers loyal. Loyalty programs or member cards can also generate a digital profile on customers, making it easier to track their behavior and send targeted offers that incentivize them to buy more.

It will also be easier to cooperate with third party operators if one gain a larger market share. Then one could offer services from these partners as well, thereby adding value to your own service. Coop can be an example for this. Customers inn Coop's loyalty program will receive offers from other suppliers which delivers cheaper accommodations, rental cars, insurances etc. If these "add-on services" from third party partners generate more sales it is fair to assume that profitability may increase.

This information can also be significant throughout the supply chain, making it possible for suppliers to gain more efficiency and reduce the cost for the entire supply chain. If create a synergy effect that can optimize the "Food supply chain management" (FSCM), then there lies a lot of possibilities for improving results and profitability. A large number of goods goes bad in the food supply chain which represents enormous costs, even if some of that loss is deductible. The marginal cost for food waste, will be reflected in the final price for the goods themselves, pushing up the prices. It is reported that about 1/3 of all produced food is going to waste or abandoned yearly, which is about 1.3 billion tons (Manning, L., Baines, R. and Chadd, S. , 2006).

Approximately two thirds of this waste occur in the supply chain like, harvesting, shipping, and storage (Fritz, M. and Schiefer, G. , 2008).

In addition to reduced costs from implementing a better logistics chain, increased efficiency from digitization, profitability can increase if customer relations strengthen. Brand building and marketing can be tailored to individual customers, such that they receive offers and add-on services that are relevant and makes life easier for them. The key is to find out what the creates customer loyalty, and what offers increased convenience for them that generates marginal income that exceeds marginal costs.

4.4.5 How do you design and build your product?

The most difficult part may be to map out and build the ordering system as there is so many choices and solutions. Should it be connected to existing store chains, or shall it be built from the ground up with new branding? Who is going to invest, what is the risk, and how? These are all essential questions that should be answered while building the product.

Figure 13: How do you design and build your product?

Step 20 till 23 in Disciplined Entrepreneurship tries to identify assumptions around this and try to develop a product that is sustainable and competitive on the market. The ordering system will be the e-grocers entry door and if it is not seen as open and easy to navigate, the risk of the customers "existing" before browsing is great. In step 23 it is important to demonstrate to the different customer segments why they should change their buying habits. This can be about the amounts of clicks for placing an order, response time, search criteria, or other preferences for each segment. It is therefore important to evaluate these factors on how to position oneself above the competition and towards potential suppliers.

E-grocery can be compared to out-sourcing for the customer, as the customer is "out-sourcing" something they used to do. To make the customer willing to "out-source" this activity, e-grocers can use the "five principles of lean" (Womack, Jones and Ross (1991). Define value based on customers´ point of view, i.e. total or partly outsourcing. Identify and mapping activities and steps to secure logic processes for the customers´. Good user experience and user friendly. Easy to add

and find product with expected functionality. Total flow and effectiveness prepared for further perfection.

4.4.6 Suggested approach for the ordering system

Above we have broken down the market and business solutions down into steps according to "Disciplined Entrepreneurship" (Aulet, 2013). This have helped us to break down the most important parts that an e-grocer must consider while developing the ordering system. This system is the "meeting point" where the customer "meets" the shop, basically the only place that connect the customer to the store. It will reflect the service as a whole and is as stated extremely important to either gain new customers, and retaining the ones you have.

A proper online ordering system should be able to answer to all of the six themes in "Disciplined Entrepreneurship:

1. Who is the customer?
2. What can you do for the customer?
3. How does the customer acquire your product?
4. How do you make money of your product?
5. How do you design and build your product?
6. How do you scale your business?

When developing the ordering system, we suggest that the customer is the number one priority. It is of most importance to segment the market into different segments of addressable/potential customers. The customers' needs and expectations should be mapped out to create an end-user profile. From here the e-grocer can define their most valuable market segments which should carry the highest focus when dealing with effort put into gaining and retaining customers, i.e. the beachhead market.

When the targeted customer segments have been identified, the ordering system should be designed around their needs. This will be the core market where the e-grocer operate with high focus, and the market with highest value proposition. This is where the process to acquire these paying customers comes in. That will come down to the design and navigation of the online ordering system. It should be flexible, easy to use, and convenient. There should not be any slow-downs or unnecessary clicks. Having a menu that customers can add to their cart and specify how

many persons they need for can help too add some value here. The mind-set must be on how to make things easy for the customer.

This above discussion has focused on how to design the ordering system based on targeted customers, in order to bring more convenience to online-customers. Therefore, it contributes to the increase of sales, bring more benefits to retailers when the volume of orders grows. The next step in order fulfillment of e-grocery process is picking activity, where the ordered products and goods are sorted and picked by pickers or machines. The following chapter will introduce those options on picking and suggest some solutions to improve the efficiency of the activity in terms of productivity improvements and costs saving.

4.5 Picking options

4.5.1 In-store picking

With picking in-store we mean that the e-retailer will conduct picking and packing inside an already existing store or super market. Pickers will go through the shelves like ordinary customers and pick up orders. There are several important parameters that must be assessed before implementing this solution. Chief among them is the cost of labor and the limitations the stores set.

4.5.1.1 Main benefits of in-store picking

Less startup costs are a major benefit for in-store picking. The biggest point for this method comes down to added cost for the e-retailer. If the agent already has the store ready and people employed, there will not be a need of big investment to get going. The people who is currently employed can be used for picking up orders as well.

The demography can also have a big impact on running food e-commerce in a market. If we operate in a market with a spread-out population, there is more beneficial to have several small distribution centers rather than fewer bigger ones.

By using already existing stores and supermarkets it may be easier to pick for already established customers, as they already have an established customer relationship. This might be more true in smaller areas where everyone knows everyone. The store employees have managed the goods for the customers for a long time, thus may decrease the customer skepticism by letting others handling their food/goods. In addition, it can be easier to offer personal follow-up for procurements as the

location is already a meeting point between customers and employees. Depending on both demography and clienteles, it is possible that the employees knows about customers preferences which will again improve the assortment. If the store facilitates storage areas and have functional solutions for storage boxes or currier bags, pickers can pick in stages, depending on the products vulnerability and time of delivery.

By utilizing in-store picking the need for change is not that massive as with other solutions like dark-stores. Thus, the process can be a step by step "out-sourcing" for the customers. It will be easier for customers to either give feedback or bring forward a complaint on the service and have a simpler access to get a refund compared to a dark-store setup. As shown from the figure above, if the difficulty of complaining is made easier, about 75% answered that this will increase their chance of returning (McKinsey, 2013). Switching of goods will likely be easier for the customer, resulting that errors and lack of products will have less of a consequence to keep the customer clientele.

In-store shops will already have existing knowledge about the customers and their shopping habits. This can be used as an advantage for mapping and forecast the expected shopping and assortment for the different seasons and trends in the local environment. They can give a more personal service and sometimes give special treatment to returning customers as they know what demand they can cover. The existing employees and the store's importance for the locals is also an important factor for in-store picking. Humans have a distinct dislike towards change and the unknows can be hard to implement. People have a will to cling onto the known and to take care of close relations with others, the stores has been such a place for many. By not replacing the store with a dark-store picking facility, in-store picking can maintain this by gradually adapt customers to order online. As offline customers visit the stores they can also valuate how pickers are working and see the process themselves. This may add to the adaption rate for e-grocery as it gets more familiar.

Short-traveled food has lately been in increasing demand for many customers, and in-store picking is in prime position to exploit this. As a store in a smaller local community it is a lot easier to make deals with small local suppliers. The local suppliers can for example deliver local eggs, bread, vegetables, and fruit. These goods can carry a higher value for many customers and they are willing to pay for it. Utilizing local suppliers for commercial gain can also be beneficial as many locals possess knowledge about the community and the locally based suppliers. Then the customer will

also know for sure that they are getting local and short-traveled goods. In addition, it is near impossible for small local suppliers to gain enough volume to compete with big suppliers. As internet orders are picked inside the store, it has a bigger advantage on delivering local short-traveled food for its customers, both online and offline.

In-store picking stores can also easier be utilized as a combination store between an online and offline act. The online act will consist of the customers placing a picking order for certain items (like house holding goods, toilet paper, spices etc.), then comes to the store and pick fresh goods themselves. This way the customer can quality check the goods that needs a quality check (from the customers perspective) and can be relived of picking up the other goods. In this case the customer can do they're quality check on fresh goods, get help with picking the rest, then pay and take the goods home. The e-grocer will then be relived of high costs associated with the last-mile delivery service. In addition, customers will be exposed to more goods and services that will contribute to upselling the customer.

4.5.1.2 Some issues of in-store picking

The biggest factor for the profitability of in-store picking lies with the cost of labor. The reason for this is that all the steps in this solution is based on man power. If orders increase, the workforce must be increased as well to maintain a good service. When picking in-store, there is a limit to how many pickers that can work at the same time

If a store gains traction with its online ordering and delivery system, the orders will naturally increase. An increase in orders will but more strain on the pickers in the store, thereby pushing the capacity to the limit. To deliver a good service to the end customer, the e-retailer must be able to deliver within a set timeframe. If the store cannot sustain the amount of orders coming in, the ability to deliver on time will be hurt. To counter this, one must increase the picking and packing capacity. Assuming we can't make the workers work faster, there will be need for extra employees. Adding more pickers will in turn increase the density of people inside the store, which will have an adverse effect on picking efficiency. The risk for, employees and customers alike, to collide and mix up orders will increase with the amount of people on the floor. Adding to this, the shopping experience for the ordinary customer could possibly suffer.

The in-store solution also carries some hidden cost that should be considered. They include the cost of restocking, inventory control, goods exposure, and the potential alternative income. We will in turn analyze these hidden costs, starting with the cost of restocking.

As of now the supermarkets receives SKUs from their suppliers on pallets with products. The pallets are then taken out to the store and moved to their respective shelves. These SKUs are based on the normal product traffic the store experience throughout a set time space. If a store should add the possibility of ordering online, the total amount of customers to that store may increase greatly. The risk is that the shelves will be emptied much faster than anticipated, or there is simply not enough room on the shelves to sustain such a load. The store will also need employees to continuously make sure that there are goods in every shelf. The hidden cost here will be the number of SKUs necessary and the employees needed to keep stock in the shelves.

This also leads us into the problem of maintaining inventory control. If you keep your store open to both online customers and physical customers, tight inventory control is needed. For people to use your online service, you must guarantee that the product is available. The online stock may show that the item is available, but there is a risk for a physical customer already picked up that last item and is on the way to checkout. If this happens a lot your services will no longer be reliable, and as a result, customers will not use your service again. The potential cost of losing customers or implement solutions for this will add to the costs of conducting the service.

Most convenience stores today use a grid layout for their products. This means that the shelves are organized in grid systems which the customers can navigate around to find what they need. Stores do arrange the layout such that the customer is exposed to as many products as possible before existing the store. However, it is not an optimal solution for picking efficiency. Such a layout will cause the pickers to take longer routes thereby adding to the picking time and add to the problem of pickers bumping into each other. Here the store needs to evaluate the benefits and costs of picking efficiency vs goods exposure. The “loosing” part here will add to the cost of going e-retail.

There is an issue for that the e-retail part can “steal” customers from the store going part. In other words, people that would ordinarily just visit the store will start to order online. The costs of supplying an online customer is far greater than supplying the customer coming to your store. So, when your own customers move over to order online, you will start to lose money on them. There is also the chance that store going customers will find it stressful or inconvenient to visit your store

which is packed with pickers. The risk here is losing the high margin customers and gain lower or non-margin customers.

4.5.1.3 Suggestions for in-store picking

As stores are open for both customers and pickers alike, physical stores will most likely continue to utilize their current layout. Such a layout that is more optimized for exposure and not for picking. Assuming that stores are not willing to change from this sort of layout (as they earn more money from store visiting customers), there is not too much that can be done about this issue. However, there is still room for digitization and inventory allocations.

As for digitization, pickers can use bar-codes or RFID chips to identify goods and mark them as picked. This way the system will know that certain goods are picked for certain orders and will automatically add the item to checkout. This will help maintaining inventory control and help employees know what is done and what needs to be done for fulfilling an order. We also see that stores such as coop hands out scanning devices to customers visiting their stores. These scanners can also be used to get data on what store visiting customers have picked from the shelfs. This information can be used to show correct inventory to online customers such that they can't buy out-of-stock items.

What is meant by inventory allocation is to allocate space for order storage, order consolidation, and packing. Since picking can be undertaken in steps there needs to be room to store the picked items in the meantime. This space must have temperature regulated zones such that fresh and frozen goods does not expire. Mainly there is three different temperatures that must be addressed; chilled, frozen, and ambient. When orders are getting picked they can be stored in this back area, ready to be consolidated, packed, and delivered. Figure 14 shows how such a back area might look like, the important parts are to maintain temperature control and have enough space to move around.

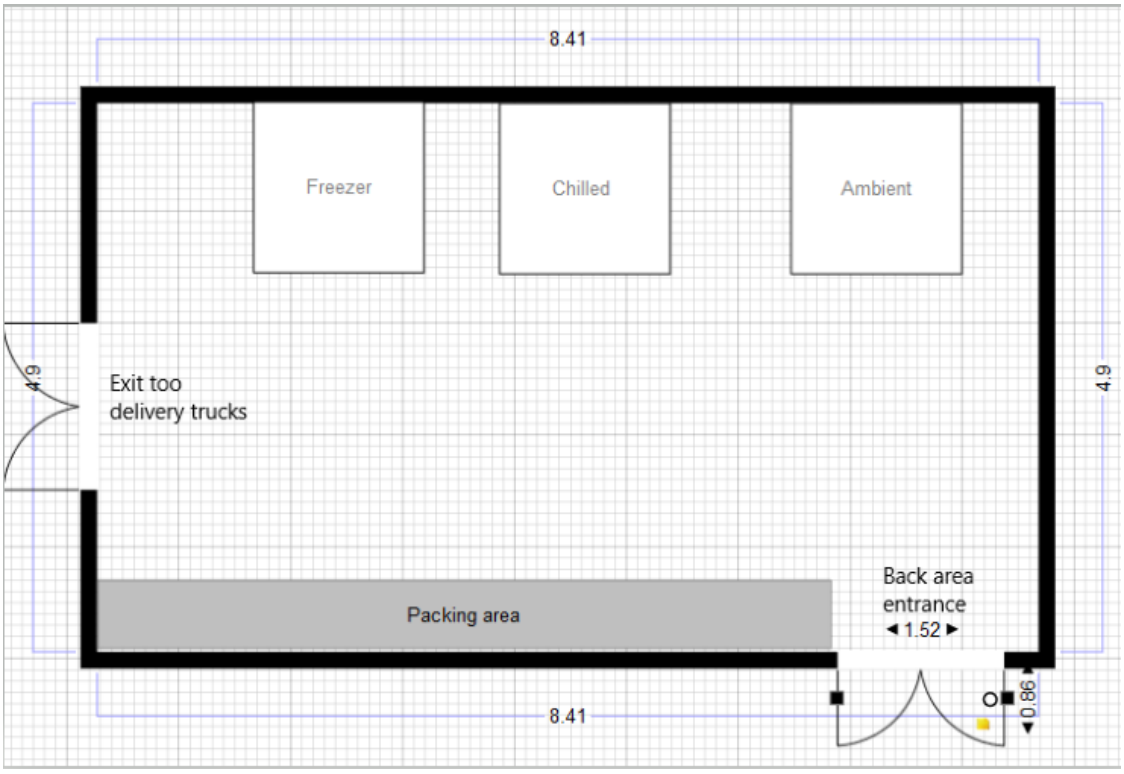

Figure 14: In-store warehouse design

This figure shows what a dedicated packing and order storage area should contain. The figure is not meant to be exact in dimensions but should paint a picture on how it can look.

According to Jacob Beer, in-store solutions are now able to handle 80-100 orders per hour and would need 120-140 orders per hour in order to reach profitability. Therefore, it is important to employ an efficient picking model too reach a higher efficiency. By implementing the suggestions mentioned above, in-store picking may be a viable option for e-grocers. It is still recommended to use this method in smaller areas as peak efficiency is far from that of a dedicated warehouse.

Another option for picking which is more and more popular in today's business is warehouse-based picking. This is a store which is only dedicated for picking and packing the working-in-process products and it is required many studies and analyzes to be optimal.

4.5.2 Warehouse-based picking - Dark stores

E-grocery is clearly a new trend for retailers. More and more chains are offering this service as one of their competitive advantages. The problem is the overall demand is increasing, yet still a significant percentage of retailers are losing money on ecommerce platforms. However, there is a

way to enhance buyer experience and they might lose more if they are out of the trend by losing their customers. At first, in-store picking and pick up at store seem to be a temporary solution of new model adaptation. Nevertheless, the problem occurs when ecommerce sales grow which could cause stock outs and crowed stores. Another model has been carried out for online order fulfillment called dark stores.

4.5.2.1 Main benefits of dark store picking

Conventional picking method would be store-based, while a newer method is rising rapidly is dedicated warehouses for picking and packing activities, also called dark store. These warehouses are built for picking and packing activities and with the idea of avoiding interferences with traditional customers since only order pickers do their job here (Alexander Hübner, Heinrich Kuhn, Johannes Wollenburg, 2016) so it may provide a more efficient process (John Fernie, Leigh Sparks, Alan C. McKinnon, 2010). The higher efficiency is made possible because of its dedicated characteristics and capacity of applying automated technology. For example, the warehouse layout will be designed to reach a best-allocated goods or products within the shortest distance and time. Therefore, dark store could be more efficient in picking activity and lead to the ability to meet the demand of a greater number of orders at the same time. In addition, dark store picking and packing activities could provide real-time data that shows the viability of warehouses which is important to logistics management. A.Gunasekaran (1999) refers to one example of improvement of warehouse operation by using barcodes in conjunction with software. This method could help to collect accurate data on the utilization of space, return on investments, material handling, labor cost, order picking, and customer service.

Vesa Kämäräinen (2001) focuses on the picking process for optimization of e-grocery business and describes that operation costs could be reduced by increasing picking speed. If the speed of picking (could be both people or machines) can be improved, it will result in a lower labor cost. Therefore, the business can be more profitable. To achieve a high level of picking speed, it is necessary to have a higher level of automation applied for warehouses. The research of Kämäräinen (2001) shows that with a highly automated distribution center, picking activity could be performed twice or even four times better than in-store picking. However, to be more effective and saving actual costs, it is needed to reach a certain utilization rate of the warehouse. This means number of orders need to be big enough to let the dark store perform at its ability. For example,

the research of Kämäräinen gave an example of a highly automated distribution center could pick 450 lines per hour while only 100 lines could be picked per hour in a conventional store without any automation; but the projected costs saving may not be reserved if the utilization rate of the distribution center does not reach up to 50-60%. (Vesa Kämäräinen, Johanna Småros, Jan Holmström, Tomi Jaakola, 2001)

In terms of automation level for dark stores, the idea is to reduce number of pickers, however, as mentioned before, the high amount of investment would be the trade-off for the efficiency. Frosdick (1989) mentioned that a fully-automated warehouse could be too expensive but IT-automated method can be applied for most of stores. The costs to claim these benefits such as improving utilization of stock, elimination of paperwork, stock location control, increasing service level and information management; will average out at 25 pounds per pallet position in the warehouse, while a new full-automation one may cost up to 400 pounds per pallet position. Therefore, considering between the level of applying automation into warehouse operation is also crucial before deciding to transform conventional warehouses. Furthermore, automation may involve flexibility risks to businesses with staff training requirements and affection to ongoing operation of companies. The real concern is about operation disruption in the short run and level of flexibility in the long run. (Baker, P. & Halim, Z, 2007).

4.5.2.2 Some issues of dark store picking

Although dedicated warehouses in e-grocery offer many benefits and advantages compared to in-store picking, the main issue is that this model requires high investments at the beginning. Consequently, this is going to become profitable only when the volume of orders is large enough. Feng & Yousept (2004) indicate that the costs of dedicated warehouse operation could also be high because of its fixed costs and unsold inventories (Irene Yousept, Feng Li, 2004). Moreover, adding one or several central warehouses may increase the needed goods or information flows to supply chain management for e-grocery activities.

Another problem of dark store picking is about the distance to residential areas which can affect the cost of delivery. Normally, a center warehouse requires a large area of space to store and allocate products and goods, therefore, it is usually located in a place away from targeted deliveries. Logistics managers must manage to create a new route to these warehouses and manage the balance between the costs saving and the speed of delivery. However, a center warehouse will

definitely help to consolidate the orders and delivery transportation, which can reduce the costs of last-mile delivery. This problem will be addressed later in chapter of Delivery options.

4.5.3 Suggested solutions for optimizing picking process with dark stores

4.5.3.1 When to invest in a dedicated warehouse

After a careful consideration between the two options of picking, in terms of investment, costs, labor available, population density, and customers demographic, retailers must decide whether they are going to invest in dark stores or not. If they go for that option, a strategy for optimizing warehouse activities is needed to reduce picking time and decrease number of workers, while improve picking accuracy to increase velocities of products and save marginal costs. Interviews has been made with Jacob Beer, a specialist in supply chain management solutions for e-grocery to further understand the underlying issues.

According to Jakob Beer from SSI-Shäffer, determine when to move from in-store picking to dark stores picking is important for e-grocers. He mentioned that a normal in-store picking can fulfill small number of orders but changing to dark stores will be costly. On average, if an e-grocer have from 60 – 90 orders per hour, they can start to move to a dedicated warehouse without losing money. And if they want to invest in a fully automated system of warehouse, e-grocers need to reach up to 120 orders per hour.

4.5.3.2 Organize the warehouse - Strategies for picking

There are three options for organize the warehouse based on the picking strategy. The research of Forte, 2014 divided them into three categories: picking by SKU, zone picking, and location-based picking method

4.5.3.2.1 Picking by SKU

Set up the positions of SKUs based on their relationship. Managers should label picking aisles and shelves based on distinctive descriptions of products and goods. The main purpose is to help the picker know where exactly the ordered SKU's is slotted so they can pick the right product as efficiently as possible. If two or more SKUs are normally ordered together, they should be located next to each other to shorten picking time. Another point is the quantity of inventory of each SKU should align with existing warehouse's facility. They should be categorized and divided into proper batches (secondary-packaging). Without the preparation of organizing SKUs and packaging methods, the picking time will properly take longer, and the efficiency may be affected.

4.5.3.2.2 Picking by location

The picking area is divided into smaller areas assigned with specific groups of SKUs, this would help picker to easily locate where the item is right away and minimize picking time. Picking by location can be more efficient than SKU picking, however, pickers still spend time in transit between locations. To increase the efficiency further, warehouse software could add support for multi-order picking and batch or cluster picking.

4.5.3.2.3 Zone picking

In this method, pickers are only working in a specific zone of the warehouse, they do not need to walk throughout the aisles to look for different products. When an order comes in, it will pass through different zones of warehouse, in each zone, pickers in that area are responsible to fulfill orders with products belonging to their zone. Zone picking in combination with warehouse management innovation can make the picking more efficient regarding time saving, thereby saving the cost for order fulfillment activities.

4.5.3.3 Layout and routing design

Routing method inside a warehouse should be considered as a contributing part for efficient picking. When picking items for an order, warehouse staff need to walk around aisles and shelves which stores the items for picking. It will take more time if they go back and forth since the distance is not optimal. Many studies have introduced algorithms that can calculate the best routes for pickers inside a warehouse, for example Rosenthal (1983), Roodbergen and De Koster (2001).

In practice, there are several ways to resolve the routing optimization of pickers. The goal is to reduce time of travel and avoid aisle congestion. Roodbergen, 2001, introduced six type of routing design for picker. They are S-shape, return, mid-point, largest gap, combined and optimal, while the most popular ones are S-shape, largest gap and combined.

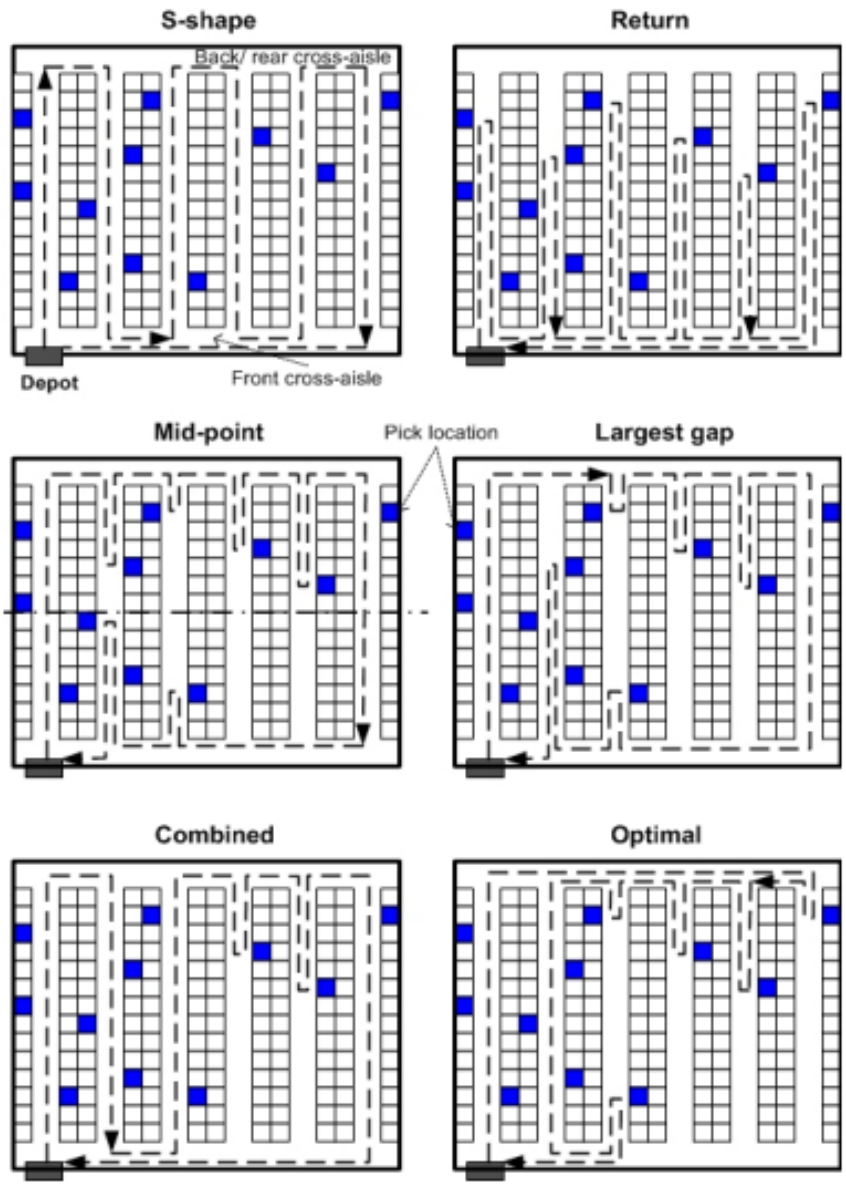

Figure 15: An example of a number of routing methods for a single-block warehouse (source: Roodbergen, 2001)

The layouts show how pickers can travel between racks and shelves for picking activities. The blue points are destinations having needed products, the routes of pickers are the dashed lines.

The S-shape method refers to a model with only one picker who is responsible for all orders and come back to the deport position. The staff visit only aisles having the needed items, entering from the front-cross aisle and exiting from the back-cross aisle. Therefore, the route creates S-shapes. A study of Hall (1993) mentioned that this S-shape routing would be productive if there were average 1-2 picks per aisles.

The second routing option which have proved its efficiency is the largest gap routing. This method is trying to save pickers from walking the entire distance of the aisle. If there is a larger gap between two picks at the same aisle, it is better to move out after picking the first item and come back to pick another one from different side of the aisle, on the way back to the depot.

The combined one is a combination of both S-shape and largest gap. While the optimal routing is combined all four methods of S-shape, return, mid-point and largest gap. Roodbergen claimed that for a warehouse having around 10 aisles of picking zone, average 20 picks, the combined would show the best performance.

4.5.3.4 Apply innovation in picking activity of warehouse

There are many automation developments which have studied to speed up these activities of picking in dark store. The main goal is to use automated processes to bring products to pickers, therefore, travel time inside the warehouse would minimized.

4.5.3.4.1 Goods-To-Man

Darke stores can experience the same problem as in-store picking when more orders come to the warehouse there is a need for more pickers. This would lead to congestion inside the picking area and will reduce the picking efficiency. Depending on the level of technology available, goods-to-man system could be a good choice. This is a combination of many racks system which moves and lifts vertically and/or horizontally, integrated with a controlling software. The whole system can respond to the request of picker in stationary. When receiving a command to pick a specific product, the system will detect the exact location of it, then by moving up and down or changing relevant racks, the system move the product to conveyor belt, and finally transfer it to the picker.

This system can be controlled by warehouse management operations with applying some innovation such as voice-directed picking or radio-frequency- directed picking to make it even more accurate and faster.

A solution has been introduced by SSI-Shäffer called A-frame. They use a separated replenishment and picking area. The automatic picking system will be collaborated with a conveyer belt to sort and deliver product very fast and precisely. They announced that the system can pick up to 350 items/articles/day for fast-moving goods, and for medium-moving goods is about 5-50 items/day

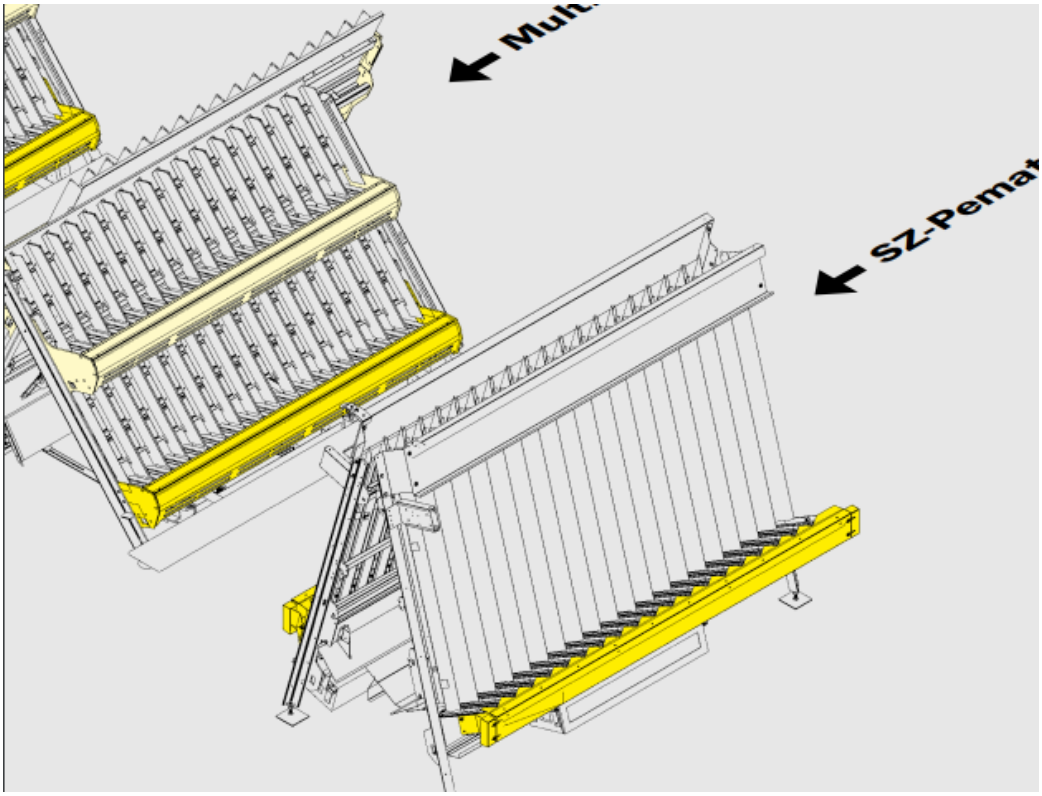

Figure 16: A-frame solution for picking from SSI-Shäffer (source: www.ssi-schaefer.com)

The figure describes the A-frame picking system where products could be picked and sorted inside the frame, then moved out to the pickers for collected.

Another example of an automated picking system is from Bastian Technology company, the system also utilizes a goods-to-man system called iBot, which can pick 1000 items per hour.

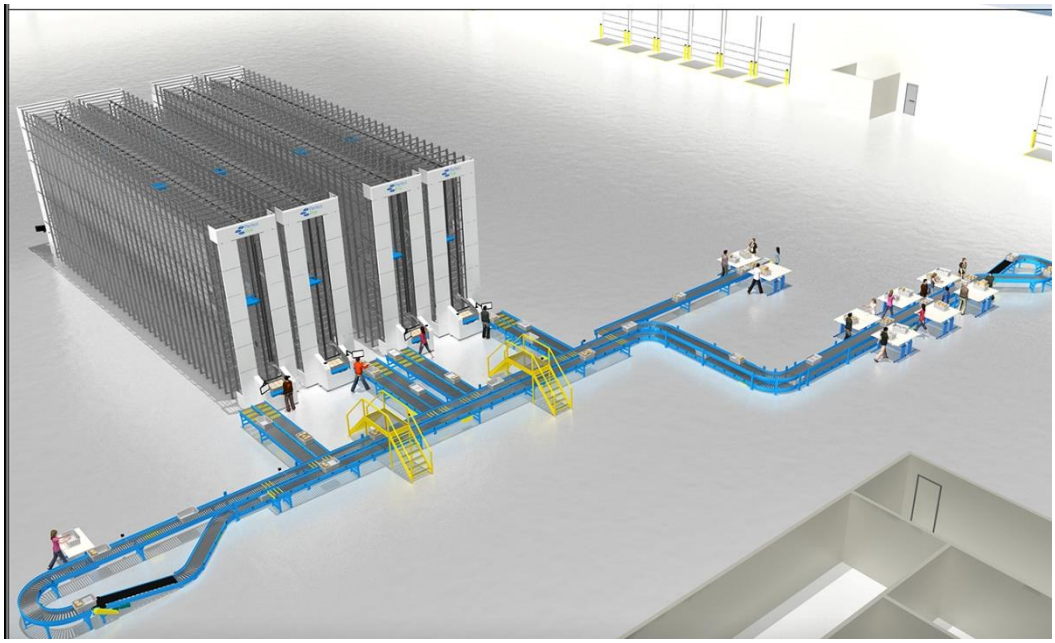

Figure 17: Goods-to-person system of Bastian Technology (source: www.bastiantechnologies.com)

The figure describes the good-to-person system where pickers do not need to go into the racks and shelves places, they wait control the orders and wait for chosen products at the sorting and pick up areas. The picking time will decrease thanks to the automated parts of the process.

4.5.3.4.2 Robotic picking

However, one important challenge for dark stores is to find employees which are willing to take a job as a picker, as the work can be considered boring and repetitive. This calls for robots that can automatize various steps of warehousing picking, sorting, and packing activities.

For the picking process, there has been a trend to use robotic vehicles to transport the products from cases to stations and then return to storage. Gradually, robotics is more utilized in detecting products, handling, and placing them in the right place. Robotic automation used to be quite expensive, but with the fast development of technology, this has become a popular method to improve the picking efficiency as it has become more affordable compared to recruiting and training staff.

Robotic picking is a fully automatic system with high picking quality and reliability. It can be operated at high-speed by integrating an upstream vision system where the products needed can be detected by specific specifications of width, length, shapes, etc. According to Robo-Pick solutions from SSI Shäffer, it is a combination of 3D and 2D image processing which means products can be recognized at two-stage. The speed of system is up to 2.400 picks per hour.

Figure 18: Robo-pick solution from SSI-Shäffer (source: www.ssi-shaefer.com)

The figure shows how an automated system looks inside of a warehouse without the need of labor's presence. This is a fully-automated process which reduces labor costs, increase pickings speed and accuracy level.

Automated warehouses improve the efficiency, accuracy, and save costs eventually. Humans are more important and more flexible in some activities, however, applying a control system of warehouse and adding automation brings more benefit to logistics systems.

In the next chapter, we will analyze the packaging activity in the order fulfillment process. Packaging is also happening inside the warehouse along with picking, and it is important to be well-prepared before the order is ready for delivery.

4.6 Packaging

Packing the goods is considered among the order fulfillment stage in the e-grocery progress. It is done either during or after the picking activity. If it is done during the picking activity, this step may be highly efficient time wise, but the result if the package needs to be stored or shipped can

be devastating. It is recommended to treat this as its own step such that the picked goods/orders will not suffer in quality, or at worst go bad.

This issue is mostly connected with how to make sure that fresh food stays fresh after picking and during delivery. Fresh food must usually be contained at a set temperature level. Mainly there is three temperature levels to consider; frozen, cold, and ambient temperature. A secondary issue also concerns fragile goods, this can for example be fruits and vegetables that can easily be crushed or bumped.

In similarities with the rest of the steps in the order fulfillment process the packaging should be done in a highly cost-effective manner. Packaging is also highly connected to the picking step, that means that a solution for a dark-store may differ from packing methods for in-store picking. This section will discuss the different packing options in each picking facilities and make a note on the delivery trucks/cars themselves.

4.6.1 Packing the order

As stated, after the picking is done the goods must be packed according to the customer's order. According to Jakob Beer, best practice in today's market is to pick into plastic bags. This is not an optimal way of pacing, considering temperature control and limited storage in delivery trucks.

First there is the issue of temperature control. As for storage in the inventory, the temperature for certain types of food must maintain a temperature level to not go bad. For example, frozen food must stay frozen till it is in the customers hand; cold/chilled food must remain so as well; and some ambient temperature goods can't get cold. If orders should lay next to each other in plastic bags for a longer period, this can severely impact the quality of the service. In addition, there is no isolation in plastic bags and they may tear easily.

Another solution is to use cardboard boxes as they are easily stackable, and easier to divide (both between different customers and dividing the goods inside). This solution works great regarding temperature control and ease of sorting, but it has some issues with size. If one or more customers orders are too small, you would end up transporting a lot of air, thereby making them less cost optimized. However, there can be variations on the sizes of the cardboard boxes, such that smaller orders do not take up as much space. To minimize this issue the e-grocer can charge extra for small

deliveries as they do today. This will give the customers incentives too chose the e-grocers preferred solution and cover some or all extra costs if the customer don't increase their order.

Another issue in packing is the goods themselves have different forms and fragility, for example an apple is much more robust than an egg. The types of food can be categorized into seven groups:

1. Canned food
2. Non-perishable
3. Perishable
4. Fresh
5. Chilled
6. Fragile
7. Frozen

Each of these groups will require different packaging. First of all, **group 1 (canned food) and 2 (non-perishable)** can be transported in ordinary cardboard boxes, without any need for extra protection. This can for example be beverages, household items, canned beans etc. **Group 3** (perishables) should be transported in plastic bags, for example flours, cookies, spices, vegetables etc. **Group 4 and 5** (fresh and chilled) should stay chilled/refrigerated. This can be accommodated by thermal bags or thermal wrapping inside a box, example of these can be fresh pasta, fish, meat etc. **Group 6 (fragile)** must be taken extra care of, regarding both packing and handling. They should be packed in cardboard boxes and coated by bubble wrap, for example eggs, fruits etc. Group 7 (frozen) should be transported in coolers to avoid them getting warm, ice for example will melt within one hour in room temperature.

By applying this packaging solutions, all the different groups can stay fresh within their respecting packaging for up to 6 hours. That should be long enough for the delivery time, and the time it takes for the customers to unpack them. Considering that cardboard boxes are cheap to acquire, easy to recycle, and robust enough to hold common food orders, it is recommended to have a standardized cardboard "order box" for each customer. This makes the orders easier to handle and label. The order box itself can be segmented into sections for each of the groups mentioned above, except form maybe the frozen goods as the temperature required is more extreme.

Conducting packing in in-store facilities and dark-stores will be different considering the space available and scale of orders. Packing in dark-stores can be heavily automatized as the structure of automation allows it. Because of heavy automation, the packing can be atomized to a much higher degree than in-store picking. By applying robotic or automated picking, the orders can be picked right into the delivery box. If the amount of orders requires it, orders can more easily be picked in advance for popular orders. It is also possible to store these orders in an efficient manner and bring them out again. Everything will work automatically and be carefully stored. By picking and packing some of the orders in advance, there is more room for orders in peak hours. This will create a buffer which can make up for time lost when the amount of orders coming in a short time is big.

Figure 19: SSI Shäffer's Cuby shuttle (source: www.ssi-shaefer.com)

This figure shows how the "Cuby" shuttle by SSI Shäffer operates. It moves on the end of the storage racks, minimizing how much space it needs and how much space the whole system takes. Source: SSI Shäffer and Jacob Beer.

SSI Shäffer's Cuby shuttle is a good example to make this work. Cuby is an efficient shuttle when it comes to storage and retrieval systems which will cover most of the area for dark-store packing. When orders are picked in advance, the Cuby shuttle can transfer them to storage and retrive them when necessary, either for order consolidation (goods from different temperature areas) or making the order ready for delivery. As seen in the picture above, Cuby are using the racks of the storage system for moving between storage areas making it space efficient and easy to scale up. The shuttle will be able to retrieve orders fast and put them on the lift at the end of the rack to bring it down to the packers. Per lift in this system will be able to handle 400 double cycles per hour, making

max capacity to retrieve orders about 800 orders per hour. As other activities in advance are slower, the efficiency for packing is not likely to be capped.

When packing in store there is not too much room for automation as it is more basic in both structure and does not have the room for the infrastructure needed. It is however advisable to have a back area to store picked and packed orders. To accommodate for different temperatures there should be three different zones; chilled, freezing, and ambient. As one order may contain a goods with all these temperatures (for example milk, ice cream, and bread), extra logistics will be necessary. As mentioned in section 5.4.1.1, the in-store solution can employ a step by step picking pattern. When goods are picked they can be "reserved" for online customers at the back and enclosed in corresponding temperature. Before delivery or pickup, the orders can be "assembled" or packed according to the customer's order. This way the food will be stored at its preferred temperature for as long as possible before delivery. When the online ordered food is at the back area, it will be much easier for packers to pack efficiently as all the goods are nearby.

4.6.2 Delivery trucks

Delivery vehicles are essential too how orders should be packed. The reason for this is to maintain temperature at a steady level and optimize for space such that one vehicle can deliver as much as possible. One also needs to think about how the driver shall empty the orders as he/she goes along the route to save as much time as possible.

As for order storing and packing, the goods still need to be at the right temperature while being delivered. There is some different solution for this issue, one is to pack the orders in cooling bags inside the order box, another one is too segment the delivery truck/vehicle into temperature zones (one for each three). By including cooling inside the order box, the thermal solutions will take up more space meaning that less orders can be taken on one delivery vehicle. However, there is a lot of possible solutions that can keep certain goods cool that does not take up as much space. In order to have chilled food cold, they can be placed into the order box in their own box coated in thermal wrapping. The space taken from these thermal solutions might not be too much of a concern. In addition, the cost of maintaining temperature regulated in the vehicle.

After considering some options to optimize picking and packing activities, the last step to bring products and goods to customers is delivery. This stage requires many resources such as labors (delivery man); loaded and unloaded vehicles and tools. It is considered one of the most difficult

activities to improve. Currently, many companies are still struggling how to be more efficient in delivery options.

4.7 Delivery options

There are two main models of e-grocery which is widely applying for retailers in Europe nowadays are Home delivery and Click & Collect model. Home delivery means the delivery will be direct to end customers 'home or workplace, while Click & Collect refers to online order and pick-up in store, in a specialized distribution center (Click and Drive) or in an automated location such as lockers nearby customers' place. Barclays reported that the direct one would drop from above 73% to nearly 65% of total physical deliveries in 2018. And the Click & Collect method would increase from 26% to 35% approximately. The report also shows that Delivery to home/work is more popular in the UK and US while France prefers collecting from collection points. (Richard Lowe, Mike Rigby, 2014)

Understanding customers' behavior and preference is important when doing delivery service for logistic company. Many consumers take this as an added value in their online shopping experience and most of them have different opinions on delivery fees and delivery times. The booming of information and digital age has leveraged transparency in pricing and assortment, therefore, it is needed that grocers have planned inventory method as well as pricing strategies in order to align to expectations of online buyers.

4.7.1 Main challenges of delivery

The clear trend of e-grocery has been bringing a new chapter for retailers, and of course coming with many challenges. Since the last decade, the percentage of users has been increasing, however, it is still covering a small portion of consumers. Therefore, combining current types of brick-and-mortar with brick-and-click is needed.

In delivery step, the first challenge is to analyze whether customers want to get home-delivery, or they prefer to pick their own order at a supermarket or a pickup point. To answer this question, a detailed survey about the area retailers would like to provide the service is needed to carry out before setting up the model of business. For example, according to BMO Capital Market proprietary customer survey 2014, more than 30% of consumers in New York, Los Angeles and

Seattle would like to pick up the order on their own. Up to 20% of customers do not wish to pay for delivery service.

The following challenge, therefore, to decide if retailers should or should not charge delivery fee. And how much customer would be willing to pay per order. This is an importance question since it affects to the margin profit of retailers and the customers satisfaction in an opposite way.

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The following part will focus on providing some suggestions of the two delivery options: home-delivery and click-and-collect model. The goal is to offer some approach to help e-grocers can improve their profitability while keep their customer's satisfaction level. For home-delivery option, we would introduce some ideas on route optimizing (to save the costs and time of transportation), how to make decision on the delivery time and delivery fee. The second model of click-and-collect, we would focus on define two options of picking up the orders, at stores or at a center warehouse.

4.7.2 Home delivery

4.7.2.1 Route optimizing

Delivery of e-grocery mostly involves to transporting activities. Therefore, the first work must to be done when going to optimize this activity is to find out the best route within the serving area. A successful deployment of route planning will bring visibility and efficiency to retailers. It is also vital to business' ability to achieve customer satisfaction and control costs while doing their work.

Manual pen-and-paper is absolutely out-of-date in home-delivery service. Retailers could not just send out the truck or van and visit customer randomly. Nowadays, it is crucial to integrate a routing solution or software with the e-grocery system to plan everything ahead. Winning route optimizing, the systems would bring convenience for customers, increase the speed and reliability of home-delivery. For retailers, they could predict the route, time and inform customers in advance in case of anything goes wrong on the road.

The routing optimization is a huge concern which requires many works with data collection, maps integration, calculation and computer science to find the best routes. There are several studies referring to this problem of home-delivery, but they have different approach in different cases. Comendador, 2012; Pluvinet, 2012 has using Geographical Positioning System (GPS) data to estimate the routes for freight transportation in his article named GPS data analysis for understanding urban goods movement on Social and Behavioral Sciences. The mythology does not rely only on GPS technique with latitude and longitude data, the authors also use some other parameters to calculate and compare the routing options such as distance, speeds, population, fuel cost, etc. After having all the needed data, with the support from compass, applications (Excel, API) and programing Python, an algorithm is needed in order to compare the routes in a specific area and find out the best.

Retailers could apply this above-mentioned technique to calculate in their own case if they have staffs specializing at routing optimization. If not, it is suggested that they could reach out for several logistics analyst agencies or using efficiency-proven solutions. Some software providers could be mentioned here including Descartes or Ortech mostly in Europe and America. The point is before making decisions on route planning, retailers need to consider both qualitative and quantitative constrain, do the detailed research on routing area and follow carefully the testing results.

4.7.2.2 Delivery time

Choosing the right time is of pivotal essence for the success of delivery. As projected, Barclay's report that online orders normally reach the peak at noon; around 5pm and 10pm. However, the number of order and browsing is highest from 6-12 pm (Richard Lowe, Mike Rigby, 2014). This is interesting fact of purchasing habits that customers still browse for online shopping at nearly midnight while they are in bed. Therefore, they may expect for longer delivery time.

Nowadays, to remain being competitive in e-grocery industry, retailers usually offer three types of delivery time for consumers: same-day delivery; next-day delivery and pre-scheduled delivery.

Understanding customer behavior is critical to improve customer satisfaction in delivery activities, especially time of delivery. Several researchers have been putting effort to find out when is the most convenient hour to meet consumer at home or at work. Because the attendance of receiver is usually required to complete the step of home delivery (Hsu, C.-I., Hung, S.-F. and Li, H.-C.,

2007). Wrong estimating last mile delivery could lead to increasing costs, increasing time of waiting and delivery, then even affect to the brand of retailers. A research about using customer related data to predict the availability of customer to receive the package has been carried on by Shenle Pan, 2017. The authors used series of telemetry data from consumers to put into a time series model and estimate the probability of customer's home attendance or absence. This is a good way to approach the real data when the author collected electrical appliance usage which related logically with the being at home of customers. The results of model show that optimal time of delivery mostly on weekdays, different points of time will be applied for different group of customers based on specific models. (Shenle Pan; Vaggelis Giannikas; Yufei Han; Etta Grover-Silva; Bin Qiao,, 2017)

When e-grocers could predict what time of the day customer would be at home, they need to plan when to start picking the order and start delivering from point of origin (store or warehouse center). This could be done by the following estimation.

Using the inputs as follows:

- Expected time to start delivery (X)
- Expected time to receive the order to cook for lunch/dinner (Y)
- Expected time customer being at home (afterword)
- Distance from central warehouse or store to delivery points;
- Number of delivery points (M)
- Number of delivery trucks/vans (N)
- How long it takes to delivery one order within the area (A)
- Average time needed for an order picking (B)

We can build up a simple model that helps retailers calculate when is the best time to delivery to customers 'house to update to their delivery policies.

$$\boldsymbol{X = Y - \frac{M}{N} * (A + B)}$$

Take a simple example of an e-grocer would like to plan their route in an area of 5km away from center warehouse/ store.

Table 3: Inputs to calculate the delivery time within the distance of 5 km

Inputs	Variables	Estimation
Time need to ready to start	X	
Expected time to receive to cook dinner	Y	16:00 – 20:00 (peak at 18:30)
Expected time customer being at home		After 16:00
Distance		5km
Number of delivery points within radius of distance (per route)	M	60
Number of trucks	N	6
Average time to reach and delivery one order	A	10 minutes (1/6 hour)
Average time needed for an order picking	B	6 minutes (1/10 hour)

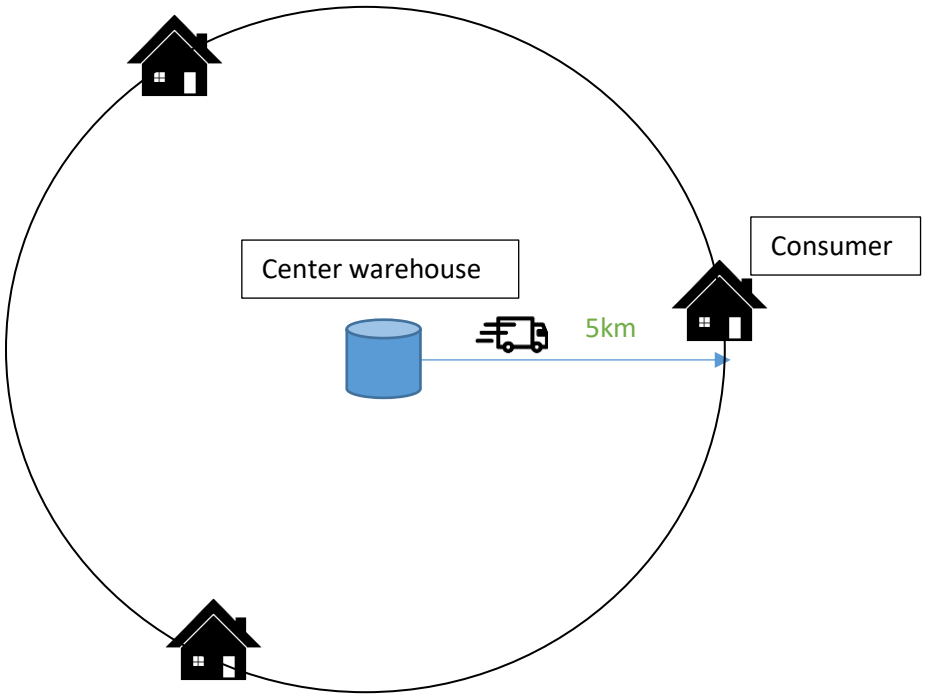

Figure 20: Delivery within 5km _ modeling by authors

Replacing the input to equation: $X = 18.5 - \frac{60}{6} * \left(\frac{1}{6} + \frac{1}{10}\right) = 15.83$

$$=> \boldsymbol{Start\ to\ deliver\ at\ 15{:}50}$$

This is only to represent how retailers could calculate the time to start delivery in the most basic case. When applying for a specific retailer with a specific location, it is necessary to consider other variables and details as follows:

- The route condition and route planning
- The furthest and shortest point of delivery
- Rush hours and traffic jams
- Type of goods and products to delivery.
- Number of chosen routes.

The next-day delivery or same-day delivery could be decided by the time of order and the capacity of picking, packing and delivery of retailers. The e-grocers could build up a completed guide and policy based on their available resources and situations (in term of infrastructures, labors and

innovation). For example, if an order has been made before 12pm, the delivery options could be same-day or next-day. While if the order is made by 12am, it is more likely to be delivered by tomorrow since the retailer needs a specific period of time for picking and packing process.

4.7.2.3 Delivery fee

Home delivery is likely most appealing to e-grocery consumers. Barclays report shows that more and more customers expect faster direct delivery. However, price is a main problem when retailers have to spend more money on labor and transportation costs. From retailers' point of view, home delivery is making no economic sense. The reason may be quite obvious. The low population density, small scale of business, high requirement on supply chain activities and unwillingness of paying extra from customers. There is only 25% of interviewees in McKinsey's reports are willing to pay higher for the privilege of instant shipment, and at younger-aged group, this share is slightly larger, up to 30%. This type of customer prefers quick service and innovation to price. Despite this fact, nearly 70% of customers care about the price of delivery first, it means they prefer the cheapest availability of shipping options. And free delivery policy will be a big encouragement for customers choosing instant delivery. Therefore, the burden of delivery cost is really on the shower of retailers, leading to the problem that most of e-grocers struggling with not gaining benefit. A report of McKinsey says that only if the cost of home delivery is under 3 euros, customers prefer to use other options of lower-speed delivery. Another interesting fact is that, there is no significant hesitation if the customer has to pay extra up to 1 euros for a faster delivery option. (Martin Joerss, Jürgen Schröder, Florian Neuhaus, Christoph Klink, Florian Mann, 2016)

Therefore, the decision for this delivery fee can be made up to 3 euro in case of instant or same-day delivery. It may less affect to the loyalty of customers. This will help e-grocers to compensate some part of delivery costs.

4.7.2.4 Innovation in home-delivery

To optimize the activity of home delivery, innovation play an importance role. Generally, there are three ways to develop this last-mile problem which are organizational innovation, technology investment and data technique innovation. The first type could relate to some strategies and actions of retailers to improve their operations such as connecting more local shops or partners for delivery, building a consolidation center to cut costs, or optimizing the method of transportation. The second innovative method could refer to applying some new technology into last mile

delivery. DHL and Amazon are both considering and testing the model of delivery with drones or automated lockers. While the last one using more techniques of data analytics and mining model to find out the effective way into practice. Some studies about optimizing the delivery route with time dependent based on the use of information from taxi historical data in the city (Chao Chen; Shenle Pan, 2015); or customers' electrical usage hour to predict the home attendance ((Shenle Pan; Vaggelis Giannikas; Yufei Han; Etta Grover-Silva; Bin Qiao,, 2017)

In the next part, the Click & Collect model will be introduced as another options for e-grocers where the delivery work has been minimized. Therefore, they are only taken into account as a different choice or parallel model with home-delivery.

4.7.3 Click & Collect

4.7.3.1 Store-pickup

One of the most traditional way of e-grocery is store-pickup. This is the model which is different from home delivery is to cut out the delivery step. Customers still place an order online, then the clerks or store-staffs could find the quite times at work to fill the online order. This is basically adding the picking costs. But, if the retailers could arrange the time management, there is most likely no extra cost related. Therefore, this method could be beneficial to both buyers and sellers. The buyers could save time of picking their products, while the sellers make use of free-time of labors and increase customers' satisfaction and retention. (Kämäräinen, 2003)

The Walmart in the US are current using this in store pick-up point. In the one hand, it is suitable for brick-and-mortar traditional retailers where they do not need much initial investment, using the same stock-keeping methods and flexible in planning staff. In another hand, it could double the job for the replenishing activity. It is also difficulty for data management and sometime causing congestion inside the store.

About the fee, it is advisory that retailers should not add more fees for people using this service. Even it costs more labors and resources, researchers show that most shoppers will come in and by more products at store. This means the sales somehow is increasing. While the retailers do not spend much on delivery, just only for picking, this way could bring more revenue and benefits for their business.

Another challenge for Click & Collect at store is failing to meet shopper's expectations when they still have to wait in a long line for picking up. JDA & Centiro's report in 2015 also said that nearly 30% experience a difficulty to locate their ordered packs.

The solution for this problem can be setting up a dedicated pick-up station, where specializing for picking up these orders without the time consuming and always having the staffs for support. This will be discussed in the next part.

4.7.3.2 Click & Collect stores

Similarity to pick up at store, after placing their online order, customers could choose a place to pick up their package where it is the most convenient. A number of places would be invested by retailers to keep customers' orders, they could be a small storage warehouse, so called stand-alone pick-up point where is located close to consumers. This method is applied by Auchan in France. They created quite flexibility for customers where they have more points to pick-up and more time to drive in to collect. The more appearance of retailers all over the places, in a way, contribute for the brand-engagement of customers to retailers. However, it is required a high investment at first, time management and stakeholder's relationship management.

To decide which model retailers should apply for their business, knowledge of customer inside is pivotal. A report from shows that they choose "click and collect" because of its collection of convenience. Customers wish to avoid the case of missing delivery (in home delivery model) or because of their empowered feeling when they know exactly what time they would like to pick up, and do not rely on others' schedule.

Other options could be picking up at local post office, other retailer stores or in a locker at gas stations or assigned place. This way could bring more choices for customers to get their orders. Amazon currently is running their locker model. Once an order is confirmed, there will be a code of pickup sent to customer's email or phone. They could use it to open the locker and pickup grocery products after the designed time. It seems expensive for investing in may lockers at first, but it could attract more customers and attract more sales by the box presence as a way of mass marketing for Amazon.

Within the model of "click & collect", retailers could offer two above models or the combination of both types of picking up. With more solutions applying for picking or other order fulfillment

process, customer experience is now getting more and more seamless service, it is a sign to project an increase in sales of retailers, bring more revenue to the business. If the retailer could keep track and optimize the costs, the future of an efficient e-grocery is feasible.

The next part will summarize the main challenges and suggestions have been given during the analysis. Based on these discussion, a comment on the trade-off between cost, revenue and customers satisfaction will be presented as a conclusion of analysis.

4.8 Summary suggested solutions for E-grocery

An optimization for e-grocery business should be implemented as a whole solution, which considers every single step of order fulfilment process. From targeting customer, to inventory preparation, ordering, picking, packing then delivery, there are rooms for retailers working on and making improvements. In this chapter – Analysis – a brief summary of given suggestions will be listed as follows:

Table 4: The summary of challenges and solutions for e-grocery business

No	Activities	Challenges	Suggestions
1	**Market assumptions**	Knowing the customer and their needs for better service	#1. Define customer segments
			#2. Find latent demand
			#3. Find customers' needs
			#4. Define the market situation
2	**Product building**	Order density and volatility	#1 Analyze customer behavior
			#2 Know which solution is best for the customer that are addressed by the online store
			#3. Know the limitations of your system
3	**Inventory control**	Lead time delay	#1. Review and evaluate suppliers
		Stock out or excessive stock	#2. Calculate optimal order quantity
			#3. Prepare optimal amount of safety stock
			#4. Adjust sales if needed
			#5. Plan and forecast sales and stocks by using enterprise resource planning and market understanding

			#6. Apply 7 lean fulfillment stream principles
4	**Ordering system**	Easiness of navigation and design. Response time. Correct inventory Which segments shall be addressed?	#1. Define customer segments
			#2. Define the TAM size and beachhead market
			#3. Focus on returning customers, and market towards the most likely customers
			#4. Allow the customers to design a personalized dashboard
			#5. Build the ordering system around customer needs
			#6. Utilize new tech, like smart-home solutions
			#7. Map out different solutions and evaluate them in terms of MC and MR
			#8. Keep a customer focus; keep flexible, easy to use, and convenient
5	**Picking**	In-store or dark-store picking	#1. Calculate the number of orders up to 80 orders/hour
		Optimization for in-store picking activities	#2. Use bar-codes or RFID to identify the products
			#3. Space layout
		Optimize dark-stores picking with speed and accuracy.	#4. Picking by SKU, location and zone
			#5. Layout design for warehouse with six models
			#6. Apply innovation for warehouse: good-to-person and robotic picking
6	**Packaging**	Reliant on picking efficiency. Order buffering. Space optimization.	#1. Dedicated packing areas
			#2. Automated storage and retrieval systems
			#3. Grouping the food and pack them accordingly

7	**Delivery**	Home delivery or Click & Collect?	#1. Research of the needs and preference
	Home delivery	Routing design	#2. Software solution or experts
		Delivery time	#3. Calculation based on specific zones
		Delivery fee	#4. Customers behavior upon charging fee of delivery
	Click & Collect	At stores or dedicated warehouse?	
		Other options	#5. Local post office/ local stores Lockers at stations/ works/ assigned places

The key driver of e-grocery is to bring more convenience for customers. All solutions suggested finally is for better customer satisfaction, attracting more customers will result in having more sales and revenue increasing. But revenue is not everything in doing business. The goal is being profitable. It means that the efficiency is even more crucial. Therefore, while trying to get more customers and more sales, the costs control in e-grocery business is equally important to managers. The analysis captured main problems in operations and order fulfillment process of retailers and introduced some suggestions to improve in terms of costs, revenue and customer service level.

To attain profitability the marginal revenue generated from e-grocery must be equal or higher than the marginal costs. I.e. the increased revenue must exceed that of increased costs. The added cost in e-grocery comes from the added service levels; the picking, packing, and delivery (or pickup service). The added marginal costs can be judged as the added cost per order that is coming in. This will include picking, packing, and delivery. For picking, the marginal cost will differ between in-store and dark store, as dark stores are more heavily optimized for picking efficiency. There is no data available for the researchers on how the cost structure is for dark store picking, making it difficult to assess the marginal cost per order. However, assumptions can be made in correlation with in-store picking as efficiency is the main difference. It is therefore assumed that dark store picking will be about 4-6 times more efficient in handling a single order, regarding both picking and packing.

By using the minimum wage for Norway and adding social costs for the employer, an hourly cost per employee is assumed to be 20 EUR. For in-store picking it assumed that peak efficiency for

one picker is 10 orders per hour (this comes from the average time the researchers use to pick up their own goods at a supermarket). The marginal cost for picking will then be:

$$\frac{Hourly\ wage}{Orders\ picked\ per\ hour} = \frac{20\ EUR}{10\ orders} = 2\ EUR\ per\ order$$

The added cost for picking in in-store will then be 2 EUR. Considering packing the same assumptions will be made as it is also done by an employee. For simplifying purposes, it is assumed that one packer can pack 10 orders per hour too. Then the added cost for packing will be the same 2 EUR plus the material cost needed to pack the order into. Based on consumer prices for packaging material, the material costs are assumed to be 3 EUR per order.

$$\frac{Hourly\ wage}{orders\ packed\ per\ hour} + Material\ cost\ per\ order = \frac{20\ EUR}{10\ orders} + 3\ EUR = 5\ EUR\ per\ order$$

By adding these together, we find the marginal cost for fulfilling one order with in-store picking (except for delivery). The marginal cost for doing these two services for the customer will then be 7 EUR. With a profit margin of 2%, one order need to be 350 EUR to break even which is not exactly normal. To attain profitability this cost must be charged to the customer, or the picking and packing efficiency must be heavily increased. With dark store picking, it is assumed that the efficiency is about 4-6 times higher. The marginal cost for dark store picking and packing will then be 1.5 - 1.75 EUR combined. For one order to break even here, still with a 2% margin will now be 75 – 87.5 EUR.

These calculations do not consider restructuring means regarding personnel's duty at work. If a supermarket does not need to hire extra pickers and packers, there will not be any added marginal costs, except from packaging material. It can also be argued that dark stores will use the same amount of people as a supermarket. If this is true for both in-store and dark store picking, the marginal cost for these activities will be far less. The calculations are made by assuming that extra workers are needed in order to be able to do e-grocery.

In addition, there is a cost associated with delivery. This is true both for pickup points and for home-delivery. As pickup points are more versatile for the e-grocer, and are fewer in number, the cost for shipping orders to these facilities is probably far less than home delivery. According to Jacob Beer, the cost for home-delivery is about 12 EUR per stop, i.e. 12 EUR per order.

To cover this cost, extra revenue must come in. The extra revenue may come from extra fees that the e-grocer charge the customers or give incentives (either via fees or discounts) to get the customer to behave the way you want (higher order volume etc.). Another way is to form partnership with other services, adding value to the customer and potentially earn more money. From the calculations above, the marginal revenue from e-grocery must increase by 7 – 19 EUR per order for in-store, and 1.5 - 13.5 EUR for dark stores. If that is attained, the margins will remain as before, about 2%.

The issue here lies with that customers are not likely to accept these charges and would rather turn to the supermarket themselves. For the food industry the bulk of the profit is made by big suppliers that delivers the goods from the farmers to the grocery stores. If a supply chain optimization could improve the cost structure, and spread out the income more evenly, there might be a solution where the customers does not need to be charged for the e-grocers extra costs, as increased margins will take care of them. This problem is however not considered in this thesis but can be a viable solution for all actors in the supply chain.

5 Validation

5.1 How our solutions perform

The master thesis approached the problem of retail businesses in the order of order fulfillment process to customers. Firstly, to understand consumers behaviors and characteristics, then giving solutions for ordering, inventory, picking, packing and delivery activities. However, it is needed to remember that one single solution could not solve the problem of being lost for e-grocers.

The tight integration in all steps of the process would ensure the channel synergies to improve the whole business situation. A good picking technology may partly improve the speed of order fulfillment process; but failing to design a good layout for packing will slow it down again. Therefore, retailers have to work on many key considerations, set priority and make it done gradually.

All suggested solutions are based on a general situation of e-grocery business which require deeper analysis before applying for a specific retailer. It could be the difference of geography with different culture and customer behavior; or sometimes the technology level is varied for each country.

5.2 Not-covered areas

There are still many other problems have been studied by other researchers which are not introduced here in this thesis due to the limitation of time and resources. The following four points are parts of the not-covered areas.

- The difference between rural and urban areas

There are a huge different in population and characteristics of customers from different regions that could lead to a specific approach should be applied. For such solutions of in-store picking could be well suitable for rural markets, while dedicated warehouse could be a good option for cities and urban areas.

- The difference among countries

People in Europe, America have different behavior towards e-grocery; and of course, they are not the same to people in African or Asian countries. The orient customs of people in China or Japan creates a distinguish way of shopping compared to European market; or the level of technology and innovation will be dissimilar among these nations at a certain level. Within this thesis, these problems have not mentioned.

- How to consolidate the orders

Consolidation in picking, packing and delivery process is an important subject in order to reduce the costs for retailers. The thesis has introduced some solutions for these parts of fulfillment order process but have worked much on how to consolidate orders. This could be in a further detailed research in the future.

- Food temperature control in delivery.

Different zones of temperature for foods from groceries is noticeable topic when it requires special materials and tools when serving the orders for customers. For example, frozen foods like fish or vegetable could not be in the same box when delivering them together with fresh food or cooked food. The thesis has mentioned partly about this problem during packing process, however, it is needed to compensate in both storage and delivery.

- Reverse logistics

Another challenge for last-mile delivery in e-grocery business is reverse logistics, which refers to a fault in order fulfillment process that cause a returns order from customers. Reverse logistics will absolutely incur additional costs for the job of taking back the wrong or faulty products from customers. It is even more complicated when retailers have to deal with refunding process or waste management since many of grocers do not have system to track the reverse flow of goods. Lean management could be applied to reduce this problem in e-grocery business. However, it requires a detailed work on this topic, the authors did not refer to this within this master thesis.

5.3 Limitations

E-grocery is a large topic which it requires much work to do the detailed research in every smaller parts of its current problems. The thesis has been carried out under hard work of authors, however, it remains some limitations during the research time.

- **Possible methodological limitations**

It would be in more quantitative way if the authors could collect reliable data from real e-grocery businesses. For example, when asking Teso in the UK for the data about the effect of number of orders on costs and revenue of two options in picking process, they declined because of its privacy. Consequently, a projected estimation could not have done to show the meaningful relationship between related parameters.

Interviewing some key people from related companies within the industry such as Jakob Beer from SSI Shäffer is the methods used by this thesis's authors. Some figures and facts from his experience and practical job has been used as a reference however it is still a few and somehow biased because of the misunderstanding in the process of transcribing with the interviewee.

- **Possible limitations of the researchers**

Both authors of the thesis are new to the topics until last five months. Unlike other researchers, they have been spending years on e-groceries topics, it is a challenge for us to have enough knowledge and backgrounds to become effective. The chosen topic requires much literature reviews on logistics, grocery business and methodology while the time constrained will cause the rush and pressure.

6 Conclusion

Revisiting the research question mentioned at the start of the thesis yield the opportunity to address whether or not the analysis allows to answer it. The research's topic is "*Efficiency in e-grocery: challenges and solutions*". Therefore, basically, this master thesis has pointed out what challenges and solutions are for improving efficiency of current e-grocery business situation.

This study has mainly used secondary data gathered from various articles, published work, and market forecasts. Challenges in this market will be the same for almost anyone who wants to venture into e-grocery. Solutions that are suggested stems from these findings, from the challenges, and from individual insight from the authors. Challenges and potential solutions have been discussed according to the three processes in e-grocery; the ordering process, inventory control, and order fulfillment process.

For the ordering process/system, the biggest challenges are to build a suitable system for the customers to use for order placement. The online ordering system is the main reason for lapsed customers as many customers will chose another service provider if they provide a better online experience. To avoid this, the e-grocers needs to know which customers they are reaching out to and how they can present their products. The layout of the web page, or app must be easy to navigate, show correct stock, and be efficient and convenient for the customer to use. Adding convenience for the customer is of outmost importance and should be the core for the ordering system. To retain and add value to the customers, the ordering system should be built around the customer, not vice versa.

The challenges for inventory control is mostly concern for inventory stock, reordering, and safety stock needed. Too much of stock will result in that perishable goods can go bad before sold, too less stock means that customers will not receive their orders. To battle these challenges, e-grocers need to review and analyze suppliers, plan and forecast future sales by utilizing proper ERP systems, and apply lean principles. Optimally, there should always be goods available for customers, and the food stock waste should be kept at a minimum. Thereby calculating the needed safety stock is of great importance. In addition, the inventory numbers communicated to the customers should always be correct. This is especially important for in-store operation as it is more difficult to display the correct stock. For in-store picking the need for safety stock, or stock not able to be picked by offline customers is a possible solution to circumvent this issue.

The order fulfillment process is divided into three separate processes; picking, packing, and delivery. Each of these processes are dependent on each other and must be completed in succession. A big challenge here is to keep these processes in accord such that efficiency is high in both handled orders and cost management. Efficiency and costs are the main areas for improvement. The added costs in this process is the main reason for failure, so decreasing costs with higher efficiency is crucial for any e-grocer. For picking there is mostly two strategies that are employed; in-store picking and dark store picking.

Our finding is that in-store picking is best suited for smaller areas, or to areas with little to medium orders. In-store picking is not a costly investment for already established stores or supermarkets. However, this solution is heavily reliant on human workforce. As orders increase, more employees must be hired, thereby increasing the costs. There is also the issue of colliding with offline customers and pickers alike, reducing efficiency. Congested stores will affect the offline customer and the picking efficiency alike, putting a limit on how much in-store picking solution can deliver. Supermarkets are also not made for picking efficiency regarding layout planning, although this can be circumvented by gradually shifting the layout planning as a balance between offline and online customers.

When orders increase there is a need for higher picking efficiency, the solution for this is dark store picking. The investment needed for this solution is high, so a high volume of orders is necessary for dark store picking to thrive. Automation will replace a manual workforce to a high degree, increasing efficiency and cost per order picked when dealing with a high volume of orders. Dark stores will be most effective in high density urban locations where one facility will deliver to many customers.

When it comes to order packing, the perishability of the different types of food is of great concern. As for example, minced meat can be deadly, and milk will go bad if not stored properly. Storing orders before packing is also a challenge as it requires space and temperature control. Solutions for these issues is to divide the storage section into three different temperature zones; frozen, chilled, and ambient. For dark stores, the storage and retrieval system "Cuby" from SSI Shäffer is recommended for storing the orders till final delivery. This provides the e-grocers with the ability to batch and buffer incoming orders, increasing efficiency. Regarding in-store picking, it is recommended to have a back room for order storage and packing activities. For the packing itself,

the order should be divided into seven different groups; canned food, non-perishable, perishable, fresh, chilled, fragile and frozen. Each group of food should be packed according to their needs to remain fresh till the customer receives the order.

For delivery, there is two different practices that are feasible, home-delivery and pickup points. The biggest challenge with each of them is to maintain the cost low. According to Beer, the cost for each stop in home-delivery is approximated to 12 EUR, and when the willingness to pay is around 3 EUR, problems arises. There are very low margins on the food products, so margins form here will not sustain the delivery costs. Therefore, depending on specific situations, retailers should conduct market research to decide whether they should charge consumers delivery fee or not, and which models of pickups or home-delivery should be applied. Any chosen models, optimizing the time of delivery and the routing is needed to be well-analysis in advance with the supports from updated software and solutions

Both the in-store and warehouse picking model may have room in this market. However, only the warehouse model will have room for further growth to deliver to an increasing number of customers. Jacob Beer also have the opinion that in-store picking has much less potential to run economically. In addition, in-store picking may have an adverse effect on its customers where the online platform may cannibalize the offline platform. I.e. customers will move form a position where you make money on them (offline), to another where the margins are much lower (online). This will be heavily depended on orders.

Cost-effective operation is crucial for success as it the only parameter that can be influenced by a single e-grocer. When adding extra services or products, the marginal costs and benefits must be mapped out and evaluated before anything is done.

Whichever solution is chosen, it is extremely important to have a focus towards the paying customer. In the service industry the customer is everything, and without them there is no room for operation.

By this thesis, we would like to bring a comprehensive view that covers the whole process of order fulfillment by pointing out major challenges in each step and suggesting some solutions based on both theoretical and practical analysis. Readers cannot have complete insight from the beginning

to the end of the process, and to understand the work of improvements that is needed to contribute to the success of the e-grocery business.

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