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Balancing Supply and Demand When Rescuing Surplus Food from Stores

Master's thesis in the Master's Programme Supply Chain Management

ÍNA BJÖRK HELGADÓTTIR
HAFDÍS JÓNSDÓTTIR

Department of Technology Management and Economics
Division of Service Management and Logistics
CHALMERS UNIVERSITY OF TECHNOLOGY
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ÍNA BJÖRK HELGADÓTTIR
HAFDÍS JÓNSDÓTTIR

Tutor and examiner, Chalmers: Dan Andersson
Tutor Chalmers Industriteknik: Kristina Liljestrand

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Department of Technology Management and Economics
Division of Service Management and Logistics
Chalmers University of Technology
SE-412 96 Gothenburg, Sweden
Telephone +46 (0)31–772 1000

Chalmers Reproservice
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Abstract

Each year a large amount of edible food is thrown away, so called surplus food. The food is discarded in all stages of the supply chain, i.e. from farmers to the end consumer. Often it is lack of demand or aesthetic criteria that causes the food to be thrown away. A project, led by Chalmers Industriteknik, has been initiated to reduce the amount of food going to waste at grocery stores. In addition to Chalmers Industriteknik there are seven project partners, each contributing with knowledge and experience in certain areas. The project aim is to deliver surplus food from grocery stores to restaurants where it will be cooked and served. Reducing the amount of produced food from source is the best solution to eliminate food waste, however since the food already exists, making use of it and fight the food waste is an important initiative.

This study aims to find out what is needed to make the system, where surplus food is delivered from grocery stores to restaurants, more efficient so that every actor, i.e. stores, restaurants, and logistics provider, will be willing to participate. If the system is too complicated and requires enormous time and effort, the actors are less likely to use surplus food. To achieve the aim, three research questions are presented. Knowing what characteristics play a key role in the balancing of supply and demand is important to be able to identify a material flow structure for the system. Furthermore, knowing which logistics activities need to be involved in the system and how they should be carried out so that the system is efficient is valuable.

A qualitative cross-sectional study was carried out where twenty interviews with various actors were conducted to gain insight into what needs must be met so that this system can be used. To have even broader perspectives, a questionnaire was sent out where 56 restaurant representatives participated. Furthermore, a pilot project was initiated to see how the material flow would look like between one restaurant and three stores. The data previously mentioned data was compared to literature which supported the argumentation in the analysis.

The findings show that to begin with, using the I type material flow structure is beneficial since that is the most simple one in terms of communication and transportation. Communication will play a key role in reducing the uncertainty in amount and type of food that restaurants will be able to receive. A third party logistics provider should be used to deliver the surplus food and delivery frequency should be at least two times per week for the actors that have sufficient storage space. Since most of the grocery stores and restaurants do have a limited storage area, deliveries four to five times per week would be better. Packaging from Svenska Retursystem are ideal and the restaurants should take care of the sorting process.

Keywords: surplus food, logistics activities, material flow characteristics

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Our supervisors, both at Chalmers Industriteknik as well as Chalmers University of Technology, deserve a great praise. Their experience, support and inspiration has been highly valuable. Kristina Liljestrand, Project Manager at Chalmers Industriteknik, helped us to set the scope of the research, provided a lot of the contact details and was always ready to help. Dan Anderson, professor at Chalmers, has provided a great assistance throughout the whole process regarding frameworks and outline of the report as well as the content of it.

Furthermore, we would like to thank the employees at Chalmers Industriteknik for extremely warm welcome and special thanks to the department of Circular Economy. Without all the data we got through interviews, questionnaire and pilot project this research could not have been performed so them we are also very thankful for.

We are grateful for the opportunity we were given to write a master thesis about such an interesting topic, at a great organization and with excellent supervisors.

Ína Björk Helgadóttir & Hafdís Jónsdóttir, Gothenburg, June 2019

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1

Introduction

This chapter provides an introduction to the master thesis and is initiated with a background to surplus food and food waste. The chapter also includes the purpose and research questions, limitation of the master thesis and the system description that will be used.

1.1 Background and Problem Description

Every year Swedish grocery stores throw 30,000 tonnes of food, although a large portion is still edible, so-called surplus food (Naturvårdsverket, 2018). The definition of surplus food is edible and reusable food but due to circumstances, such as lack of demand or aesthetic criteria, is rejected by producers and retailers (Facchini, Iacovidou, Gronow, & Voulvoulis, 2018). At every stage of the supply chain, surplus food is produced and can arise from a variety of sources such as farms, manufacturers, supermarkets and bakeries. The types of surplus food can therefore be diverse and can include agricultural crops, nonperishable processed foods, and perishable fresh or prepared foods. Surplus food can arise for different reasons, such as incorrect or damaged packaging, expiration date, size or shape, and small blemishes (Facchini et al., 2018). According to Mourad (2016), the most appropriate response to surplus food can be ranked as following: prevention where the food is reduced at the source; recovery such as redistributing food to people who need and/or want it; recycling where the food is used for feeding animals, energy or compost. Alexander and Smaje (2008), argue that the standard hierarchy for grocery stores, when disposing of surplus food, is as follows: First, the aim is to sell to customer and thereafter to sell to customer at reduced price. After that has been done and there is still surplus food left, the store uses it in the staff restaurant, if there is one in place. Selling to staff is thereafter and then they donate to charities for human consumption. Lastly, they donate to farms, zoos or other animal sanctuaries and if there is food left, it is disposed to landfill.

Surplus food can easily become waste if it is not used quickly (Facchini et al., 2018). There are many definitions for food waste. One such from Buzby, Farah-Wells, and Hyman (2014), states that food waste occurs when edible item goes unconsumed,

either because it gets discarded by retailers due to appearance or color or is thrown away by consumers. Bellemare, Çakir, Peterson, Novak, and Rudi (2017), define food waste as every product that is produced in the food system and ends up in landfill, i.e. food that is used for animal feed, fertilizer or biomass is not considered as waste. For this project the latter definition is used. There is a great potential for grocery stores to reduce the amount of food that is thrown away as a waste. A possible alternative is to make use of this surplus food by delivering it to restaurants that can make high quality meals out of it. At the same time it is important to look at this as an educational effort for consumers as there are possibilities to change the attitude towards food waste in Sweden by demonstrating that quality dishes can be cooked from the food that often gets thrown away at home. The reality is that this is not the most preferable situation for the environment since the best alternative would be to reduce the amount of produced food from the source, but making use of what exists and fight the waste is the main reason for using surplus food.

Chalmers Industriteknik, (CIT), is a consulting company specializing in innovation within circular economy, energy, material, digitalization and design industry. They have an ongoing development project, including eight project partners that can be seen in Appendix A, with the aim to develop strategies for restaurants who want to save surplus food. The project's idea roots back to when Paul Svensson, who is one of the project partners, managed a restaurant that was solely driven by surplus food from stores. Everything regarding the restaurant in itself functioned quite good except the logistics solutions. The way Paul Svensson and his colleagues did it was to drive between grocery stores and ask whether they had something they could offer that day. That was considered insufficient, since some days the stores had nothing to offer, leading to the reason for initiation of this project where the objective is to improve the logistics solution. Responsibilities are divided between the researchers of this paper, the project leader and other project members. Figure 1.1 shows an example of a material flow for a process where surplus food is being transported from a grocery store to a restaurant. At first, store employees pick the surplus food from the shelves and place it in a storage. The food gets transported to a restaurant where it is stored and later processed. The processing can e.g. be pickling, making jam or fermenting. The food is then stored again and later served to end consumers.

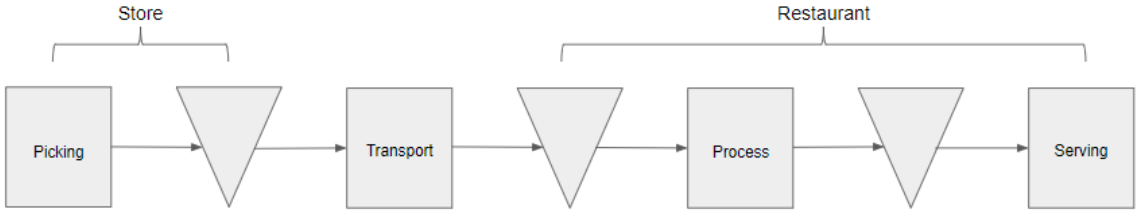

Figure 1.1: A simplified flow chart of the process

1.2 System Description

The system description can be seen in Figure 1.2. The dashed box represents the scope of the study, showing that not every activity within the store nor the restaurant will be analyzed. Examples of activities that will be excluded are the procurement decisions at the grocery stores and serving at the restaurants. The top arrow in the figure points in both directions since both supply and demand affect the balance of surplus food. The flow chart below represents the flow of surplus food and the activities that need to be in the system so that it can work. Regarding the material flow, the boxes represent activities in the system and the triangles represent the storage in between those activities. It is worth to mention that this material flow is only an example of how a system could look like since it can vary. The vertical dashed lines are showing that each actor is responsible for certain activities.

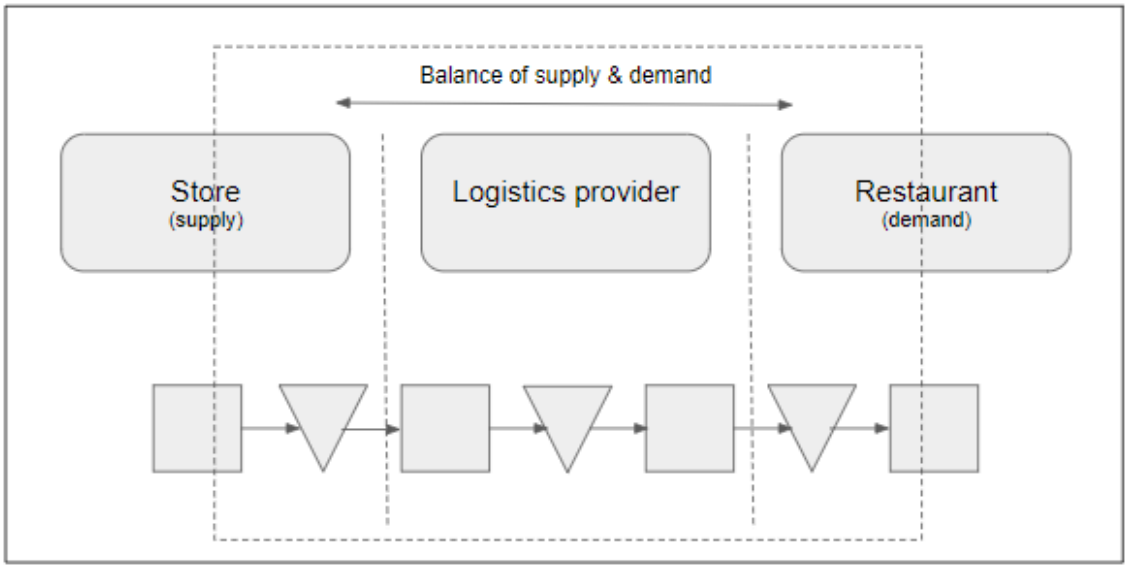

Figure 1.2: Overview of the system boundaries

1.3 Purpose and Research Questions

The purpose of this thesis is to find out what is needed to make the system, where surplus food is delivered from grocery stores to restaurants, more efficient. Here, an efficient system is when activities are performed in the best possible way with as little waste of time and effort as possible. This is important since actors in the system are less likely to use surplus food if it will require too much time and effort on both sides. A definition of an activity from the CSCMP (2013), is "work performed by people, equipment, technologies or facilities" (p. 4). In this study actors represent stores, restaurants, and logistics providers. To be able to achieve the purpose, characteristics and logistics activities need to be identified and analyzed. For the system to work in an efficient way there is a need for balanced material flow of

surplus food, in relation to supply and demand. Having a balanced material flow implies for a reduction in amount of surplus food going to waste, at the store and the restaurant.

Three research questions have been presented here below and to achieve the purpose of the study they need to be answered. Following is also an explanation on how each question came up.

In order to understand the system better and how the flow between grocery stores and restaurants can be balanced, it is valuable to identify certain characteristics that play a big role in balancing supply and demand. The first question aims to identify those characteristics:

- What characteristics are important to consider when efficiently balancing supply and demand of surplus food?

In order to be able to make the system more efficient, it is important to know which logistics activities take place within the system. The second question aims to identify the logistics activities and how they should be handled:

- What logistics activities are involved in the material flow and how should stores, logistics providers, and restaurants handle them in an efficient way?

The structure of the material flow can vary between every system depending on e.g. the supply from the stores, the demand from the restaurants, whether actors want to be in close collaboration, etc. The final question aims to investigate different advantages and disadvantages of different material flow structures:

- What are the advantages and disadvantages of different types of material flows structures that can be used in the system to balance supply and demand of surplus food?

1.4 Limitations

The focus in this paper will limit itself to only look at the current situation in grocery stores and how it is possible to make use of what would otherwise be considered as a waste. Cost estimation must be kept in mind since otherwise everything would be considered feasible, but this study does not include any cost calculations. Some boundaries were needed when choosing restaurants to interview resulting in restaurants that are, or are willing to be, sustainable were preferred and a decision was made to not include fast food restaurants in this project. It is also worth to mention that a restaurant in this sense can offer everything from having only catering service to a restaurant where the customers can sit down and eat. No limitations as such were made when it comes to selecting grocery stores. The reason for that is because in the beginning it was quite difficult to get a hold of representatives from grocery

stores, the ones that were willing to be interviewed and had time, were kindly accepted. When looking at different material flow structures to balance supply and demand of surplus food, advantages and disadvantages of having a hub between the grocery stores and restaurants was not looked into.

2

Literature Framework

The following section is divided into six different parts, each contributing to answer the research questions and provide the reader with information necessary to understand the report.

2.1 Food Supply Chain

Food supply chains are global networks that create a pathway from farms to consumers. Involved in this is production, processing, distribution and disposal of food (Yu & Nagurney, 2013). Relationships within a supply chain are constantly developing and changing. Operating in a food supply chain is complex, dynamic and time-critical environment. Meeting consumer needs, wants and even their desires is a challenge for the food supply chain to satisfy. To be able to do that, understanding what the consumers are buying, how they buy and the reason for the selection is essential to know. Product integrity is vital and it must be ensured that the food will be of a certain quality. Consumer needs, in terms of quality and time, are becoming more fragmented (Bourlakis & Weightman, n.d.).

The main difference between food supply chains and other product supply chains is the continuous change in the quality of food products throughout the entire supply chain until the point of final consumption (Yu & Nagurney, 2013). Manzni and Accorsi (2013), discuss three categories of issues; strategic, tactical, and operational. The strategic issues can be e.g. deciding the right site for manufacturing, tactical issues include determining the material flows within the system and operational issues are e.g. vehicle routing, delivery scheduling and material handling. These decisions must be handled and addressed quickly in the food supply chain since their consequences affect level of quality of products, costs, and level of sustainability and safety. This will have a direct and indirect impact on the safety, health, and well-being of consumers. Food quality is determined by time and environmental conditions. Factors such as way of loading, packaging, availability of temperature controlled packages, vehicles and warehouses can have affect on the environmental conditions (Manzni & Accorsi, 2013).

According to Bourlakis and Weightman (n.d.) the stage of the food supply chain

where interacting with final consumers and customers takes place is at the retailer's. The major issues for them relate then to communication with final consumers through the stores network and marketing initiatives such as branding. Compared to number of customers a retailer deals with, the customer base for wholesaler is much smaller where processors and manufacturers within the food chain are dominant followed by retailers, caterers and institutions at the end of the chain. For the food supply chain in this study it is at the restaurant's stage where interaction with final consumers and customers takes place as can be seen in 2.1

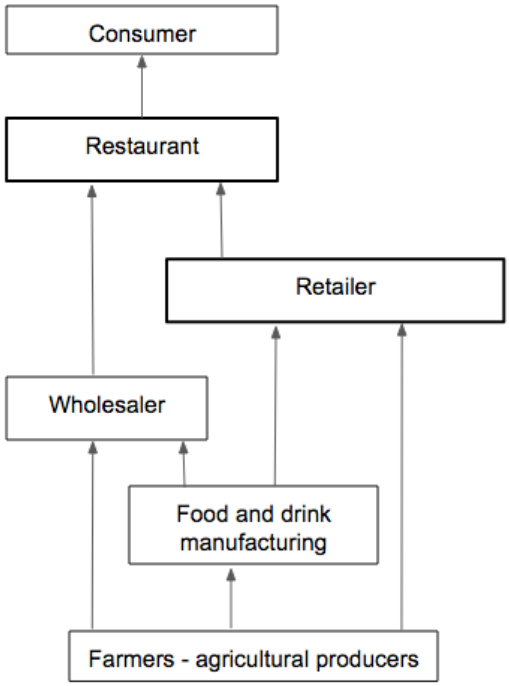

Figure 2.1: A model showing the food supply chain in this project. This is based on The UK Food Supply Chain by Bourlakis and Weightman (n.d.)

2.2 Food Waste and Surplus Food

In developing countries, food losses mainly occur in the early stages of the food supply chain. The reason behind that is poor harvesting technologies, poor storage, lack of transport and extreme climatic conditions. In developed countries, the consumption stage accounts for over 40% of the total food losses in the food supply chain (Papargyropoulou, Lozano, Steinberger, Wright, & Ujang, 2014) and estimated food wastage is as high as 280-300 kg per capita per year in Europe and North America (Garrone, Melacini, & Perego, 2014b). If Sweden is taken as an example, almost 50% is wasted during the consumption stage (Priefer, Jörissen, & Bräutigam, 2016). Papargyropoulou et al. (2014), state that it is essential to have a distinction between the terms 'food surplus' and 'food waste'. Often surplus food is incorrectly referred to as food waste. When food is produced beyond nutritional needs it be-

comes a surplus food, and waste is a product of surplus food. In all stages of the food supply chain, priority should be on preventing overproduction and oversupply of food beyond human nutritional needs. Garrone et al. (2014b) agree with this and discuss that in the effort to attain environmental goals, an important part is to reduce food waste, and that source reduction as well as recovery are strategies that should have high priority in the food waste hierarchy. In order to increase the likelihood of consumers buying food products that are close to its expiry date, retailers are recommended to reduce the price (Priefer et al., 2016). There is a distinction between avoidable and unavoidable food waste. Avoidable food waste is food that is thrown away because it is no longer wanted or has been allowed to go past its best. Unavoidable food waste waste is food that is not, and has not been, edible under normal circumstances such as meat bones, fruit skin and apple cores (Papargyropoulou et al., 2014).

Surplus food management policies affect the amount of food waste. As has been mentioned, surplus food can be used in food recovery or re-used as livestock feed, compost, biodiesel or other fuels and finally, there is a possibility of waste disposal. These alternatives are often compared in consideration to environmental terms. However, many believe that an emphasis should be put on creating a food recovery hierarchy that prioritizes food donations to the hungry. In that regard, not all surplus food will be economically recoverable. Supplying recovered food to potential recipients is often difficult due to food recovery efforts being limited by logistical and financial constraints. In addition to that, food safety must be maintained (Garrone et al., 2014b). Figure 2.2 shows how available food can either become consumed, surplus or scrap. Food availability is all food produced throughout the supply chain. Consumed food is edible food that is consumed by humans. Surplus food is food that has, for various reasons, not been sold to or consumed by the intended customer but is still edible. Food scrap is non-edible food and is no longer suitable for human consumption. Four surplus food management policies are then considered. Firstly, feeding humans e.g. by donating to food banks or sales through secondary market. Secondly, feeding animals. Thirdly, waste recovery, where the surplus food is provided to companies that produce goods such as fertilizers. Lastly, waste disposal where the surplus food is disposed of by methods such as burying it in landfills (Garrone et al., 2014b). This model is applicable to this study since the system of delivering surplus food from stores to restaurants is designed to feed humans surplus food through a secondary market.

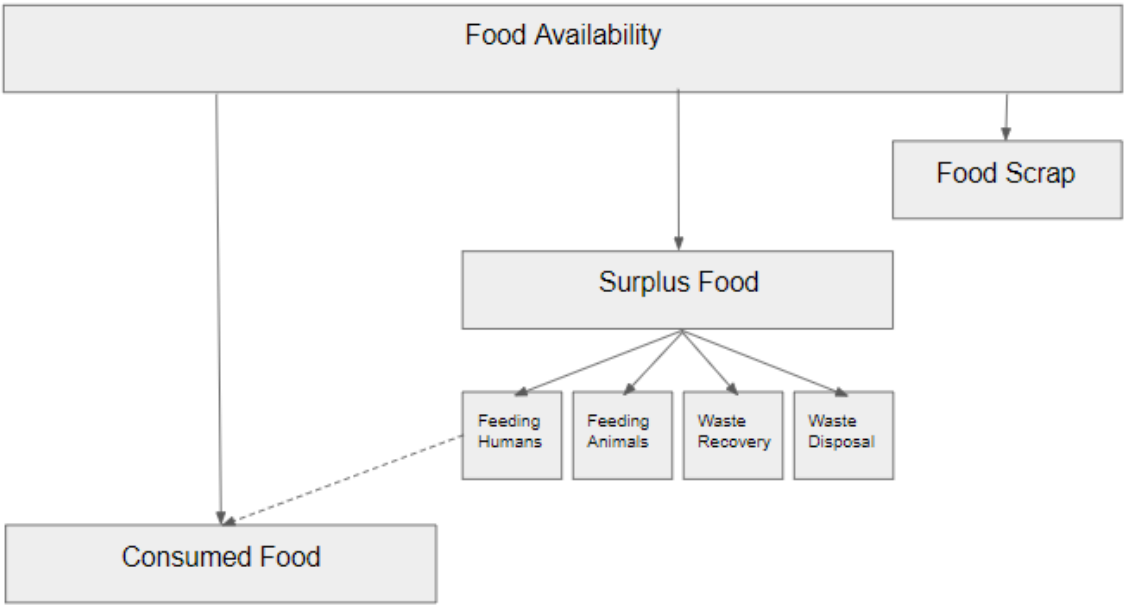

Figure 2.2: A model showing what becomes of food availability. This is based on The ASRW conceptual model from Garrone et al. (2014a)

2.3 Logistics Activities

Physical distribution of goods requires some logistics activities to be performed. Two frameworks have been looked at to identify logistics activities. Firstly, Lambert, Stock, and Ellram (1998), identified the following logistics activities: demand forecasting, customer service, inventory control, communications, order processing, material handling, plant and warehouse site selection, parts and service support, packaging, procurement, return goods handling, warehousing and storage, and traffic and transport. Secondly, Jonsson (2008), identified the following logistics activities: customer order management, production and materials management, forecasting, procurement, transport planning, materials handling and internal transport, storage, production, and freight transport. In this subsection these previously listed logistic activities will be discussed in more detail in order to be able to identify which activities relate to rescuing surplus food from stores and delivering to restaurants. Many of the activities in those two frameworks are similar, and since the framework from Lambert et al. (1998), is more comprehensive and includes more activities, a decision has been made to use those activities. Three activities are out of scope for this research and will therefore not be discussed in detail, those activities are; plant and warehouse site selection, parts and service support, and return goods handling.

2.3.1 Demand Forecasting

Planning is the process of making decisions about activities in the future. The activities that are planned affect material flows and manufacturing. To be able to

make decisions about the future, information and assessments are required about how the future operation can possibly be affected by external factors. Forecasts in a company may concern decision making on strategic, tactical and operative level. The tactical and operative forecasts relate to decisions regarding usage of resources, procurement, and decisions in terms of operative activities. Demand forecasts are assessments of company's products future demand. The size of demand plays a significant role, both for control of manufacturing and also for controlling the material flow. Companies are usually able to affect demand through marketing activities and pricing (Jonsson & Mattsson, 2009). There is always some degree of error in forecasts, those defects must be accepted but at the same time minimized. Jonsson and Mattsson (2009), list up common reasons for why a forecast may be of lower quality; the forecasting method is ineffective, the data used is misleading, expectations are unrealistic, acceptance levels are low, conflict of interest between different departments within the company, there is a lack of forecast responsibility and follow-up, and/or not enough combination of automatic forecasting and manual assessments.

If the demand uncertainty is high, it becomes more difficult to generate an accurate forecast (Jonsson & Mattsson, 2009). An essential concept in demand forecasting is time series. This concept is a collection of historic demand data which shows previous demand volumes. When working with time series as basis for forecasting, it is important to tell the difference between various demand patterns. Three common demand patterns that occur are random variation, trend and seasonal variation. Trend changes is when demand either increases or decreases period for period. Seasonal variation is when the demand varies with the time of year (Jonsson & Mattsson, 2009). Figure 2.3 shows an illustration of these three common demand patterns.

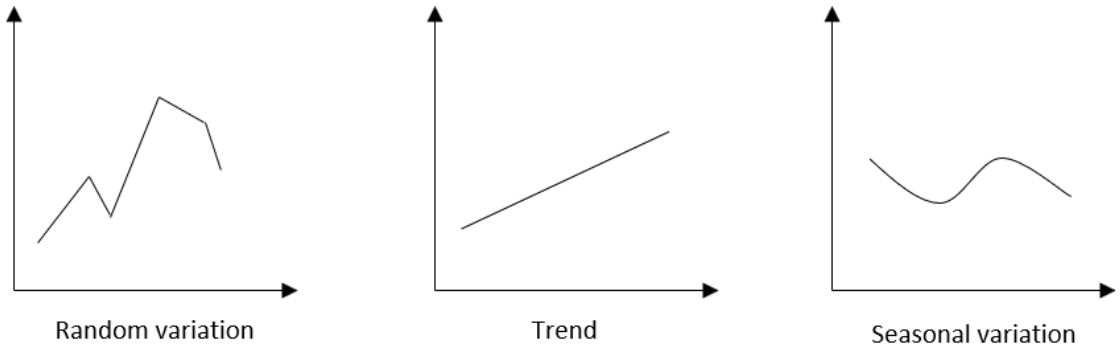

Figure 2.3: Three common demand patterns. The figure is based on the picture on page 109 in Jonsson and Mattsson (2009)

2.3.2 Customer Service

Lambert et al. (1998), describe customer service as the output of the logistics system. Having good customer services can increase customer satisfaction. Both Lambert et al. (1998), and Rushton, Croucher, and Baker (2016), discuss the seven 'rights' of customer service. Those are right product, quantity, place, condition, time, cost, and customer. All those aspects listed before can be seen as key requisites of good customer service offering. Customer service differentiation can give an organization a competitive advantage (Lambert et al., 1998). Rushton et al. (2016), state that it is vital for any organization to have a clear definition of customer service. Furthermore, there should be specific customer service measures. Customer service and the requirements from it can and will differ, both between industries and also between the market segments that a business might have. Every company that provides products and/or services to customers should have a customer service policy. Since there can be so many different customers, the company may want to segment their customers into different customer categories and have a distinct customer service policy for each category. The effects of poor customer service can lead to buyers switching to an alternative supplier.

There are many influences from logistics that are relevant to customer service, such as ease of ordering, delivery reliability, and stock availability. A balance must be achieved between the the level of service provided and the cost of it. Often the service offerings are unrealistic and carry a high cost, and it may be a service that is not required by the customer (Rushton et al., 2016). Elements in logistics customer service can be divided into the following three categories; before, during, and after delivery of the product. Customer service factors that happen before delivery include method of ordering and order size constraints. Factors that are during delivery are often concerned with distribution and logistics, such as delivery time and reliability. After delivery, the elements are e.g. invoicing procedures and returns policy (Rushton et al., 2016).

2.3.3 Inventory Control

Inventory management involves the trade off between the level of inventory held to satisfy customers and the cost of holding inventory (Lambert et al., 1998). Decisions regarding replenishment in the food supply chain is challenging, the reason for that is because of the limited shelf life which requires the products to move quickly from producer to the end consumer, thereby limiting the possibility of using buffer inventories. Other reasons for the difficulty in managing replenishment's is the increasing product variety and the non-stationary demand (Kiil, Dreyer, Hvolby, & Chabada, 2018). The performance of food supply chain is dependent on those replenishment decisions since it balances availability of food and the risk of food waste, meaning that if too much is ordered there is a risk of food being wasted and if too little is ordered, there is a risk of a stock out (Kiil, Dreyer, et al., 2018). Two replen-

ishment policies are mentioned by Kiil, Hvolby, Fraser, Dreyer, and Strandhagen (2018), as periodic and continuous review policies. They state that the continuous review policy requires less safety stock (SS) than periodic review policies, however, they require that the inventory level is continuously reviewed and there must be an ability to place an order at all times. In grocery retailing, the most common policy is the periodic review since stores have predefined days where they place and receive orders (Kiil, Hvolby, et al., 2018).

2.3.4 Communications

Communications are becoming more automated, rapid and complex. In logistics there are many functions and organizations that must communicate. To have an efficient functioning system, good communication is key. Communication can also be a key source of competitive advantage (Lambert et al., 1998). Zanjirani, Shabnam, and Kardar (2014) state that in a logistics system, the information flow is as important as the material flow, and that information is a key source in a logistics system. When the complexity of the logistics system increases, and more members become involved, the role of information flow becomes more important. Accurate and timely information facilitate logistical operations (Zanjirani et al., 2014).

Zanjirani et al. (2014) discuss two categories that information flow can be divided into. The first one is the information that connects directly to the physical material flow, such as order, replacement, and delivery information. This flow is necessary for production and other operations. The second category is the information that relates indirectly to the physical material flow. This flow is not necessary for daily operations such as processing information about customers' satisfaction (Zanjirani et al., 2014).

2.3.5 Order Processing

Usually the ordering process is kept as simple as possible due to the fact that the focus is primarily on selling products. Within the retail sector, a common sight is that the space for storage and material handling is limited leading to frequent delivery is required which is the reason why sophisticated ordering techniques have been developed. The ordering system is often directly coupled to the actors upstream in the supply chain by having an automatic as a trigger when the the inventory has been reduced to a certain level (van Weele, 2017). Lambert et al. (1998) describes order processing as the systems that a company uses to get orders from customers, looking at the status of orders, communicating to customers, and filling the order and making it available to the customer. It is a broad area and a key area of customer interface with the organization. It can therefore have a big influence on a customer's perception of service (Lambert et al., 1998).

2.3.6 Materials Handling

Materials handling is a broad area and includes all aspects of movement of raw material, work in process, or finished goods. Since moving materials costs but does not add any value to the product, the primary objective of materials management is to reduce handling as much as possible. That includes minimizing inventory levels, travel distance, bottlenecks, and loss due to waste (Lambert et al., 1998). Order picking is the process of retrieving items from their storage location. Most companies manually pick by having employees go around the storage area, but some have automated this activity. According to Jiang, Zhou, Zhang, Sun, and Hu (2018), the manual approach is more flexible than the automated one. An efficient approach for improving the efficiency of order picking is to use a method called order batching meaning that the orders are then grouped into batches for picking. This process however requires a sorting process afterwards since the items in a batch belong to different orders. If there are many items and orders in a batch, then the sorting process can become time consuming. Jiang et al. (2018) discuss two strategies for batch picking: pick-while-sort and pick-and-sort. The former strategy, i.e. pick-while-sort, is when the processes of picking and sorting are done simultaneously. This may slow down the pickers but it will eliminate the need for downstream sorting. In the latter strategy, i.e. pick-and-sort, the sorting process is done after the picking process. With this strategy, the pickers can move faster but it requires an individual sorting process (Jiang et al., 2018).

2.3.7 Packaging

Wood, Barone, Murphy, and Wardlow (2009), list up three purposes that are served by packaging: protecting the product, identifying the product, and aiding in handling. The protective function is both for protecting the product, during storage and transport, and also, in some cases, to keep the product from damaging items that are surrounding it. The packaging can make the handling a simpler task. Choice of packaging material is increasingly influenced by concern for the environment, meaning that packaging material made of recycled material have increasing demand.

2.3.8 Procurement

Procurement is the process of procuring supplies, materials, and services. Each purchase may appear different, however, there is a general purchasing process. First, the needs must be identified and the market analyzed so that potential suppliers can be identified. The process of identifying potential suppliers can be as simple as verifying contact information of the supplier or more complex such as asking for a preproposals and supplier meetings. This depends on the type of purchase and on the product, or the service that is being purchased. Thereafter, a request for quote (RFQ) is generated, negotiations and awarding a contract to a supplier (Taylor,

2007). After the contract has been awarded, the major responsibility of purchasing is to make sure that the correct quantity of the correct goods are being delivered to the right place. Finally evaluations of the purchase and supplier is done to avoid any future problems. If many transaction do not meet the standards that have been decided upon, purchasing may seek a new supplier (Taylor, 2007).

Companies have developed and are using an array of strategies to improve their performance when it comes to supply channels. Approaches can be e.g. being in a tight partnership with the suppliers, offering Just-in-Time (JIT) deliveries or having a sophisticated information system that allows for smoother transactions. Taylor (2007), discusses the two major sourcing strategy options, single sourcing and multiple sourcing. The former can be defined as the organization's needs for a particular item are fulfilled from one supplier. The latter is when the item is purchased from two or more suppliers. There are advantages and disadvantages to both approaches and they have been grouped into five categories: disruption of supply, price escalation, technology access, inventory and scheduling, and quality. The first category includes a risk that the supplier decides to terminate the sourcing relationship for whatever reason, and by doing so, cutting off the supply. The risk of price escalation is if the supplier tries to take advantage of being the only supplier and increasing the prices. These two aforementioned categories are the most commonly cited reasons for following multiple sourcing strategy instead of single sourcing strategy. The last category, quality, is the main drive for having a single sourcing strategy. It is likely that multiple sourcing strategy increases the administrative work at the buyer's side, makes it more difficult to involve suppliers in the business plan and increases fixed cost that is associated with purchasing. Which strategy is chosen depends on the industry, market and the specific purchasing situation (Taylor, 2007).

Deciding which supplier to work with is as important as deciding how many suppliers to work with. When choosing a supplier, the customer must analyze the trade-offs among the relevant criteria. There can be e.g. trade-offs in price, delivery reliability, and quality, where the supplier with the lowest price might not offer the best quality (Taylor, 2007). Dickson (1966) identified 23 different criteria that should be evaluated when selecting a supplier. The article put much emphasis on quality being important. Other criteria such as performance history, delivery, production facilities and capacity, warranties and claim policies, price, financial position, and technical capabilities were viewed as being of considerable importance in the selection process.

In some cases, the buyer-supplier relationship is made formal through a binding contract. In those contracts, the buyer and supplier may agree on picking, supply quantity, delivery lead times and a return policy (Taylor, 2007).

2.3.9 Warehousing and Storage

Warehouse activities include receiving, storing, picking, packing, and shipping operations (Jiang et al., 2018). Warehouses play a significant role in delivering the right product in the right quantity since that relies on warehouse picking and dispatching products accurately. Products must be labelled correctly and loaded onto the right vehicle so that it reaches to the right customer and within the delivery deadline. The products must also leave the warehouse clean and damage free. Warehouses can have many different roles and can be operated by raw materials suppliers, finished goods manufacturers, wholesalers, retailers and etc. Third-party logistics providers can also be subcontracted and operate the warehouse (Richards, 2014).

Warehouses can be used to fulfill different roles, to name a few there is raw materials storage that stores components and raw material close to the point of extraction, these materials must be in place to enable continuous production. Finished good storage where items are ready for sale are stored on behalf of wholesalers, manufacturers and retailers. This storage provides a safety stock or a buffer for companies, allowing them to build up stock e.g. for expected increases in demand, and also to deal with seasonality. Consolidation centres receive products from different sources and combine them for onward delivery to the customer. This type of centre differs from cross-dock centres since here the product can stay in the centre for a certain period of time. It is usual that consolidation centres are operated by third parties. Cross-docking centres have efficient consumer response and the goods are moved quickly through the supply chain. The deliveries into these centres must be labelled and ready for onward delivery since the items should only be in the warehouse for as short time as possible, preferably less than a day. Items are consolidated with other deliveries (Richards, 2014).

2.3.10 Traffic and Transport

The role of transportation in a logistics system is more complex than carrying goods between places. A well handled transport system satisfies the customers' demand by sending goods to the right place at the right time. It builds a bridge between consumers and producers and brings efficacy. In logistics activities, a good transport system brings benefits to both the service quality and also to the company competitiveness (Tsend, Yue, & Taylor, 2005). As Morash and Clinton (1997), discuss, firms compete on the basis of time, cost, and/or service, and transportation can play a big role in the structures of the supply chain. Transportation is in a position where it can integrate and coordinate flows throughout the chain. Transportation time can be reduced with operational coordination and information sharing, thereby reducing total supply chain costs. Faster transit time minimizes the need of inventory and may allow customers to have lower safety stocks. If the time compression leads to more frequent deliveries, then cycle stocks can be lower (Morash & Clinton, 1997). Cycle stock is the amount of inventory available for the normal demand during a

certain period, excluding safety stock and excess stock (Jonsson & Mattsson, 2009). Speed may however not be of a value to the customer, it all depends on the product. Just-in-time (JIT) deliveries could therefore be important (Morash & Clinton, 1997). Transportation involves selection of the transportation mode, e.g. truck, water, rail, or air, the routing of the shipment, selection of the carrier, and assuring a compliance with regulations (Lambert et al., 1998).

Reliability is often seen as more important than speed, meaning that the delivery times are consistent and that the shipment does not get lost or damaged. Standardizing transportation is an important capability since it makes the supply chain flow and activities more predictable. By having standardization, other processes and personnel can be more efficient in terms of less labor costs, equipment, risk, time, and other resources. Transportation that is unsynchronized can create confusion, congestion and poor production sequencing at the customer's receiving station. This can lead to inefficient production, overtime, extra labor, loss and damage. Therefore, early shipments may have worse consequences than late deliveries (Morash & Clinton, 1997).

2.4 Uncertainty in Supply and Demand of Surplus Food

Christopher (2011), claims that the goal of supply chain management is a simple one, to match supply and demand, but in reality it becomes difficult because of uncertainty. Furthermore, a fundamental problem is the fact that the time it takes to deliver a product to a customer is longer than the time the customer is prepared to wait for it (Christopher, 2011). In the food industry, timely deliveries are important, especially when it comes to surplus food that is reaching its best before date. Customer's order cycle is the length of time that the customer is prepared to wait, from placing an order to receiving the goods. This can, in some cases, be measured in months and in others it is measured in hours. There are ways to bridge the gap, such as carrying inventory (Christopher, 2011), however, the relationship between the supplier and customer will have a big influence on what actors are willing to do to satisfy each others needs.

Market problems, in terms of when, where and in relation to what product, are often uncertain which leads to there being uncertainty in what surplus will be available. This can be problematic and cause instability for food receivers. Furthermore, gathering together enough food and variety of food to distribute can be difficult (Midgley, 2014). In order to maximize utility for receivers, the surplus food needs to be donated early in the supply chain, this may conflict with logistical arrangements. Furthermore, a conflict can arise for retailers since they seek to extract as high profit as possible from commodities and through donations want to avert disposal costs. These aims can work against each other if donation is delayed for too long (Alexander & Smaje, 2008).

Fisher (1997), divides products into two categories, primarily functional products and innovative products. The former type, i.e. functional products, have stable and predictable demand and long life cycles. Furthermore the level of competition is high which results in low profit margins. For those supply chains, the focus should be on efficiency to minimize physical costs. The latter type, i.e. innovative products, have unpredictable demand, short life cycles and higher profit margins. The level of product variety is also usually higher. These supply chains should focus on responsiveness to minimize market mediation costs, which is a cost that will arise when variety of products does not match what consumers want, resulting in lost sales opportunities. According to van der Vorst, van Dijk, and Beulens (2001), many food products can be characterized as functional products with unpredictable and volatile demand. The demand uncertainty has grown while flexibility in production is still rigid.

2.5 Physical Distribution of Surplus Food

According to Garrone, Melacini, and Perego (2014a), well developed logistics capabilities are important to have in place when handling the material of surplus food. Organizing the collection and distribution trips as well as the frequency of it is necessary. However, Willersdorf (1990), mention that in the food supply chain, the frequency of deliveries is not necessarily the most important attribute, but rather a high delivery reliability. Nair, Rashidi, and Dixit (2017), state that to be able to effectively plan and manage distribution trips as well as allocating different categories of food equitably among receivers, the pattern and availability of the food needs to be understood. The sequence of visits to food providers should be determined based on their location, the quantity of food rescued, and the demand of the receiver. The frequency for receivers during a week is dependent on the average daily availability of different categories of food. A big reason for wastage and unbalanced distribution is that the amount and category of food donated is unknown. The authors explain that it is important to understand how uncertainty issues affect the logistics of surplus food rescue operations. Uncertainty in supply can lead to higher operating costs, re-routing, wastage of rescued food and unfair allocation of food. According to the authors, it is crucial to understand the pattern and availability of donated food to be able to effectively plan and manage routes, and allocate different categories of food among different receivers. Estimates of average daily availability of different food categories would enable decision makers to understand overruns, when supply is greater than required, and underruns, when supply is less than required. By knowing this, organizations could design an effective schedule with frequency of visits that matches the supply and demand and minimizes risk (Nair et al., 2017).

Direct distribution between stores and restaurants shortens the transport distance and thereby reduces the risk of spoiled food products (Priefer et al., 2016). Jonsson and Mattsson (2009), distinguish between so-called V, A, X and I types of material flow. Relationship between stores and restaurants can be applied to these different

types of flows as Figure 2.4 shows. The circles represent suppliers, and receivers are represented by squares. The V type is characterized by divergent material flow, which in this case means that one store is supplying multiple restaurants. This can be due to large amount of supply and small demand from restaurants. A and X types are examples of converging material flows, for the A type, multiple stores are supplying one restaurant, this can be when the demand from a restaurant is bigger than the supply from one store. The X type is when multiple stores supply multiple restaurants. The I type is a direct relationship between one store and one restaurant.

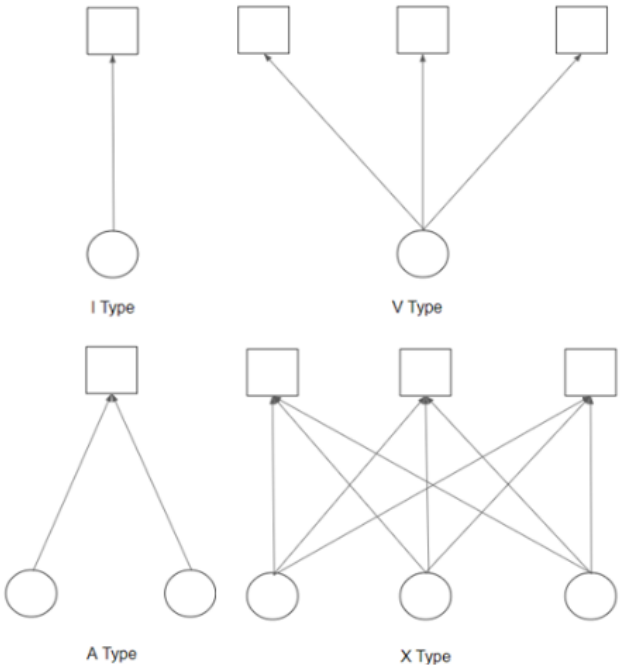

Figure 2.4: Different types of material flows. The figure is based on the picture on page 27 in Jonsson and Mattsson (2009)

Distribution centres and grocery stores have different characteristics and capabilities when it comes to handling surplus food. Distribution centres are usually capable of handling complex processes, while grocery stores have its focus on providing good customer service and often have limited logistics capacity in terms of transportation and storage. The main source of surplus food in distribution centres are product returns from stores, non-compliance of packages or the internal sell-by date has been reached. For stores, the main source is damaged packaging and the reaching of sell-by date. When it comes to recoverability of surplus food, distribution centres are very capable since most of the food consists of packaged products that have shelf life remaining and are ready for consumption. Furthermore, when the food has been identified, it only needs to be stored and can be picked up by the receiver in large quantities. Stores have challenges because the space for storing surplus food is often very small and the receiver must make frequent pick ups because of the short shelf life of the food (Garrone et al., 2014b). Handling and distribution of perishable food is always of concern when it comes to food safety. When transporting the food, access to refrigerated vehicles is sometimes limited and existing resources must be

used efficiently. There is a need to identify suitable approaches for collecting and delivering food if an organization has a limited fleet of vehicles. Furthermore, other challenges include diverse delivery and collection network, and the characteristics of the surplus food influence the collection and delivery strategy (Davis, Sengul, Ivy, Brock, & Miles, 2014).

Morganti and Gonzalez-Feliu (2015), list three factors on why most city logistics projects do not deal with logistics of fresh products. Firstly, there are constraints in food logistics that do not apply in non-food supply chains. This is especially the case with goods that require cold chain technology but other constraints are e.g. short lead times, regulatory issues in terms of temperature requirements and specific handling procedures. Secondly, the operational cost of delivery services often increases because of the constraints listed above and therefore, the economic viability is limited. Lastly, the number of suppliers and receivers affects the feasibility of coordinating urban transport operations directly. The authors point out that the distribution of goods in urban areas is not organized efficiently which results in negative impacts in regards to CO2 emissions, congestion and noise and air pollution.

2.6 Time Sensitivity of Surplus Food

It is important to consider time in the discussion about food waste because of its material nature, i.e. it decomposes with time and thereby becomes inedible and eventually waste. The properties of food change within a relatively short amount of time and for that reason, the time dimension is crucial to the transition of food into food waste (Papargyropoulou et al., 2014). Handling of the food products depends on the food's perishability and agreements between the involved actors. Storing the food in a warehouse where it might be sorted, packed and sometimes processed before delivering to specific delivery points might be one solution. However, collection and delivery of perishable food might need to take place the same day (Nair et al., 2017). That is due to the reason that highly perishable food products have short lead time and must therefore be distributed quickly which is in contrast to food products with a longer shelf life that can be stored and distributed later on (Davis et al., 2014).

Date marking on food products has been practiced in countries around the world for decades. It gives a guide on the shelf life of a food, and is based on either health and safety considerations or quality properties of the food (Newsome et al., 2014). Considerable confusion has been shown to be among consumers regarding the expiry dates and the difference between a best-before date and use-by date. Both terms have been connected with spoilage and non consumability of the food products (Priefer et al., 2016). A best-before date means the last day the food can be expected to maintain all of its quality properties, such as colour, taste, flavour and freshness, provided it has been stored in accordance to specified storage conditions and the package has not been open (Newsome et al., 2014). This date is not set by law and does not refer to food safety, rather it is usually based on manufacturer's

laboratory studies (Priefer et al., 2016). The quality of a food that has passed its best-before day might have reduced but it could still be perfectly edible. The last safe date to eat a food, given that the package is not open and it has been stored in accordance to specified storage conditions, is called a use-by date and due to safety and healthy reason it should not be eaten after this date (Newsome et al., 2014).

To maintain food quality, nutrient content and control of bacterial growth, correct temperature control is vital. There is a need for storing various types of food differently depending on the their features including dry foods, dairy products, frozen foods, produce, and fresh meats. Storage areas for these items have requirements that must be built into the storage space in order to handle the specific types of supplies (Bell, 2018).

Food products are time sensitive in various aspects such as they require timely delivery, otherwise there can be spoilage and economic losses, and they are temperature sensitive and can therefore not be in improper conditions for long time. Food preservation options are available in order to extend shelf life of food products (Smith & Stratton, 2007). These methods are vital for safety and for maintaining the quality attributes that customers find appealing. By using preservation, a change is done to the nature of a product that limits the growth of microorganisms or reduces the microbial load (Mustapha & Lee, 2017). For effective preservation one should use clean and high quality ingredients. The method used is dependent on the product, the process facility in terms of space, equipment, hygiene, and power, and its effect on product safety. Preservation methods can be e.g. canning, pickling, drying and smoking. Shelf life extension is achieved by changing the product packaging and/or storage conditions to inhibit microbial growth. Common methods of shelf life extension include chilling which can only extend the shelf life by a few days. This method is often used in conjunction with other methods. Freezing can in some cases extend the shelf life by years and can be a simple process to implement (Smith & Stratton, 2007).

3

Methodology

This section is divided into seven subsections, starting with a description of the research strategy and design. That is then followed by an explanation on the data collection through the process, namely the literature study, interviews, questionnaire and a pilot project that was conducted. Lastly, there will be a discussion on ethical consideration and trustworthiness of the paper.

3.1 Research Strategy and Design

The purpose of this thesis is to find out what is needed to make the system, where surplus food is delivered from grocery stores to restaurants, more efficient. To be able to achieve this purpose three research questions were introduced that need to be answered. The research questions will enable identification of characteristics, logistics activities, and advantages and disadvantages of material flow structures. In order to answer those questions, an appropriate research design must be followed. Bryman and Bell (2011), discuss five different research designs which will be briefly described. Experimental design is where a true field experiment takes place in the research which tends to give very strong internal validity. Cross-sectional design includes more than one case where researchers are interested in variation and data is collected simultaneously. Longitudinal design is usually used to map change in business and often requires much time and cost. Pilot project entails an intensive and detailed analysis of one case. Comparative design is when identical methods are used on two or more cases that have a contrast.

To achieve this purpose a cross-sectional research design will be used. The collection of data will be through combination of interviews and questionnaires with multiple actors, as well as a pilot project. This study may not necessarily entail much variation but there will be some differences in answers between all the different actors. Bryman and Bell (2011), mention that cross-sectional design is more often discussed in the context of quantitative approach, which is a research strategy that puts emphasis on quantification in the collection of data. However, qualitative research often entails a form of cross-sectional design and that is when the researcher uses unstructured or semi-structured interviewing with a number of people. Qualitative

research focuses more on words in the collection of data while the quantitative research emphasizes on numbers, as the name implies (Bryman & Bell, 2011). The data collection for this research consisted mainly of qualitative data from interviews and a pilot project with a support from quantitative data from a questionnaire that was sent out.

According to Bryman and Bell (2011), the relationship between theory and research is possible to approach in two ways, namely deductive or inductive. The deductive approach is when theory guides research meaning that theory will lead to some findings or observations and the inductive approach is when the output from findings or observations is theory. However, it is possible to combine these two approaches into one which is what has been done in this study. This study followed a strategy that is iterative, meaning going back and forth between data and theory (Bryman & Bell, 2011). Findings from this iterative strategy have been collected and are presented in an analysis chapter, meaning that analysis starts when some of the data has been collected and the implications of that analysis shape the next steps in the data collection process. Repetitive interplay is then between the collection of data and analysis of it (Bryman & Bell, 2011). Each research question will be answered separately in the analysis and then the purpose of the thesis, what is needed to make the system more efficient, will be discussed.

3.2 Literature Study

Bryman and Bell (2011), emphasize the importance of a literature study, stating that it provides a basis for the research, informs how data should be collected and enables an informed analysis of the data. Furthermore, the authors discuss two types of literature study; systematic review and narrative review. These types of reviews can be contrasting, where the former type is more likely to generate comprehensive and unbiased accounts of the literature while the latter type is more for gaining an initial impression and generating an understanding rather than accumulating knowledge. Narrative review therefore has a wider scope than systematic reviews (Bryman & Bell, 2011). For this research the narrative review will be used as it is better fitted with a qualitative research (Bryman & Bell, 2011).

A literature study was conducted to identify what is already known in the area of surplus food, logistics activities, supply chain design and physical distribution. As accepted and published articles are reliable sources, books can be both published through established publishers as well as self-published meaning that anyone can write a book and publish it. The literature study for this research consisted of peer reviewed, reliable and quality sources such as scientific articles, books, and ebooks from Chalmers University of Technology library and Google Scholar. Some of the books used for the literature study have been used as teaching material for courses in the Supply Chain Management program. Search words include: surplus food, balancing supply and demand, logistics activities, material flow characteristics, food

supply chain, efficient material flow.

Regarding these areas of literature, there is a great amount of information available. To facilitate this amount, the selection of literature is based on relevance to the scope of this thesis and the industry that is being investigated.

3.3 Interviews

Data collection in form of interviews has been performed to a large extent in this study, data used in this research was among other things obtained from interviewing restaurants, stores and current initiatives. This section will present how the sampling was done for the interviews and how they have been conducted.

3.3.1 Purposeful Interview Sampling

The sampling method chosen is purposeful interview sampling where the participants are sought after based on pre-selected criteria. Bryman and Bell (2011), recommend selecting respondents in a non-random way so that the interviewees have relevance to the thesis purpose. For this project, the sampling was divided into three segments; current initiatives, grocery stores, and restaurants. The process of selecting companies to interview started with identifying current surplus food initiatives, both in Sweden but also in other European countries. The sampling of current initiatives was made based on their knowledge and experience of receiving and serving surplus food.

Both the project leader at CIT as well as the project partners, seen in Appendix A, had some contact information which were used as well as few of them were gotten at a workshop that was held for restaurants and producers, which the authors of this report participated in. However, for most of them the contact information were found on the organizational websites.

Subsequently, restaurants and stores who were thought to be interested in the project were contacted, by e-mail or telephone, and proposed to participate in an interview. Since they were asked to give up their valuable time, the project was explained briefly to give an insight into how their contribution would be useful. Bryman and Bell (2011), mention that this is of particular significance. For grocery stores, selection on who to interview was made by representatives from the stores, regardless of location. The restaurants interviewed were chosen based on a few factors such as them having a focus on sustainability and working with either local suppliers, being organic or serving healthy food. The reason for that is because they were perceived on being more likely to be interested in this concept and therefore be more willing to provide necessary information on how this system can work. The transport providers were chosen since they have different capabilities. One of them having global operations

and few hundred thousand employees and the other only operating in Gothenburg with few employees.

3.3.2 Conducting Interviews

The response rate from possible interviewees that were contacted was moderate at first, where approximately 18 answered or about 60%, which prompted the researchers to follow up with another email or a phone call. The respondents were always given a chance to suggest a time that was suitable for them and according to Bryman and Bell (2011), that should be made clear in the process of conducting an interview that finding a time to suit the respondent is important. Thirty actors were contacted and in total twenty interviews were conducted. Moreover, seven interviews were conducted with current initiatives, five with potential restaurants, six with grocery stores, and two with transport providers. Four initiatives in other European countries were contacted, namely Denmark, Italy, Poland and United Kingdom, and they either responded to the e-mail they were sent by announcing that they were not interested taking part in an interview or did not respond at all. In the beginning of each interview, the project was introduced again for the respondents, on a more detailed level as well as they were asked for a permission to audio record, with unanimous approval. The recordings were treated as confidential and were not shared around, only transcribed for analysis of data.

The interviews followed a semi-structured approach, meaning that the interviewers prepared a list of open ended questions. The questions covered quite broad spectrum which led to that they were not only applicable for this research but for the project in general. Some questions were more general to gain insight into the company, but others more detailed so that necessary information was gathered to be able to answer the research questions. Having a list of open ended questions results in flexibility and enables the interviewers to respond to the direction in which interviewees take the interview. Furthermore, allowing for adjustment to the emphasis in the research and freedom which can give insight into what the interviewee sees as important (Bryman & Bell, 2011). Three interview guides were constructed; one for current initiatives, one for restaurants and one for grocery stores. These interview guides can be seen in Appendix B, C and D respectively. When interviewing two of the transport providers, a list of questions was not made in beforehand, rather questions were asked spontaneously after viewing the companies websites. This was due to them being scheduled by the project leader and being performed with a short notice.

Interviews have been conducted through physical meetings where possible, preferably at the interviewees location. This approach was chosen since it allows for more engagement with interviewees and in some cases it allowed the interviewers to see the facilities. However, due to long distances apart, in some cases, few of them were handled via Skype or through phone calls. According to Bryman and Bell (2011), in-person interview can be much longer than telephone interview which is considered to be not sustainable beyond 20-25 minutes and that is exactly what

the interviewers have experienced in this project. By having an in-person interview the discussions sometimes tend to be deeper and broader as well as there is more engagement among the involved ones (Bryman & Bell, 2011). Regardless of whether it was a personal interview or a telephone interview, the interviewers were aware of not feeding the respondents with answers or affect the way they chose to answer rather letting them reply in a way they felt was right without anybody being deemed. According to Bryman and Bell (2011), the likelihood of respondents' answers being affected by the interviewees are more for face to face interviews rather than telephone interviews. All the interviews were held in English, except for three which were in Swedish due to language barriers among interviewees. Even though the authors do understand a lot in Swedish, the interviews that were held in Swedish were conducted with other project members who are fluent in Swedish so that there would be no misunderstanding nor no information would be missing. At beginning of every interview, the interviewees were asked for a permission of recording it. This was decided since the interviewers wanted to focus more on listening carefully rather than taking notes. This allows the interviewers to show more interest, come up with follow-up questions and make it feel more as a conversation (Bryman & Bell, 2011). Each interview lasted for approximately half an hour, and was recorded and later transcribed.

3.4 Questionnaire

A link to an online web questionnaire, made by the leader of the project, was sent out by Menigo to large group of their customers working in the restaurant business and Martin & Servera published it on their web page. The questionnaire can be seen in Appendix E. How many people the questionnaire reached to is unknown, which can be considered as a drawback of applying this method. The reason for this is that since the questionnaire was available online for prospective respondents on one of the wholesaler's webpage it was not possible to keep track of the total amount of actors that were able to reach the questionnaire. However the number of actors that responded to the survey was in total 56 actors. The aim of the questions asked was to get a better understanding of what is needed for the restaurants so that they would be willing to work with surplus food. Questions were e.g. in terms of importance of certain factors when deciding if they would want to receive surplus food and interest in certain product groups. The data from the questionnaires was used in this report, in addition to the interviews that were conducted and the pilot project, to get broader perspectives on the topic about rescuing surplus food from people working in diverse businesses. The restaurants that participated in the questionnaire were all kept anonymous in this report. An advantage of using web questionnaire is that it is possible to reach out to a large group of actors (Bryman & Bell, 2011).

3.5 Pilot Project on Rescuing Surplus Food from Store

During the interviews a question was brought up whether the actors would be willing to join a pilot project where it would be tried out to rescue surplus food from a store. The purpose of the pilot project was to see if and how this concept would work out between store and restaurant. This is supported by Bryman and Bell (2011), mentioning that complexity and particular nature of the case is of a concern when doing a pilot project research, focusing on a specified bounded system. In continuation of the interviews, a small scale pilot project was performed over eight weeks where three stores, namely Coop Väst which is a project partner in this project, provided a restaurant, called Nordish Market, with surplus food. The process between them is so that the store welcomes representatives from the restaurant to come by and collect surplus fruits and vegetables, as only fruits and vegetables consists in this pilot project. As for now the collaboration will start out by having three stores (Coop Avenyn, Coop Friggagatan and Coop Landala) that are located rather close to Nordish Market, i.e. they are all located in the city center of Gothenburg. The collection is done by electric bicycles, owned by Nordish Market, and the time of this pilot project spans from the 23rd of April 2019 until 21st of June 2019. Even though the pilot project will exceed the time of this study, it was considered relevant since valuable information was gathered from the participants. Preliminary findings will be used in the analysis.

3.6 Ethical Considerations

The nature of ethical principles was taken into consideration for the research. What is written in the report or occurred through the process of it should neither adversely affect the authors nor the companies and their employees, so dignity and rights of the participants will be guaranteed. (Bryman & Bell, 2011), list up four main ethical areas that are harm to participant, lack of informed consent, invasion of privacy and deception. These ethical areas have been considered in the process of writing this report. Everyone interviewed was informed about their involvement in the project. Discussions took place regarding whether individuals and companies consider the necessity of remaining anonymous in the report due to handling of e.g. sensitive data. A decision was made to publish the company names, however, the position and name of the person interviewed will not be published so that it is not possible to trace individual answers back. Furthermore, everyone received an introduction on the project and what would be discussed during the interview so that there would be no surprises during the interview. Every interviewee was asked for consent for recording the interviews and told that the researchers would be the only ones with access to the recordings.

3.7 Trustworthiness

In order to ensure reliability of the paper some considerations have been taken into account to increase the trustworthiness of it. Trustworthiness can be made up of the following four criterias; credibility, transferability, dependability, and confirmability (Bryman & Bell, 2011). Authors and websites were analyzed to see if they are considered as reliable sources. To further support the writings, triangulation of data sources was used in this study, where sources have been compared by using more than only one. Regarding the interviews, both authors of this paper were present and the interviews were recorded. Only the interviewer have access to the recording for the purpose of analyzing the data.

As argued by Bryman and Bell (2011), a single pilot project is not a sample of an ideal situation for all studies so it can not necessarily be applied to other cases nor represent a certain class of objects. Every case is unique in its sense. Therefore, when working with different restaurants and grocery stores, adjustments will always need to be done depending on for example preferences from the actors and everything they are dealing with.

4

Empirical Data

The empirical research will present the findings from the interviews that were conducted with actors classified as current initiatives that already work with surplus food, restaurants that are willing to work with surplus food, grocery stores supplying the surplus food and transport providers that are able to transport the food from the grocery stores to the restaurants. This chapter also includes a discussion about a questionnaire that was sent out to restaurants as well as data received from the pilot project that was performed between a restaurant and grocery stores.

4.1 Company Descriptions

This section will include a brief description of the companies that have been interviewed. The section is divided into four parts, first is an introduction of companies that are already working with surplus food, followed by restaurants that do not work with surplus food but are interested in doing so, then grocery stores and lastly transport providers.

4.1.1 Current Initiatives

Different actors that have experience in working with and receiving surplus food from stores or wholesalers will be discussed in the following paragraphs. The current initiatives can be categorized into restaurants, school kitchen, and charities. All respondents provided insightful information on how they handle the logistics activities, what needs must be met so that they are able to work with surplus food, and their view in general on surplus food and food waste.

Backaskolan

Backaskolan is a school located in Härryda municipality and the lunch that is served is mainly cooked from surplus food. They have three suppliers, one for fish, one for meat and one for fruits, vegetables, flour, rice, and other ordinaries. There are approximately two hundred students from the age of six to eight.

Gotthards Krog

Gotthards Krog is a restaurant located in Umeå that serves breakfast, lunch, and dinner. Since middle of August 2018 they have been serving surplus food which they receive from one supplier. The menu is planned two to three days in advance depending on what food they receive.

K märkt

K märkt is a restaurant located in Stockholm. They operate at six different locations and two of their restaurants serve surplus food. One of them is a lunch restaurants, located in Garnisonen, and the other is located in an office building and serves breakfast and lunch to the employees. They have many suppliers of surplus food and the menu is decided the same day when the chefs see what food they will have for the day. To reduce food waste at their own restaurant, have a system where customers pay for the weight of the food.

Liseberg

The staff's restaurant at Liseberg amusement park serves surplus food and has been doing so since 2016. The number of suppliers differs for them from time to time. In addition to having their own storage they share a central storage with the other restaurants in the park. A part of the menu is decided beforehand but some of it depends on what surplus food they receive from their suppliers.

Restaurang Spill

Restaurang Spill is a restaurant located in Malmö and they serve lunch that is made from surplus food, they also offer takeaway and catering. They have been serving surplus food since end of May 2018. They have between five to ten suppliers that are wholesalers. Their menu is decided day by day depending on the food they receive.

Smyrnakyrkan

Smyrnakyrkan is a church located in Gothenburg and they operate a food store called Manna. In this store, people in need can collect food bags. The surplus food comes from two different sources, Allwin that provide fresh food with short dates from grocery stores and in addition to that, volunteers from the church go to eight different companies and collect food from them. To compliment this, there are givers in the church that donate items that they seldom get from the other suppliers.

Stockholm Stadsmission

Stockholm Stadsmission is a charity organization which operates a social store. The store is located in two places in Stockholm, one in the north and one in the south. Everyone is welcome to shop there but this is mainly intended for members that have low income. They are in collaboration with approximately forty companies, both stores and wholesalers, that provide them with surplus food.

4.1.2 Restaurants

In this section, the restaurants that are currently not serving surplus food will be described. The restaurants have some different focus areas, e.g. one operates a digital food court, some offer catering service, while others serve lunch and/or dinner.

Happy M Kitchen

Happy M Kitchen is a restaurant located in Gothenburg. The restaurant is ecological and puts much emphasis on sustainability. They offer buffet, café, catering, food- and juice boxes as well as cooking classes.

Liseberg Wärdshus

Liseberg Wärdshus is a restaurant located in the amusement park Liseberg in Gothenburg. They serve both lunch and dinner and the finest ingredients of the seasons are used as much as possible. Furthermore, organic and locally produced ingredients are used as a base.

Nordish Market

Nordish Market is a digital food court with a kitchen located in Trädgård'n in Gothenburg. They deliver food to offices in central Gothenburg with electric bicycles. The raw material is organic from local suppliers. They are currently a part of a pilot project for this study.

OOTO

OOTO is a restaurant located at Johanneberg Science Park in Gothenburg. The restaurant serves lunch based on locally produced and fair trade organic products. They put a lot of focus on vegetarian food.

Spira Food

Spira Food is a catering company located in Gothenburg. Lunch dishes for companies along with all kind of catering is their main focus. In addition to that they also cook for special events as well as they have a food truck. They put much focus on sustainability, both in terms of where they buy their products from as well as using ecological labelled packaging.

4.1.3 Grocery Stores

This section includes a description of the grocery stores that were interviewed. Stores from two large retail chains were interviewed.

Coop

Coop stores are approximately 650 in Sweden. One store, Coop Landala, was interviewed which is approximately 900 m^2. This store is part of the Coop Konsum chain which provides affordable goods and fresh produce of the highest quality. These stores also have the widest range of organic alternatives.

Ica

Ica stores are approximately 1,300 in Sweden. Five stores were interviewed, Ica supermarket Majorna, Ica Supermarket Tierp, Ica Maxi Visby, Ica Maxi Mölndal and Ica Nära Bärkehallen. The first two stores are a part of the Ica Supermarket chain, these stores are located in many areas and offer a good and exciting product range. The third and fourth stores are a part of the Ica Maxi chain where the aim is to simplify everyday life by collecting everything under one roof. The last store is a part of the Ica Nära chain which includes personal stores that can be found all over the country. These stores are rather small and therefore easy to navigate.

4.1.4 Transport Providers

Two transport providers offering completely different transport solutions were interviewed. Those actors are discussed in the following text.

DHL

A global and leading logistic company located, among other places, in Gothenburg. They have a warehouse where the food products can be stored, for a short period of time, before being distributed further. However, they are also capable of distributing directly from stores to restaurants.

Pling Transport

Biking with goods around the city are Pling's specialities. They have four bicycles in total, three of them are armadillos and one is eco-ride with a trailer. The aforementioned are able to take up to 1 m^3 and 100 kg whereas the latter one can handle up 2 m^3 and 200 kg. The area they operate within in Gothenburg is divided into two zones where customers are charged depending on the distance from the central city.

4.2 Grocery Stores Perception of Surplus Food

This section will include data gathered from interviewing representatives from the grocery stores. These interviews provided valuable information, both in terms of learning about the supply of surplus food, and also what their needs would be if

they were to supply restaurants with surplus food.

4.2.1 Surplus Food from the Viewpoint of Grocery Store Representatives

All the store representatives that were interviewed agreed that it is important to reduce food waste and most of them have a process when it comes to saving surplus food from becoming food waste. When finding ways to save the surplus food, it is important to follow all laws and regulations in terms of food safety. One approach that the grocery stores Coop Landala and Ica Majorna use is to pay a company to come and collect the surplus food for the same price they would pay for throwing the food away, this company then distributes the food to charities. Ica Mölndal donates their surplus bread directly to a charity while Ica Tierp delivers surplus food to a kitchen, which is owned by the store and is located close by. The food is cooked and then sent back to the grocery store where it is sold to customers. By doing this, they are able to sell almost everything and only around one to two kg are thrown away each day. Ica Bärkehallen has farmers that come and collect the surplus food and they then use it as animal feed. Ica Visby has a few initiatives when it comes to working with surplus food. For approximately eight years they have cooperated with a church that receives surplus meat and coffee from them and in addition to that they are in a collaboration with a restaurant in Gotland that collects surplus food during the summers. They also sell bags for a reduced price where they have collected together variety of surplus fruits and vegetables.

4.2.2 Surplus Food Supply from Grocery Stores

The stores interviewed were of different sizes. Ica Tierp is the smallest being 650 m^2 and Ica Mölndal is the largest at around 10,000 m^2. Coop Landala is then 900 m^2 and Ica Majorna 1050 m^2 in total. The size of the store affects the amount of surplus food that a store is able to supply to restaurants, but another factor affecting the amount is how stores work with reducing food waste. A few of the grocery stores interviewed work with a company called WhyWaste, who is one of the project partners of this project, who specialize in a system to help grocery stores reduce their food waste. The system registers the food's best before date and everyday the stores get an overview with the products that are about to expire. This gives the grocery store an opportunity to reduce the price on those particular products and thereby increase the likelihood of them being sold.

When asked about the amount of surplus food at the grocery stores, most representatives had difficulty putting a number on the amount. Ica Tierp was able to give a rough number on the amount that they rescue yearly and that is around 5.000 kg. Only a representative from Ica Tierp responded that the amount of surplus food does not vary much, and that they can usually count on it being the same.

Representative from Ica Visby mentioned that the level of surplus food is rather low everyday but there is some in every department. Representative from all the other stores said that it can vary a lot, and Coop Landala said that it can be somewhere between two kg to 200 kg per day. A representative from Ica Mölndal said that it depends on the time of year and that the summer season was the most difficult one. The reason behind that is the weather plays a big role in what customers buy at the grocery store, e.g. if there is sun, customers are more likely to buy something on the grill but if it is raining those products are not bought in the same amount. Because of this variety in amount of food, the store representatives said it would be difficult to inform the restaurants well in advance what they would be able to supply. A representative from Coop Landala said that the information could be given the same day, at around nine in the morning. A representative from Ica Majorna said that it would depend on the communication platform used, meaning that if a sufficient platform would be in place, e.g. an app, the information could be delivered the day before. Otherwise, a lot of extra work would be needed to list up every food available and the grocery stores were not prepared to do so.

When asked how long before the best before date the grocery stores would be willing to sell or donate the surplus food, the answers were similar. Most said either the same day as the best before date or the day after. All representatives said that they will try to sell as much as they can to their own customers before selling or giving away to restaurants. The most common surplus food products were fruit, vegetables and bread but meat and dairy products were also quite common. Products with longer shelve life such as dry products, namely pasta, beans, cereal, etc., are not picked out as often. It sometimes happens that stores get products in packages that either have incorrect labels or the package is damaged. In those cases, the product can not be sold at the store.

4.2.3 Transport Capabilities for Grocery Stores

When asked if the grocery stores would be able to transport the surplus food from stores to restaurants, all representative answered unanimously that it would not be a possibility. The reason for that is because it would require additional labour to take care of the transportation.

4.2.4 Storage Area and Capabilities for Grocery Stores

The grocery stores did not see any problems with storing the surplus food in their storage area before being picked up for delivery. Most of them had large storage areas with big fridges and freezers that could be used to store temperature sensitive products.

4.2.5 Materials Handling at the Grocery Store

All of the stores manually check the shelves in the stores and pick out products that are about to go past its' best before date. Every representative responded that this is done everyday but when during the day was different between stores. All the grocery stores except Ica Tierp check the shelves in the morning, usually between six and eight. Ica Tierp checks the shelves in the evening. All respondents agreed that the time it takes to do this varies but most agreed that it is between 30-60 minutes.

Every store uses reusable crates from an organization in Sweden called Svenska Retursysem. Those crates can be stacked, and they protect the primary packaging from impacts. The representatives from the grocery stores were satisfied with this system and claimed that it was easy to handle and to store products using the crates.

Sorting of surplus food can be a time consuming task. The stores interviewed discussed that it would be better for them if a restaurant would be able to take every surplus food they had so that they would not need to put extra labour on sorting the food. Representatives from Coop Landala and Ica Majorna said that they could sort the surplus food roughly, meaning that they would throw away products that are clearly inedible. A representative from Ica Mölndal said that the restaurants would be more capable of sorting the food, especially since the store would not be able to open the packages to see if the product looks and smells alright. When asked if the stores would be able to supply more than one restaurant and sort the surplus food into predefined boxes, each intended for one restaurant, the stores said that they would potentially be willing to supply more than one restaurant but that the sorting process would be too time consuming. Thereby they suggested a first come first serve policy.

4.3 Restaurants Perception of Surplus Food

This section includes data that was gathered from interviewing both restaurants that are currently serving surplus food and restaurants that do not serve surplus food. Interviewing restaurants that do serve surplus food provided valuable insight into how they are working with surplus food, both in terms of logistics, and also for how it is perceived by their customers. For restaurants not serving surplus food, it is important to know what their needs would be if they were to serve surplus food.

4.3.1 Surplus Food from the Viewpoint of Restaurant Representatives

When conducting the interviews it became apparent that the chefs knew the importance of reducing food waste. They are all aware of the food waste they produce and, according to them, they try their best to keep it to minimum. Representatives from K märkt and OOTO spoke about that if the end customer pays for the weight of the food instead of a fixed price, they throw away less. K märkt currently has this system and it is working out well. Other ways to reduce food waste at the restaurant is to use left over food e.g. to produce stock, make seasoning, etc. Many also discussed that not having a set menu is a way to reduce food waste. Most agreed that this food waste issue needs to be fixed earlier in the supply chain and a representative from Backaskolan said that there should not be so much of surplus food that a restaurant should be able to serve multiple portions with it. A representative from Spira Food mentioned that restaurants must be able to go with the flow and accept food that would otherwise go to waste, even though the amount of food available can differ a lot. When it comes to accepting surplus food, two restaurant representatives mentioned that one restaurant should not accept everything, but rather a certain percentage. By doing this, more restaurants can serve surplus food and also that if one restaurant accept everything, that it is likely to be difficult to manage that on daily basis with all the extra work that goes into processing the food. By only taking a certain percentage, there will not be so many portions of the surplus food, but it is a good thing if the surplus food gets sold out.

The restaurants currently working with surplus food try to take everything that they are offered and conforms to their characteristics, e.g. if they only serve organic, vegetarian or vegan food. Furthermore, the storage capacity is often a limiting factor as well as they need to take into consideration whether they can sell it all to customers or if it will become food waste at their restaurant. There were mainly two factors mentioned when asked for the reason why the restaurants started working with surplus food. Most of the chefs mentioned that prior to working at their current restaurants they got to see how much food was being wasted, although it was still consumable. Wanting to do something about this issue they started working with surplus food so their reasoning was mainly environmental. Other chefs mentioned that the reasoning was more a financial one. They saw an opportunity to reduce the material cost by purchasing or even getting surplus food donated.

4.3.2 Surplus Food Demand from Restaurants

The restaurants interviewed that do not currently serve surplus food but were interested in the concept were asked whether they would prefer to be in a collaboration with one supplier or many. Representatives from Happy M Kitchen, Liseberg Wärdshus and Spira Food said that they would prefer to start in collaboration with only one supplier. If that would work out well, then adding on more suppliers would be

of interest. The reason for starting small was the same with all three restaurants, it is the uncertainty in supply and not knowing fully what you would receive and in what amounts. It would also be easier to plan and communicate with the suppliers if they are few. The other two restaurant representatives, from OOTO and Nordish market, said that it would not matter if it were in collaboration with one supplier or multiple suppliers. OOTO representative said that the more they can get, the more variety they can offer. Liseberg Wärdshus representative said that it would be good to have a middle man that would take care of collecting everything and distributing it to restaurants. All restaurant representatives were interested in receiving fruits and vegetables and representatives from Spira Food and Liseberg Wärdshus mentioned that it would be a good start to only receive those products from one supplier in the beginning to test this out.

Many of the restaurants interviewed have a certification called Krav which is a well known eco-label in Sweden. This certification means that the restaurant is cooking with raw material that has been approved by an independent certification company. Restaurants can have one, two or three stars to show how much of the restaurant's food is prepared with approved ingredients. The restaurants that have this certification discussed that it would be important for them that the food they would accept from the stores would not affect this certification negatively.

Currently the restaurants receive deliveries from their suppliers usually in the early morning. Representatives from Happy M Kitchen, Spira Food and Liseberg Wärdshus said that they would like the same with the surplus food deliveries, i.e. receive it around eight in the morning and use the food the same day. Representative from Nordish Market said that it would be good to receive the surplus food in the afternoon so that they could plan what to do with it the next day. According to the representative from OOTO, receiving food is all matter of planning so they were able to receive the surplus food whenever during the day. When asked how much surplus food they would like to receive and how often, the answers varied. All the representatives had difficulties in answering how much they would want since it depends on the products and also on how much they are serving every day. Representative from OOTO said they would only want a small percentage and to receive it two or three times a week. Representatives from Happy M Kitchen, Nordish Market and Liseberg Wärdshus said that they would like to have it every day.

The restaurants that do currently serve surplus food mainly receive it from wholesalers. The number of suppliers varied, from being one to many. It also differs if the suppliers are supplying regularly or if it is only a few times per year. The amount of surplus food that the restaurants receive is also very different, both between restaurants and also how much they get day-by-day. Gotthards Krog is receiving about 200 kg to 400 kg per week, Restaurang Spill is getting 55 kg to 100 kg per day while the others said that they do not measure the amount. Representative from K märkt said that it is important to be able to take big volumes because otherwise it would be too much trouble for the supplier to divide the shipment. All restaurants currently serving surplus food, except for Gotthards Krog, receive daily deliveries of surplus food. K märkt and Restaurang Spill receive multiple deliveries per day.

Gotthards Krog receives deliveries two times per week. All of the restaurants that do serve surplus food have a flexible menu, meaning that they plan the menu once they know what supplies of surplus food they receive. Liseberg staff restaurant had both a set menu and a flexible menu. All the restaurants that serve surplus food were open on receiving everything that was available, and the only reason for rejecting a product is if they knew they would not be able to serve it and have to throw it away themselves.

4.3.3 Transport Capabilities for Restaurants

Access to transportation vehicles varied between restaurants that are currently not serving surplus food but representatives from Happy M Kitchen and Liseberg Wärdshus said that they would need to get the food delivered so that they would not have to put an additional labour in collecting the food. The other representatives were more flexible such as Nordish Market and Spira Food, but they have transportation vehicles that could be used to collect the food. Nordish Market has electric bicycles that they currently use to deliver food, while Spira Food has a food truck and a car. OOTO representative said then that if it would be possible for them to choose what they would get by picking up themselves they could do that. They would, however, need to invest in a pick up truck to do so.

All restaurants that do currently serve surplus food get it delivered to them. It was only occasionally that a few of them went to pick up the food themselves. The shipments usually arrive with the non surplus food that the restaurants have ordered. Representatives from Liseberg staff restaurant and Restaurang Spill mentioned that for some of the suppliers they do not pay for the food but only the price of the transportation.

The two charity organizations, Smyrnakyrkan and Stockholm Stadsmission have vehicles for transportation. Smyrnakyrkan both gets some of the surplus food delivered to them but they also have a transportation route that they go five times a week. Stockholm Stadsmission have three transportation vehicles, two that pick up surplus food and one that makes deliveries to charities. They also have a fixed route. Some of the food also gets delivered to Stockholm Stadsmission.

4.3.4 Storage Capabilities for Restaurants

When interviewing restaurants it became clear that most of them do not have a large storage space. Because of this, many would prefer to get deliveries everyday from grocery stores and in smaller amounts, rather than large amounts few times a week. The ones that have enough storage capacity said it would be no problem for them to store the food. In regards to time sensitivity and the need to serve the food as early as possible, all the chefs interviewed had ideas on how to preserve the food so that it would last for longer time.

The restaurants serving surplus food did not have any trouble with storing the surplus food because the storage space was big for most o f the restaurants. Gotthards Krog representative said that it was important to preserve some of the food, e.g. by cooking it the day before serving it or make a tomato sauce out of the surplus tomatoes.

4.3.5 Materials Handling at the Restaurant

All restaurants interviewed were familiar with the crates from Svenska Retursystem that are being used by the grocery stores. Some representatives from restaurants were using them and thought that it was a good system. The biggest advantage with these crates, according to representative from OOTO, is that they are easy to handle, can be stacked and they are allowed to be stored in a fridge. That is not the case with all packaging material, e.g. carbon boxes should not be stored in a fridge because of risk of fungus or animals.

When interviewing the restaurants, all representatives said they would be willing to do the sorting and saw some advantages in doing so, e.g. the employees at the stores may think that an item is waste but the chef could have more knowledge of whether it is possible to still serve it. The downside they saw with that was that they would need to pay more money to a recycling company that takes care of what is thrown away, so some agreements would need to take place between the supermarkets and restaurants.

For restaurants serving surplus food, the sorting either took place at the restaurant or the supplier took care of it. Liseberg staff restaurant said that some suppliers do it before delivering while others deliver everything without sorting it. Gotthards Krog representative said that the cost has moved from the ingredients to labour, since there are more hours put into the work such as sorting.

4.3.6 Data from Questionnaire

This section will contain data gathered from the questionnaire that was sent out to restaurants. Most of the restaurants that participated in the questionnaire are currently not serving surplus food, or approximately 62%, while 34% do use surplus food, see Figure 4.1.

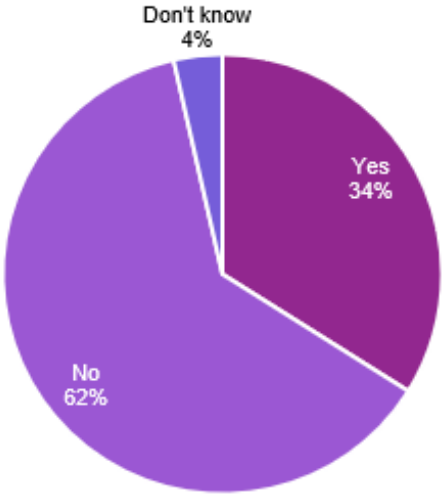

Figure 4.1: Current use of surplus food at the restaurant

Those who do currently purchase and serve surplus food mostly buy it from wholesalers. Of those that do not serve surplus food, 57% said that they could either consider it or maybe consider it, see Figure 4.2.

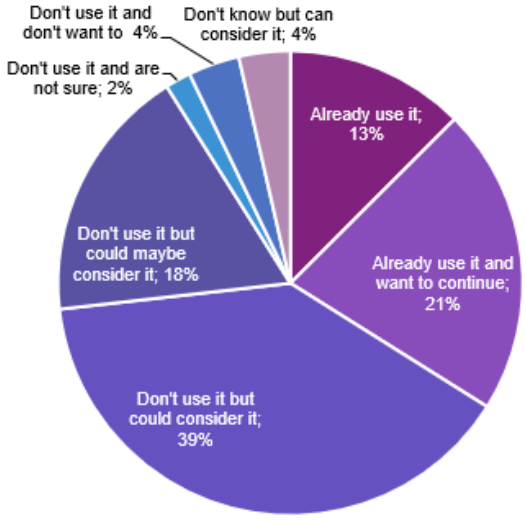

Figure 4.2: Attitude towards usage of surplus food

The size of the restaurants, in terms of number of guests per day can be seen in Figure 4.3.

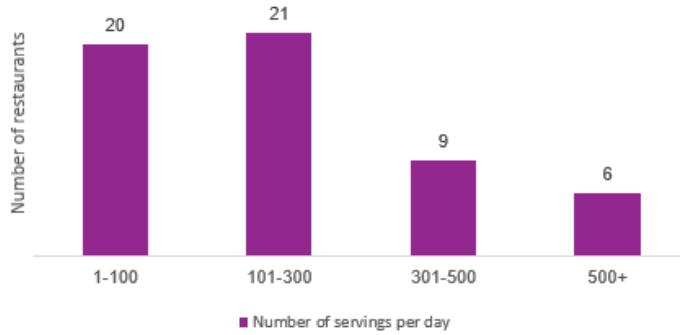

Figure 4.3: Number of guests per day

Three factors stood out when asked about what factors played an important role in deciding whether they would use surplus food or not, namely simple ordering process, reduced price, and possibility of selecting which product is delivered. See Figure 4.4 for all the different factors.

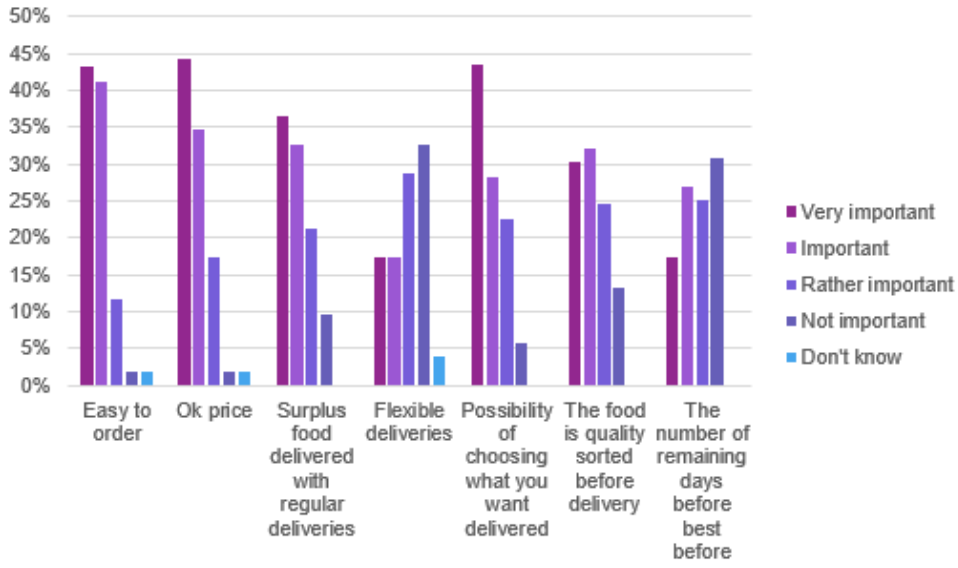

Figure 4.4: Factors for using surplus food

Food products were sorted into the following categories: fruits and vegetables, bread, meat, frozen products, dairy, and dry products such as beans and pasta. When asked what products they would mostly be interested in, dry goods and fruits and vegetables were the most popular ones. The least wanted was bread. See Figure 4.5 for all product groups.

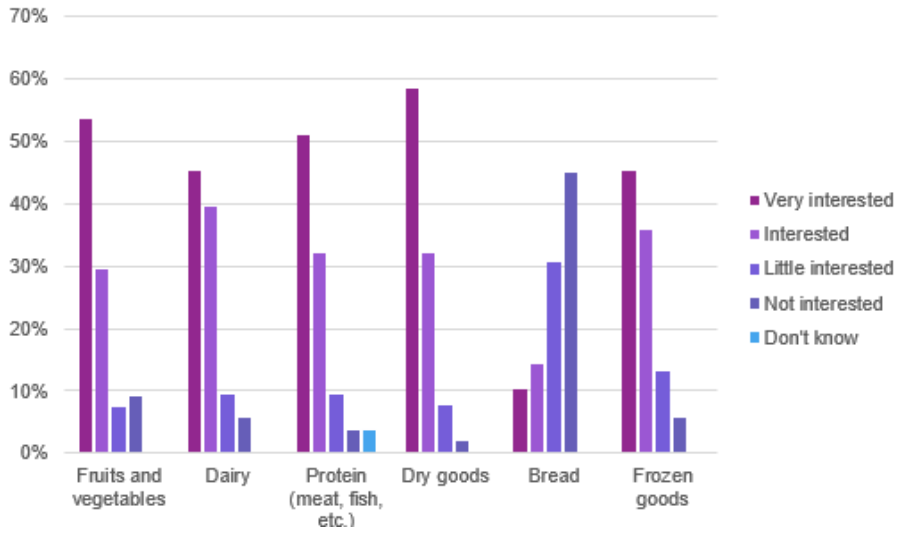

Figure 4.5: Interest in different product groups of surplus food

When asked about frequency of deliveries, most answered that two times per week would be suitable. Thereafter was three times per week and five times per week, see Figure 4.6.

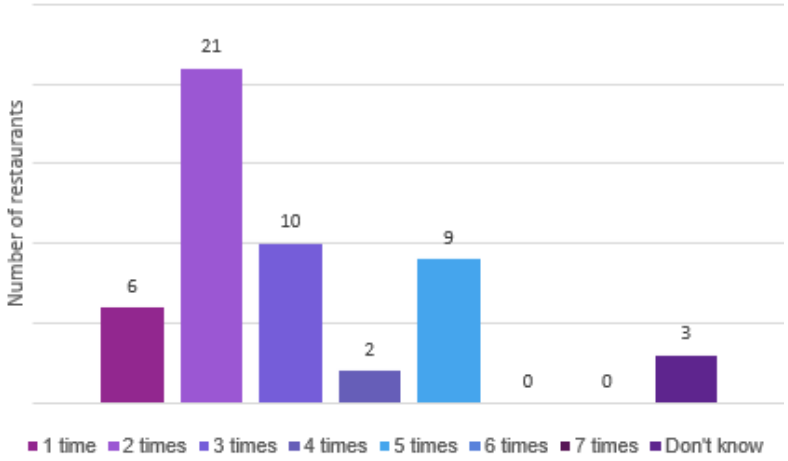

Figure 4.6: Delivery frequency of surplus food

Great majority of respondents wanted the deliveries to arrive in the morning, between seven and nine, while some preferred before lunch, or around nine to eleven. Some said that the time did not matter, see Figure 4.7.

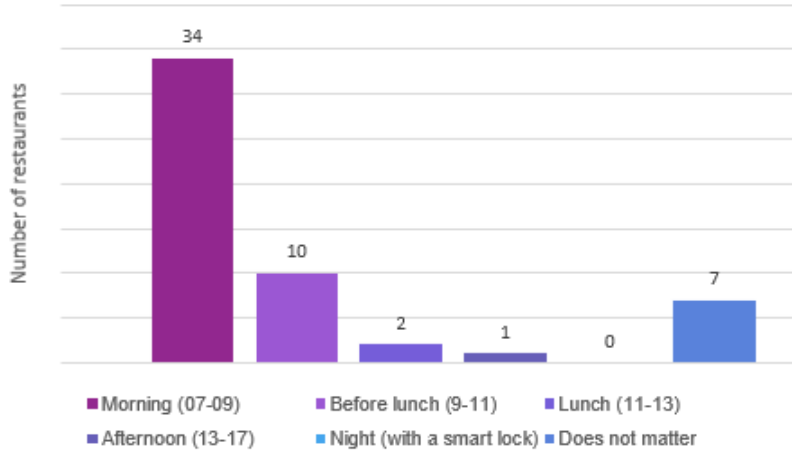

Figure 4.7: Desired time of surplus food delivery

When it came to ideas of how to serve the food, most said they would serve surplus food in smaller amounts but incorporate it with the planned meals. Many said they would use the fruits and vegetables, process them and serve it in either the buffet or planned meals. Some would like to serve only surplus food for lunch or dinner, see Figure 4.8.

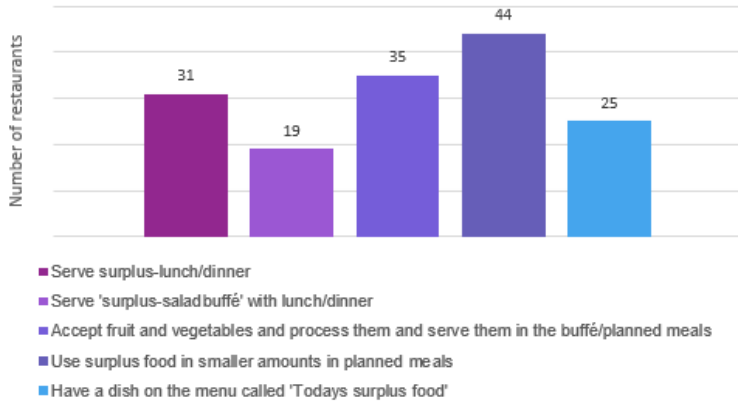

Figure 4.8: Suggestions for cooking and serving surplus food

The majority of respondents, or around 91%, believed that customers would have positive reaction to the restaurants serving surplus food, see Figure 4.9.

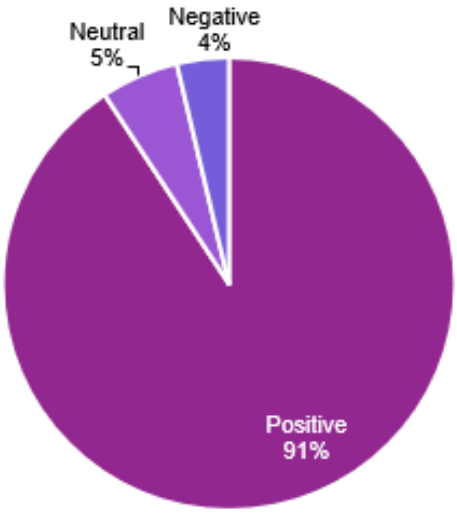

Figure 4.9: Expected reaction from costumers on the use of surplus food

A chi-squared test was performed to see if there was any correlation in answers. The test was performed on the following criterias: size of restaurant and delivery frequency, size of restaurant and expected reaction of customers, those that are interested in fruit and delivery time, and those interested in fruit and the importance of ok price. It was however not possible to make any conclusion of the results since there were too few expected answers for some of the categories.

4.4 Transport Providers

For one transport provider, the price of the service they offer was dependent on three factors, namely the weight of the delivery, in which zone the delivery takes place, and whether or not they could be flexible. It is cheaper e.g. if they can choose when they would deliver, rather than being told to deliver from point A to point B at a certain time. For this transport provider, the time around lunch is when they are busiest. Customers are sometimes able to book delivery with as little as one hour in advance, but it is better to order one day before. The weight limit is 150 kg, and currently they only have a prototype for a self cooling container, and having this container reduces the capacity.

Another provider said that they could handle packaged food, i.e. the fruits and vegetables would need to be in packages. They could not store much in cold storage because of lack of fridges. A standardized process for them is to deliver everything to a terminal and deliver it to the receiver the next day. They also do direct transportation but it depends on the volume.

One representative spoke about the importance of having a document which states what products they are handling. The reason for that is in case they get stopped in

a controlled check, they must be able to identify what is in their vehicle.

4.5 Data from Pilot Project

Three times per week, namely Monday, Tuesday and Thursday, around noon a representative from Nordish Market picks up surplus food that has been sorted into boxes by Coop's staff. An exception from this is though made if the stores do not have any surplus food to give away. If that is the case, a representative from Nordish Market is notified by a representative from the store. The pick up takes place at Coop Avenyn, Coop Friggagatan and Coop Landala and electric bicycles are used for this operation. Before this pilot project was initiated they used to work with local suppliers from the area close to Gothenburg and focused on buying organic. To begin with, they accepted almost everything they got regardless of whether it was organic or not and it was decided that they would only take fruits and vegetables to begin with. However, sometimes they need to refuse accepting more fruits due to overload of it. In addition to that they started to accept dairy products as well. According to the owners of Nordish Market, the challenge for them is that they need to be more creative when it comes to making meals with the surplus food they get since the variety of fruits and vegetables is more compared to what they were used to when they bought it from other suppliers. This has also led to some kind of expand in the business where they now have started to offer smoothies for breakfast to their customers. Nordish Market aims to offer a special surplus food dish later on, given that this pilot project will work out well. Since they have many environmentally aware customers today, they have only had positive feedback and hope and believe that this is something the customers appreciate.

According to Nordish Market, the total surplus food they get from all the three grocery stores, the days the pick up takes place, weights around 25kg. Approximately 10%, or 2.5 kg, of the surplus food they receive is not edible and results in them needing to throw it away. Currently, in the meal they serve, the ratio of surplus food is around two thirds and one third is bought from their local suppliers. During this pilot project, Nordish Market orders from their regular suppliers after they see what they get from the stores. This operation usually takes place in the afternoon, when the pick up at the stores is finished. The reason is to reduce the risk of having too much of food that would lead to food waste at the restaurant. It is suitable for them to receive the surplus food in the afternoon since then they have time to look over what supplies they received and more time to prepare the food and plan the meal they will be cooking the next day. It is worth to mention that Nordish Market was one out of two restaurants that were interviewed that said they were ready to pick up the food themselves instead of getting it delivered.

There are three things that Nordish Market valued as very important when having this collaboration between restaurant and grocery stores. One of them is that the chef needs to like the creative thinking that is necessary when receiving food that is

not pre-determined by themselves. This leads then to the need for flexible menus, as that allows them to make meals without any restrictions. The last but not least important thing is to have strong relationship between the two actors, store and restaurant, built up by trust and honesty.

5

Analysis and Discussions

The following chapter contains an analysis where the literature is compared with the information from the empirical findings. This chapter has been divided into three sections, each intended for one research question. By doing so, the research questions will be answered.

5.1 RQ1: What Characteristics are Important to Consider When Effectively Balancing Supply and Demand of Surplus Food?

In this chapter the characteristics that were identified from the interviews will be discussed and insight from theory provided on the subject will be used to support the empirical data. Since the goal is to have an effective balance in the supply and demand, it is important to have the viewpoints from both the supplier and the customer. Therefore, the viewpoint from both the representatives at the grocery stores and from the restaurants was used to determine the characteristics. From the interviews, three characteristics were identified that play a key role in balancing supply and demand. Those characteristics are; *amount of food, type of food, and delivery frequency*. The following paragraphs will go into more detail on each of them and describe why they are considered being important in this system.

As van der Vorst et al. (2001) point out, many food products have the characteristics of a functional product but have unpredictable demand. This leads to difficulty in creating an accurate forecast (Jonsson & Mattsson, 2009) which affects the amount of food waste generated at stores. Therefore, the *amount of food* that will become surplus at the store constantly varies. Furthermore, leading to that *the type of food* that becomes surplus at the grocery stores also varies and can be different depending on seasonality, trends, or it can even be completely random. The former characteristic, *amount of food*, can both be measured in weight and cost. It was difficult for representatives from grocery stores to put a number on how much surplus food they would be able to deliver, but a rough estimate from Ica Tierp was that approximately 5.000 kg of surplus food is currently being rescued yearly by delivering

the surplus food to a kitchen, owned by the store, and after the food has been cooked it is sold in the store. It was also hard for the representatives from the restaurants to say how much surplus food they would like to receive because it depends on how many customers they get and what they have on their menu. It is also difficult to provide a number in kg since the weight varies so much between food products, there is e.g. much difference between 1 kg of carrots and 1 kg of lettuce. The amount of food that restaurants that currently do serve surplus food receive varies a lot, both between restaurants and also what they receive day-by-day.

As Midgley (2014), discussed, collecting enough food and having different variety to distribute can be difficult. With the high uncertainty and the amount of surplus food varying from day-to-day, restaurants must be able to plan around it to be able to have this type of system. If supply from grocery stores does not meet the demand from restaurants, a solution for the restaurant could be to order supplies from other suppliers, such as wholesalers or farmers, once it becomes clear what products will be supplied from the grocery stores. This is what Nordish Market have been doing in the pilot project, after they have received surplus food from the grocery stores, they see what more supplies are needed and order them from other suppliers. As representatives from Spira Food mentioned, it is important to be able to go with the flow even though the amount can differ. A representative from Backaskolan discussed that it is good if there is not much supply from the grocery stores because it is good if there is little or no food waste at the grocery stores.

For many of the restaurants, the storage area was a limiting factor when it comes to receiving food. This means that restaurants will not necessarily be able to take every surplus food available, simply because they do not have the space for it. They must also take into consideration how much food they serve to their customers on daily basis. Receiving too much surplus food will only lead to waste at the restaurant.

Type of food is, as mentioned above, another characteristic categorized into the following groups; fruits and vegetables, protein such as meat and fish, bread, dairy products, frozen goods, and dry goods such as pasta and beans. From both the interviews and the questionnaire, it was apparent that restaurants have strong opinions on what type of food they would like to receive. This is understandable since the type of food that restaurants want to receive depends on the type of food they serve to their customers. Some restaurants do for example only serve ecological, vegan or have a certain certification. Collecting food with only the purpose of reducing food waste at the grocery store is not a good strategy if it means that the food will become waste at the restaurant. Restaurants can either operate having a set menu, where the chefs have planned what will be served well in advance, or have a flexible menu. The flexible menu is then decided on daily basis, depending on what food products are available each day. The set menu can be more restricting in terms of what type of food restaurants are willing to receive. The reason for that is because if a grocery store is able to supply e.g. a certain type of vegetable, but it is not on the menu, then the restaurant is less likely to want it. Restaurants using a flexible menu would be more willing to accept everything the grocery store is able to supply and plan a menu around that.

Delivery frequency is another characteristic that affects the supply and demand. Since storage can be limited in restaurants, receiving smaller but more frequent deliveries can be beneficial. Other restaurants, that have sufficient storage space, discussed receiving deliveries approximately twice per week. However, as Christopher (2011), mentions, timely deliveries are important in the food industry since food is a time sensitive product. In time, food decomposes and becomes inedible (Papargyropoulou et al., 2014), and for that reason restaurants must be able to count on frequent and reliable deliveries. Whether or not the delivery frequency is high, it is important that the food is stored correctly and kept in the correct temperature to maintain the quality and to control the bacterial growth (Bell, 2018). Once the food product has been delivered to a restaurant, the chefs can extend the shelf life of the products by using food preservation approaches.

There was a difference in answers from the current initiatives, restaurants not serving surplus food and questionnaire when asked about the delivery frequency. For the current initiatives, all restaurants, except for one, receive daily deliveries of surplus food from their suppliers. Three representatives from the restaurants that do not serve surplus food said they would like to get the food delivered every day, while the other two said either two or three times per week or they were not sure. From the questionnaire it can be seen that most of the respondents want the food delivered two times per week. The difference in these answers can be manifold. To begin with, the current initiatives are mainly serving surplus food, meaning that they do not receive a lot of non surplus food. Since surplus food is their main focus they must receive daily deliveries to be able to cook fresh food every day. For the restaurants not currently serving surplus food, both from the interviews and questionnaire, it can be hard to understand all the additional labor that goes into receiving the surplus food, e.g. sorting and cleaning. If the deliveries are less frequent, the amount in each delivery is more, and the time it takes to do the additional labor increases. Furthermore, the ones that are not serving surplus food mostly get their food supplies from wholesalers, who, according to Garrone et al. (2014b), have different characteristics and capabilities than grocery stores. They state that wholesalers are more capable of storing larger amounts while the space for storing surplus food is often small for grocery stores. Therefore, it would be better for the grocery stores if the deliveries are more frequent. However, as Nair et al. (2017) discussed, frequency during a week depends on the average daily availability of different types of food. Many of he grocery store representatives did mention that it would be possible for them to provide food for daily deliveries.

In regards to delivery time, the responses from both the questionnaire and the interviews were similar or that most would like to receive the surplus food early in the morning. That way they can serve the food the same day as they receive it. However, some said they would want it in the afternoon and the advantages to that is that they have more time to process it and plan what will be cooked the day after.

5.2 RQ2: What Logistics Activities Are Involved in the Material Flow and How Should Stores, Logistics Providers, and Restaurants Handle Them in an Efficient Way?

In this chapter, the logistics activities that were described in the literature framework will be discussed, and data from the interviews, questionnaire, and pilot project will be used to identify how the actors in the system should handle them. To answer this question, it is important to have the viewpoint from the supplier side the customer side, and the logistics provider side to be able to identify who is best suited to perform the logistics activity. As Manzni and Accorsi (2013), discussed, deciding on these logistics activities can both be seen as tactical and operational decisions. The following paragraphs will go into more detail of each activity.

Demand Forecasting

Grocery stores currently generate demand forecasts for their regular costumers, however, that process is out of scope for this study. It is though worth to mention that the degree of errors in those forecasts may lead to either stock out or surplus food at the store. It is difficult to know in beforehand how big this error is, and how much surplus food there will be.

Restaurants need to know approximately how many customers they will be serving each day in order to know how much food they should prepare. The number of customers can however vary from day-by-day which can lead to the restaurants either having too much inventory which can result in food waste, or the risk of not having enough food to serve every customer. It is good if restaurants have some flexibility in their menu in case if the demand is more or less than anticipated. By having flexibility, they can either use some of the food they are not able to serve the day after, or if the portions are sold out, they can change the menu so that other customers are able to order something else to eat.

The three demand patterns, seasonal variation, random variation, and trend, discussed by Jonsson and Mattsson (2009), can all be applied to the grocery stores and restaurants. One store representative spoke about how the weather and the summer season often affect the demand of certain products. Representatives from one restaurant spoke about how it was good to have a stable demand with occasional peaks. Having the peaks allowed them to use products that they have a lot of and had not been able to serve in their regular dishes.

Customer Service

As Lambert et al. (1998), mention, customer service can be seen as the output of the logistics system and that good customer service increases customer satisfaction. In this system, the restaurants are the customers to the grocery stores. Rushton et

al. (2016), spoke about the importance of segmenting their customers into different customer categories. This is important since there should be a balance between the level of service provided and the cost of it, and some customers do not require as high service levels as others (Rushton et al., 2016). In this study, the grocery stores have customers, other than the restaurants, that come regularly and purchase products from the shelves at a full price. The grocery stores want to sell as much as they can, and if the grocery stores have little or no surplus food, then that means they have had a good day in sales. As Priefer et al. (2016) mentioned, stores are recommended to reduce prices of food products that are approaching their best before date to increase the chances of the consumers buying the product. Therefore, the restaurants can not expect the same level of customer service as the regular customers get. Example of a customer service element that will be missing for the restaurants is the certain availability of variety of food products.

For this collaboration, between stores and restaurants, to work out both actors have to realize the importance of reducing food waste and be willing to help minimize it. The grocery stores can save money on waste disposal by supplying restaurants with surplus food. The restaurants spend less money on buying surplus food, however, more time and cost goes into labour and material handling.

Inventory Control

Inventory control is an activity that is performed by both grocery stores and restaurants. For this study, the replenishment decisions made at the grocery stores are not within the scope of the system. However, the process of store employees going over the shelves everyday to take a look at the inventory and picking out food that is about to expire is within the scope. This process is performed everyday at the grocery stores.

The restaurants check their inventory regularly to see what they need to order. Restaurants should have a continuous review policy to be able to keep less safety stock, which is beneficial due to often limited storage space. Restaurants usually have the possibility of placing an order at all times. In the pilot project, Nordish Market collected the surplus food early in the afternoon and once they had looked at what they received and planned what they would cook, they contacted their ordinary suppliers and ordered what was needed additionally to complete the dish. When Kiil, Hvolby, et al. (2018), discuss the different review policies, continuous and periodic, they mention that for continuous review policy there must be an ability to order at all times. The restaurants will not be able to do this with the grocery stores, since the supply can be very limited, but they have the chance of contacting their ordinary suppliers.

Communication

In this system, good communications between actors are important. However, two communication challenges were identified during the interviews. The first one being that grocery stores are only able to inform restaurants what surplus food will be

available with a short notice, giving the restaurants little time to plan ahead. The second challenge was with how grocery stores should communicate what is available. For them it is important that it does not take long time, so writing a list of everything is not considered feasible. One suggestion is to have a communication platform such as an app where stores can easily send out notification to restaurants informing them of what is available. Others said that using email or phone is sufficient.

Communication i necessary in this system for many reasons. One example is if a grocery store has a supply of surplus food but they do not inform the restaurants, then the surplus food will be more likely to become food waste since food is a time sensitive product (Papargyropoulou et al., 2014). Additionally, if e.g. a grocery store does not have supply of surplus food, and they do not let the restaurant know, it can cause some troubles for the restaurant. It could be that the restaurant was counting on that supply of food, and also, if the restaurant collects the food themselves, they will waste time by going to the store and not receiving anything.

Order Processing

van Weele (2017), discussed an automatic trigger which goes off when the inventory goes down to a certain level. Having this type of automatic system is not really applicable here, especially if the menu is flexible. The restaurants can not expect a fixed number of products and a stable supply from the grocery stores since there is a lot of uncertainty. In this system, where stores supply restaurants with surplus food, the stores will not let the restaurants know what surplus food is available for them since that requires an extra work. Therefore, the restaurants will not know in before what surplus food is available at the store. If the restaurants need something extra in addition to what they got from the store, it has to be ordered through other suppliers. The restaurants should therefore have a manual ordering system.

Material Handling

Grocery store employees manually pick the surplus food from the shelves. For this system they should use the pick-and-sort process discussed by Jiang et al. (2018) because with this strategy, the pickers can move faster. By using this process, there needs to be a sorting process afterwards. Sorting can be time consuming, but it became apparent in the interviews that the representatives from the restaurants were interested in doing it. The main reason is because they have more knowledge about the food, and they will be able to open the packages. Store employees are however able to do a rough sorting of what is edible and what is inedible.

One challenge if restaurant representatives do the sorting is that it costs to throw away food. Therefore, if stores were to send high amount of food to the restaurant that may already be inedible, the restaurant would be paying both for the food, and also to throw it away.

Packaging

It depends on the type of surplus food whether it is displayed in packages or not in

the grocery stores. Milk is in cartons, meat and some sorts of bread are e.g. wrapped in plastic, but many fruits and vegetables are not displayed in packages. When employees are picking out products that are reaching its' best before date, they put it in some sort of a container, which differs between stores and food assortments. Stores working with a company, that collects the surplus food and delivers it to charities, use red plastic boxes that have been provided by the company. Other store that donates surplus bread to charities put all the bread in plastic bags. During the interviews, every grocery store representative discussed their use of the plastic crates from the Svenska Retursystem. They are useful both in displaying the products and also easy to handle since they have grips and can be stacked. Currently grocery stores and wholesalers are using this system. These crates will function to protect the surplus food from damage. Most restaurants interviewed had heard of these crates and some were using them. It can be beneficial to include the restaurants in the system and it would be an easy procedure since most actors are already familiar with this system. Grocery store employees should pick the surplus food out of the shelves and place them in crates. The crates would then be delivered to the restaurant, containing the surplus food. Once the restaurant has emptied the box, it will be sent back to the grocery store. As Wood et al. (2009) discussed, there is more awareness when choosing packaging material and the concern for the environment. The crates from Svenska Retursystem are reusable and allow for a better working environment.

Procurement

For this system, identifying which grocery stores are willing to supply surplus food to restaurants can be challenging. Some grocery stores already have a system in place when it comes to reducing food waste. Thereafter, a decision needs to be made whether to be in close collaboration with one supplier, or to have a multiple sourcing strategy. Having a partnership with one grocery store can be more simple in terms of communication and transporting the goods between actors. The main downside is that it reduces the amount and variety that can come with multiple sourcing strategy.

Warehousing and Storage

With surplus food being a time sensitive product (Papargyropoulou et al., 2014), it can not be kept in storage for a long time. The surplus food can be kept in storage in the grocery stores after it has been picked out from the shelves. The store representatives did not see any issues with storing the surplus food for a limited time since they all had some available storage area. Furthermore, the storage area at the grocery stores meet the requirements that are needed to handle sensitive food products. It is however important that the surplus food gets picked up and delivered and that it does not stay for too long in storage, both because then there will be higher risk of it becoming food waste and also since the storage space should not be taken for granted. Once it arrives to the restaurant, the food will be sorted and processed and possibly served the same day or the day after. It is extremely important that the storage conditions are correct so that the food quality and nutrient content are

maintained (Bell, 2018).

Traffic and Transport

It was clear from the interviews that the grocery stores will not be able to deliver the surplus food to the restaurants. This does not come as a surprise since grocery stores do not specialize in transportation. Most of the restaurants do want the surplus food delivered to them, since that is how they currently receive their products from their suppliers. Adding delivery would mean increasing labour work and for some, the need to purchase a vehicle.

As Morash and Clinton (1997) discuss, reliability in transportation is often seen as an important element. This is also mentioned by Willersdorf (1990), who states that reliability is more important in the food supply chain than the frequency of deliveries. Having a third party logistics provider who is competent in transportation solutions would be the best solution.

5.3 RQ3: What are the Advantages and Disadvantages of Different Types of Material Flow That Can Be Used in the System to Balance Supply and Demand of Surplus Food

According to Christopher (2011), the uncertainty is always difficult to handle when matching supply and demand. The material flows that have been listed up earlier based on Jonsson and Mattsson (2009), can be transferred to a relationship between store and restaurant. For all of those material flow types, there is always some kind of uncertainty. It is difficult for the retail stores to know how much they will have in advance of surplus food and it is not less difficult for the store to know how much a restaurant is able to accept each and every time. The store's representatives that have been interviewed have mentioned that they want to throw as little as possible so they are ready to increase the workload, to a certain extent, to make this efficient for both the store and restaurant. The restaurants are the ones specializing in what is edible and what not but according to the stores representatives, they can do a rough sorting on the surplus food before the restaurants get it delivered. There are some trade offs for all the material flows that have been evaluated in the following sections.

5.3.1 V type

Having one grocery store serving multiple restaurants, see Figure 5.1, means that either the grocery store expects to have a lot of surplus food or they would divide the food between the restaurants, leading to smaller amount to each restaurant.

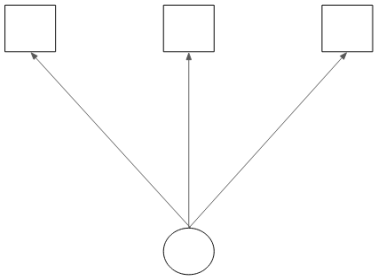

Figure 5.1: V type material flow showing one grocery store supplying multiple stores

By using V type material flow it is more likely that the food will not be thrown away as more restaurants are able to receive the surplus food. According to the representatives from the grocery stores, sorting surplus food into predefined boxes, each intended for one restaurant, requires too much work for them. Rather they suggested that it would be first come, first serve, and if the restaurant that comes first is not able to take everything then some other restaurant has the chance to take what is left. However, this type of system, i.e. first come, first serve, creates a lot of uncertainty for the restaurants, especially the ones coming second or third. They will not necessarily know what has been taken by previous restaurants. Furthermore, if a third party logistics provider is handling the transportation and deliveries, this will perhaps not work. Having a third party logistics provider for this type of material flow is not very convenient since they do not know what type of food it is that the restaurant prefer, if any, nor the amount of it. However, an application as a communication platform may reduce some of the uncertainty by constantly refreshing the stock of available surplus food. It could also be possible for restaurants to get a list sent to them, telling them what surplus food is available, and the restaurants could order it and pay it before getting it delivered.

5.3.2 A type

Here, two or more stores serve one restaurant with surplus food as can be seen in Figure 5.2. Having this type of material flow may be suitable when the restaurant wants a lot of surplus food and more variety. However, a downside is that the transportation and delivery becomes complex.

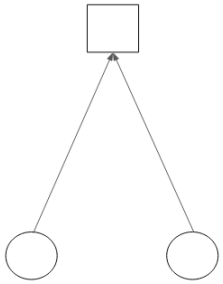

Figure 5.2: A type material flow

This type of material flow is similar to the one used in the pilot project that is ongoing between Nordish Market and three of Coop's grocery stores. So far, that has been successful for all actors. The transportation is handled by Nordish Market given them the change to work in a close collaboration with the stores as no third party logistics partner is involved in the process.

5.3.3 X type

Multiple stores supplying multiple restaurants, as Figure 5.3 shows, can be suitable when restaurants prefer different type of surplus food. This can be the case if there are specific product requests from the restaurants, e.g. if one restaurant only wants all the coffee available while another restaurant wants every vegetable. Thereby, one store is able to provide multiple restaurants with surplus food at the same time as the restaurant gets surplus food from multiple grocery stores. As Zanjirani et al. (2014) mention, when the complexity of the logistics system increases and more members become involved, the role of communication becomes more important. For this type, it could therefore be good to use an application as a communication platform to simplify the information sharing.

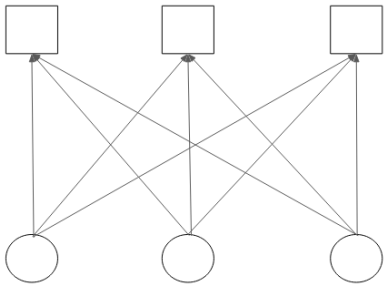

Figure 5.3: X type material flow

Given that a grocery store supplies restaurants with specific products requested from the restaurant, the advantages of using X type material flow is that the sorting can be done by a third party logistic provider since a decision has been made beforehand on what each restaurant will get. It is also more likely that the surplus food will not

go to waste as there are multiple restaurants that are willing to accept it, particularly if the second alternative is the case.

The disadvantages, on the other hand, can be that close relationship will be hard to reach since there are many actors that has to be taken care of for each and every individual actor.

5.3.4 I type

The most simple material flow is the I type where only one grocery store serves one restaurant, as can be seen on Figure 5.4. By having a direct relationship between one store and one restaurant, the complexity in terms of communication and transportation is reduced. If the restaurant is not able to accept the surplus food, there is no other actor to accept the food and therefore there is a risk for the grocery store of having to throw it away which can be seen as a downside of I type material flow.

Figure 5.4: I type material flow

Most representatives, from both stores and restaurants, mentioned that they would want to start with this type of material flow structure. This would give the actors a chance to be in a closer collaboration and allow them to get a better understanding of the material flow. When some experience has been gained they mentioned that it would be easier to change to one of the other material flow structures as they involve more complexity.

6

Conclusion

The conclusion of this master thesis is that supply and demand of surplus food will probably never be completely matched due to the uncertainty that is difficult to handle. Forecasts of surplus food is not possible to make, and should not me made, since the grocery stores of course do want to sell as much as they can through the ordinary food supply chain. To be able to balance supply and demand of surplus food, that is delivered from grocery stores to restaurants, requires having few things in mind.

It is hard for grocery stores to really know what type of food and the amount of food that will become surplus and therefore it is very important to have good relationships between actors and good communication. To begin with, using the I-type material flow is beneficial since that will allow a closer partnership between actors and them to get to know each other. Furthermore, it could be good to start simple, i.e. with only one product category such as fruits and vegetables. This way, the restaurants can get a better feeling of the quality of the food they are receiving and also seeing if there is any trend in the amount and type of food. When more experience has been gained, the actors can expand. The restaurants can decide if they want more product assortments and if they would like to collaborate with more than one store to increase the amount and variety of food. The stores could also see opportunities in supplying more restaurants if there is a high amount of surplus food.

Before transporting the surplus food to the restaurants, grocery stores are willing to store the food for a short period of time. Third party logistics provider would be preferable as a transporter since that is neither the grocery stores nor the restaurants expertise. Delivery frequency should take a part at least two times per week, but even better would be between four to five times a week due to limited storage area at the grocery stores as well as restaurants. Having a compliance between the actors by using crates from Svenska Retursystem would be ideal. The sorting of the surplus food will be done at the restaurants due to their knowledge of what is edible and what is not.

7

Future Studies

A relevant material flow structure that would be interesting to look into is to operate a hub where the grocery stores could store the surplus food before the restaurants would pick it up. A question is, among others, who should be in charge for this hub and operate it, how should the rules be both for the grocery stores that supply the surplus food and the restaurants or other actors that demand the surplus food.

The second phase of the project might include local farmers, wholesalers and other producers where logistic solutions would be combined for all involved actors. Future studies could also look into the logistics problems the project might entail such as lack of information sharing and communication between the parties as well as planning. Further, looking deeper into the monetary values for the different parties might be of an interest. Additionally, including more actors that can make use of surplus food in the system such as wholesalers, schools and charities can be relevant. As said before, the ideal situation would be if no surplus food would exist in the world. Therefore suggested future study is to look into how grocery stores could be more accurate in their procurement's by better forecasting.

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A

Appendix 1

Table A.1: Project Partners, what they do and what they will provide for the project

Who	What	Why
Chalmers Industriteknik	Offers academics consultation within the areas of energy, material, digitalization, design and circular economy	Project initiator
Coop	One of Sweden's largest grocery chain with approximately 650 stores in Sweden	Will give insight on the operations within grocery stores and how they handle surplus food.
Logtrade	An intelligent software for transport administration and digital logistics	Cloud based technology that can be used for storage systems and e-commerce platforms
Martin and Servera	Leading restaurant and catering specialist in Sweden with daily deliveries of food, beverages, and equipment to thousands of customers all over Sweden	Will provide useful knowledge in food delivery for this project
Menigo	Wholesaler for restaurants and catering services. It is one of Sweden's largest food suppliers and is located in eight cities around Sweden	Will provide useful knowledge in food delivery for this project
Paul Svensson Mat AB	Swedish chef and a restaurant owner. One of his restaurants uses rescued raw material both for food and beverages. He has published cookbooks, appeared on television and held lectures	Provides valuable insight from his previous experience
Stockholm Stadsmission	Non-profit organization that works towards reducing food waste by selling food mainly to members with low income	Knowledge and experience in storing the surplus food
Whywaste	Provides a solution for grocery stores where they can keep track of the best-before dates in the stores	Will offer a service where restaurants can access a list of surplus food from stores

B

Appendix 2

B.1 Initiatives to donate and receive surplus food

General questions

- Which organisations and companies are involved in the collaboration?
- Which company or organisations has the overall responsibility?
- How was the collaboration initiated?
- How do the actors communicate?

Donators

- Which are the donors of the surplus food?
- How many donors of surplus food do you have?
- Who initiates the donation, is it you or the donators?
  - Do you ask for surplus food or do the donors ask for someone to receive the surplus food?
- What is the frequency of the donations?
- How large is a typical donation and does it vary much (kg)?
- What kind of food is normally donated? (different categories?)
- Would you accept everything from the donators or do you prefer/reject something?
- How many days before the best-before-day does donations usually occur?

- Does it occur that you get non consumable food?
  - What do you do then?
- What kind of packaging/load units are used for the surplus food?

Transportation

- Who is handling the transportation?
- What kind of truck/vehicle is used?
- How is the transportation planned? (Fixed routes, number of stops etc)
- How is the transportation booked?
- What is the frequency of the pickups at the donators?
- Estimations of the transport costs?
  - Who pays for these?
- Do you use different types of vehicles/load units depending on the type of surplus food?

Logistics centres

- Are any kind of logistics centres/warehouses used between the donators and the receivers?
  - How are these organised?

Receivers

- Which are the receivers of the surplus food?
  - Do you have any regular customers?
- How many receivers of surplus food do you have?
- Do you need to store the food?
  - If so, do you have any storage?

- What do the receivers use the surplus food for?
  - Restaurants
  - Soup kitchens
  - Social supermarkets?
  - 'Food bags'
- Do the final customers/receivers know that it is surplus food?
  - How do they feel about it?
- What is the frequency for the recipients?
- Do the receivers pay for the surplus food?
- Do all the "matkassar" contain the same food?

Others

- Is any kind of traceability system used?
  - If so, what?
- Do you take storage conditions of the surplus food into consideration?
- How do you work with food safety?
  - Manual checks?
  - Equipment to do tests?
- Any important lessons learned?

C

Appendix 3

C.1 Interview Questions for Restaurants

Restaurants that are currently working with Surplus Food

- For how long have you been working with surplus food? Why did you start doing it?
- How many suppliers of surplus food do you have?
- Which are the suppliers of the surplus food?
- How was the collaboration initiated?
- How much (in kg) do you receive per week? Does it vary much?
- How frequently do you get shipments?
- Do you have a set menu or do you adjust it according to what you receive?
- Do your customers know that the food is surplus?
  - How do people perceive it?
- What type of food do you get?
  - Is there anything specific that you especially want?
  - Is there anything you reject?
- How is your storage solution for the surplus food?
- How is the logistic solution, do you pick the food up or do you get it delivered?
  - Who pays for the transportation?

- Who initiates the contact? Do you ask for the surplus food or does the supplier contact you first?
- Is the food donated or do you pay for it?
- At what time during the day do you receive the food?
- Who does the sorting, e.g. between good tomatoes and tomatoes that have gone bad?
  - How much is the percentage you need to do of sorting?

Restaurants that are not working with Surplus Food

Logistics and purchasing

- Time requirements: Discuss around times when you would get the surplus food
- Information need: Can you receive the food later if you know what you will get?
- Transportation: Do you have any existing transport solutions that can be used to pick up food?
- Storage: Can you consider being a storage hub for surplus food for continued transport to other restaurants in the area
- If you would receive surplus food, how much do you want per day (in weight)? /How many meals? And how often?
- If you were to start using surplus food, what conditions would need to be in place?
  - Food is for free or reduced price
  - Delivery is taken care of

  - Receive the food by a certain time
  - Good reputation, CSR
- Is there something special you would prefer or reject?
- Would you prefer to be in collaboration with one supplier or have multiple suppliers?

Preparation

- This is the mix you can expect from the stores. What can you do with it?
  - Frukt och grönt 70% – (Mycket tomtater och mycket gurka)
  - Kött/protein 2%
  - Mejeri 1%
  - Bröd 20%
  - Kolonial 5%
- Different ideas for using surplus food
  - Cook a complete lunch with it
  - Cook a complete dinner with it
  - Prolong the shelf life by conserving etc and serve parts of it in existing meals
  - Part of the salad buffet
  - Other ideas?

Customer Offer

- Ideas on how to market 'the surplus food rescue' towards customers?

D

Appendix 4

D.1 Interview Questions for Stores

Current amounts

- How much surplus food and food waste do you have (in kgs)
  - Per day
  - Per week
- Does the amount of surplus food vary much?
- What type of food is mostly surplus? (percentage of each)
  - Fruits and veggies
  - Protein
  - Dairy products
  - Bread
  - Colonial
  - Is it possible to get some data
- How long before the best before date does the food become unsellable at the stores?
- How long in before or after the best before date would you be willing sell/donate the surplus food?

Current activities

- Is there any process you follow when it comes to food that is reaching its best before date e.g. reducing the price, giving/selling to charities, etc.?
  - If so, what do you do with it?
  - What handling do you do?
  - How is the transportation planned?
  - How many initiatives do you have?
- Do you have any definitions of surplus and food waste?
  - What is the difference?
- At what time do you go over the shelves and pick out food?
- What kind of packages/boxes do you have for the food you pick out?
  - Do you have different for different assortments?
- How big is this store (in sqm)?
- What is the storage capacity (in sqm)?

Set-up with restaurants

- Would you be willing to:
  - Store all surplus and food waste in a package/load unit
  - Sort out surplus food from food waste (in other words separate edible and non-edible)
  - Divide the surplus food in deliveries to different restaurants
  - Are there any challenges you see with that?
- For you to do this, what would you like in return?
  - Nothing
  - Economical compensation
  - Joint marketing with the restaurant/restaurants
- What would be a suitable package/load unit to store the surplus food?

  - Roll-cage
  - Pallet
  - SRS/grå backar
  - Other

Transport

- When, during the day, would it be best for a transporter to pick up the surplus food?
- Number of pick-ups per week?

Communication

- How would you like to communicate the supply of surplus food with restaurants?
  - Telephone
  - Email
  - Whywaste platform
  - Not at all
- How far in advance could you communicate to the restaurants which food will be available for them?

E

Appendix 5

E.1 Questionnaire

Background - Type and size of restaurant

- What does your restaurant serve?
- If you serve lunch, what service type do you offer?
- If you serve dinner, what service type do you offer?
- How many consumers do you have per day?
- Where in Sweden is the restaurant located?

Serving of surplus food

- Do you receive or buy surplus food?
- From what type of organization do you receive or buy surplus food from?
- If you do not receive or buy surplus food, could you consider doing so?
- How important are the following factors when deciding if you should receive surplus food?
  - Easy to order
  - Ok price
  - Delivery of surplus food with the regular supplies
  - Flexible delivery times
  - Possibility of choosing what you get delivered
  - The surplus food is quality sorted before delivery

  - Number of days before the best before date

- How interested are you in receiving the following product types of surplus food?
  - Fruits and vegetables
  - Dairy
  - Protein (meat, fish, etc.)
  - Dry goods
  - Bread
  - Frozen goods
- How many kg of surplus food per week would you like to receive (estimated)?
- How many times per week would you like to receive deliveries?
- At what time during the day would you like to receive deliveries of surplus food?
- If you were to serve something from surplus food, how would you do it?
- Which arrangement for serving surplus food would be interesting for your business?
- In what way do you believe the majority of the restaurant's customers would react if you were to start using surplus food?
- Why do you believe it will be positive/neutral/negative?