Tampere University

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FOOD PRODUCTION AND CONSUMPTION

Reducing food waste in the Finnish food industry

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ABSTRACT

April Hautala: Food production and consumption: Reducing food waste in the finnish food industry: Reducing food waste in the Finnish food industry
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The objectives of this research include to identify food production and consumption patterns in the Finnish food industry and to explore the degree of food wastage in the Finnish food industry. In addition, the thesis evaluates the challenges of food management in the Finnish food industry due to food wastage. The aim was also to identify the strategies adopted for the reduction of food wastage in the Finnish food industry and how the strategies helped to tackle the challenges.

For achieving these objectives qualitative methods and data collection were used. The empirical data was gathered from 7 participants from the Finnish food industry during the Summer of 2023. The findings of this study revealed that food wastage is a major issue in Finland, where households are a major contributor to it. At the same time, supply chain inefficiencies also contribute to food wastage. In addition, it was found that food wastage impacts the environment and wastes the efforts applied to food production. However, there are several strategies that are applied to overcome food wastage in Finland, such as using data analytics to understand consumer demand. Therefore, to further improvise the strategies, it was recommended to use a data monitoring system to monitor wastage.

Keywords: Food Industry, Sustainability, Food Wastage, Food Management

The originality of this thesis has been checked using the Turnitin Originality Check service.

PREFACE

This thesis of the master was conducted and completed at the department of Leadership for Change. This thesis project contributed to the completion of my master's program in Governance for Sustainability and Tampere University.

I would like to dearly present my thanks to my supervisor at Tampere University, Helena Leino. Thanking my supervisor for the companionship and support along with the whole journey towards the completion of my master's program. I have truly and wholeheartedly appreciated all of your advice for my master's thesis, especially for the things that you taught me at Tampere University.

Finally, I would like to thank my family and friends, who always supported me and were always there for me, as well as encouraged me throughout my studies and the thesis of my master's program.

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LIST OF ABBREVIATIONS

Terms	Abbreviations
CAGR	Compound Annual Growth Rate
UN	United Nations
SPSS	Statistical Package for the Social Sciences
E-COM	Electronic-Commerce
AI	Artificial Intelligence
KPIs	Key Performance Indicators

1 Introduction

1.1 Background

Food is one of the basic necessities of humans to survive on earth, and this is counted as a basic need of human beings since they exist in the world. With the pace of time, as the population is increasing, food production and consumption are also increasing. In the race to produce and consume food, there are numerous countries such as India, Pakistan, and Finland are wasting food in huge quantities (Eigenbrod & Gruda, 2015).

The population of the world is being increased, and it is projected to reach around 9.8 billion individuals by the end of the year 2050 (Searchinger et al., 2019). Furthermore, this increase could lead the world towards a huge ratio of food poverty and food insecurity, which have to be noticed by the world, and specifically, those countries must have to observe this issue that is highly involved in food wastage, for instance, Finland. In the entire world, around 30% of the food is wasted individually. In the Finnish food industry, approximately 25 kilograms of each individual within a year are wasted (Kopittke et al., 2019). This is leading the Finnish food industry towards a huge kind of food waste.

In addition, it has been noticed that global warming all over the world is being increased, and the wastage of food is becoming the major reason as the huge amount of food is being wasted by the Finnish food industry, which is directly contributing to the increment of the global warming because the wasted food could be able to generate the greenhouse gases which is damaging the environment of Finland and also in the entire world (Leeson, 2018). Other than that, De & Goswami (2021) claimed that the world combined is producing a huge amount of food, which is enough for the world's population to fulfil their needs of having food. However, this is not becoming possible because people all around the world are wasting 40% of food, which could be enough for millions or billions of individuals who are surviving in the world due to food poverty. In addition, Chen et al. (2020) highlighted that around 2.5 tons of food are thrown away by people who have excess amounts of food, which is gradually increasing food poverty and insecurity food in the entire world, specifically Finland.

It has been observed that the major reason behind food wastage in the Finnish food industry is the gap between food production and food consumption, which is created by the weak supply chain of the Finnish food industry. This gap must be reduced by the Finnish food industry in order to reduce food wastage in the country, which is highly contributing to global warming (Silvennoinen et al., 2015). Other than that, the supply chain of the Finnish food industry could play a key role in the sustainability of the food in the country. The major flaw in the Finnish food industry is that they have a weak supply chain, due to which the produced products arrive late to the retailers, and the retailer has to throw away the products due to the end-of-expiry data (Kymäläinen et al., 2021). This issue is leading the Finnish food industry towards a huge waste of food each year. To cater to this issue of the wastage of food by the Finnish food industry, the industry has to make its supply chain strong and make the distribution channel of the supply chain reliable and efficient. In this manner, the Finnish food industry could be able to provide the delivery of food to the retail chain to reduce the gap which exists between the production of food and the consumption of food (Lehtokunnas et al., 2022).

It has further been observed that, due to reducing food wastage among the people in Finland through the Finnish food industry, the economic and welfare conditions of the country could become better. Moreover, due to the reduced food wastage, the people of Finland need a minimum amount to be spent on their feed, and this can lead them to buy their other necessities. In this manner, the fulfilment of their other basic needs keeps them in good and effective economic conditions (Heikkilä et al., 2016). In addition, it has also been noticed that reduced food wastage could lead the society towards the enhancement of the welfare system, as the leftover food could be donated by the individuals in Finland, which could help the country in reducing food poverty and insecurity of the food from the country. These effects of the reduction of food wastage could be beneficial for society and also the environment of the entire country (Betz et al., 2015).

Furthermore, there are a few causes due to which food wastage is being increased in the Finnish Food industry, which include "lack of appropriate planning", "extra storage of food", "Lack of accurate distribution channel", and "errors in industrial processing" (Caldeira et al., 2019). However, planning for food consumption and production is compulsory before making the start of consuming or producing it. There are numerous businesses which are linked with the Finnish food industry which are producing food without measuring the demand for the food in the market, and this is causing the availability of excess amounts of food into the markets, which are expired by being in the stores' shelves (Jeswani et al., 2021). Other than that, the excessive storage of food by consumers is the major cause of food wastage in Finland. It is well-known that the world is suffering from inflation and bad economic conditions due to the habit of individuals not storing huge amounts of food for bad times in future, which is highly responsible for food wastage in the Finnish food industry (Jörissen et al., 2015).

Food in Finland can be counted as the major cause of environmental influence. Other than that, when it comes to assessing the climate individually within Finland, "agricultural", "food industry", "retailer of food", "wholesalers of food", and "household" are combined, affecting the environment in Finland and contributing highly into the global warming (Närvänen et al., 2020). Around one-quarter of the climate impacts are due to these sectors, which are directly related to the Finnish food industry. Also, it has been noted that these sectors are influencing the water supply system of Finland because of "eutrophication". Furthermore, it has been proved that food wastage is environmentally wrong, and this should be reduced by making some kind of strategies which can help make the environment better and suitable for the people who are living in the country (Malefors et al., 2019). Additionally, the reduced gap between food production and consumption should be balanced by the Finnish food industry as a significant step towards the enhancement of the environment. Although, among the households in Finland and the Finnish food industry, the major contributor to food wastage is the Finnish food industry as they are wasting a huge amount of food, which is directly affecting the environment and the climate of Finland (Kymäläinen et al., 2021).

1.2 Research Aim, Objective and Questions

The food industry all over the world has increased efficiency. However, with the pace of time, since the food industry of the world's different countries has been enhanced in terms of their performance and profitability, the food waste ratio all over the world has similarly increased (Hartikainen et al., 2018). In addition, the ***aim*** of this research is to explore the way through which food wastage can be reduced within the Finnish food industry with the assistance of production and consumption.

When it comes to the accomplishment of the aim of the study to explore the topic, the objectives always remain important through which the study could be completed and reach the desired outcome (Jörissen et al., 2015). The following are the research ***objectives***:

- To identify food production and consumption patterns in the Finnish food industry.
- To explore the degree of food wastage in the Finnish food industry.

- To evaluate the challenges of food management in the Finnish food industry due to food wastage.
- To identify the strategies adopted for the reduction of food wastage in the Finnish food industry.

According to Närvänen et al. (2020), the food industry can be considered the most prominent industry for revenue collection by different countries all over the world. However, the food industry of Finland is increasing day by day, as Beretta & Hellweg (2019) claimed that the food industry of Finland would earn a total revenue of around 17.13 billion dollars by the end of the year 2023. It has a growth rate of approximately 1.73%, which is far better than the previous years. Subsequently, Kuokkanen et al. (2018) have noticed that every year in Finland, around 25 kilograms per person of food is wasted, which is highly contributing to global warming as the wasted food in Finland generates greenhouse gases. This was the major ***problem*** which needed to be catered to by this research.

On the other hand, Tikka (2019) claimed that, the ratio of food poverty in Finland was around 10.80%, which is being increased due to the wastage of food. In addition, Kuokkanen et al. (2018) highlighted that from the year 2016 to the year 2020, it had been observed food hunger in Finland remained the same, which is approximately 2.50%. These were the issues on which the current research has worked.

Following are the research ***questions*** which have been used while extracting the data in relation to the study's topic

- What are food production and consumption patterns in the Finnish food industry?
- What are the challenges of food management in the Finnish food industry due to food wastage?
- What are the strategies adopted for the reduction of food wastage in the Finnish food industry?

1.3 Research Rationale and Significance

Food can be considered the most crucial for human lives. However, there are a number of countries which are highly contributing to food wastage, and that is the reason that poverty all over the world is constantly increasing (Silvasti, 2015). In addition, Salonen et al. (2018)

highlighted that the best way to reduce food wastage all over the world is to balance food production and food consumption. The governments of those countries which are highly contributing to food wastage should have to make policies regarding food wastage and keep an eye on the balance between food production and food consumption. This could be helpful for those countries such as Finland, which are wasting food in huge quantities and at the same time facing food poverty and food insecurity.

Other than that, Salonen et al. (2018) pinpointed that for the purpose of reducing food wastage, the governments of specific countries, such as China, India, Finland, and Pakistan, have to take some actions against food wastage and must take some government-level strategies which could prove as helpful and viable strategies in order to reduce the food wastage. Furthermore, food wastage is increasing global warming as it could be able to produce greenhouse gases which are directly hitting the environmental conditions of the entire world.

Also, Salonen (2016) claimed that the international food security forums, which are working under the supervision of developed countries, must take action against the Finnish food industry, and the forums should pressure the Finnish food industry to make some strategies which can cater to the issue of food wastage into the country. These were the ***rationale*** due to which the study was finalised with the topic of "food production and consumption: reducing food waste in the Finnish food industry".

This research was conducted on the topic of "food production and consumption: reducing food waste in the Finnish food industry", which is directly in relation to the food industry of Finland. This is why this research will provide more ***significance*** to the Finnish food industry directly and indirectly to Finland as the enhancement in the Finnish food industry could enable entire countries to lower their food poverty and food insecurity ratios. However, this research will also be significant for the society of Finland, as the society will be improved in terms of its food sector. All the individuals will get out of the risk of food insecurity and the risk of food poverty. Other than that, this research will similarly be significant all over the world, as with the help of reduced food wastage, Finland's contribution to global warming will be decreased, and this can be a positive point for the entire world.

1.4 Structure of the Study

Aimed at the completion of the research in the right manner, the appropriate structure has been made, which has been followed throughout the study as indicated in ***Figure 1***.

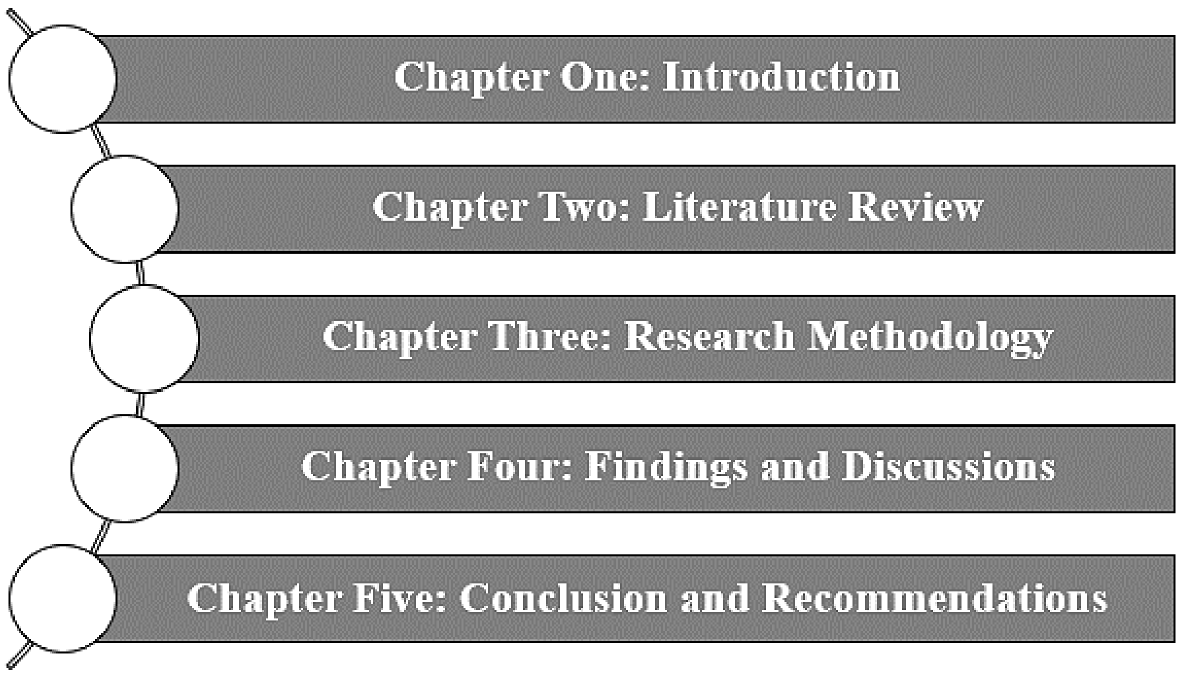

Figure 1 Structure of Research

Source: (Illustrated by Own)

1 Introduction – This chapter indicates the background of the study, research aim, research objective, research questions, and the research problem. In addition, the rationale of the study and the significance of the study is also presented in this chapter.

2 Literature Review – This chapter consists of several viewpoints in relation to the topic of the study that had been presented previously while completing the studies which were close to the current study's topic. Other than that, the theoretical framework also exists in this chapter, which provides the link of the study's topic with the numerous theories.

3 Research Methodology – The entire methodology through which the study was completed within the study had been presented in chapter three.

4 Findings and Discussions – This chapter showed the entire findings of the study, which had been extracted from the interviews conducted by the different participants.

5 Conclusion and Recommendations – This chapter is completely based on the conclusion of the study. All the perspectives which had been observed from the collected data from the previously completed studies.

2 Literature Review

This chapter is based on three different components, such as the reviewing of the research literature in order to understand the different perspectives which have been formulated previously.

2.1 Food Production and Consumption Globally

In the countries which exist all around the world and individually, the business had produced food items to feed individuals all over the world, which was approximately 9.4 billion tons. In addition, Rohr et al. (2019) claimed that the world's countries are combined, producing enough amount of food that can be served to the billions of people who exist in the world. However, the scarcity of food and food poverty still exist there because the distribution of food is wrong and has not been focused on by any individual, company, or country. In contrast, Springmann et al. (2016) argued the amount of food needed by the individual who is living in the world is enough. However, food is being wasted by the countries or the individuals who have excess amounts of it. Around 30% of the total production of food is being wasted, and companies, individuals, and groups of people are involved in this damage.

According to the study done by Lehtokunnas et al. (2022), it has been claimed that from the year 2015 to the year 2021, the increment in food consumption was observed as approximately 2.5 billion metric tons of food were consumed in the year 2021 all over the world. Differently, Silvennoinen et al. (2015) criticised that where food consumption is being increased, food wastage is also increasing all over the world. In addition, Samberg et al. (2016) pinpointed that from the total production of food from all around the world, approximately 17% of the food was wasted, which about 61% of food was wasted by the household, 26% wasted by the food services providers, and around 13% was wasted by the retailers of food.

According to the study completed by Kirchhelle (2018), it has been highlighted that countries around the world are producing enough amount of food that can be consumed by individuals as per their needs. However, it has been noticed that there is a gap between the production of food and the consumption of food. This is becoming the major cause of food wastage all over the world. This is because the food that is being produced is according to the demand raised by the market and people all over the world. In this manner, the gap is a reason for food wastage. However, Berners-Lee et al. (2018) argued that the weakness of the supply chain is contributing to food wastage all around the world. Due to the weak supply chain, the produced food cannot be reached at the time of the market and is wasted while in the process of distribution. In this manner, the supply chain is the major contributor that is creating the gap between food production and food consumption.

According to the research done by Crist et al. (2017), it has been identified that there are numerous countries all over the world which are known as developed countries. However, India and China are the top countries that are producing huge quantities of food and contributing towards the food poverty and food insecurity which exist in the entire world. Other than that, Ray et al. (2019) claimed that individually, China is hugely contributing to the world's food production as China is producing around one-fourth of the total food produced in the world. China is an economically, financially, and domestically stable country which is having the most advanced and the most efficient technologies, which are leading them in the world's food production. However, Schader et al. (2015) pinpointed that, when it comes to the production of food, the name of India cannot be ignored. After China, India is one of the most developed and economically stable countries which produce, producing around 275 million tons of food and contributing to food poverty in the whole world.

2.2 Worldwide Food Wastage

A study completed by Manzocco et al. (2016) stated that it had been identified that the world is facing hunger and food poverty on one side. On the other side, people are wasting food and are having an excess amount of it. Food insecurity and food poverty are not there in the world because of the lack of food. However, it is there because people do not understand the importance and the value of food, which they are wasting in huge quantities. Contrastingly, Misiak et al. (2018) argued that food poverty, hunger, and food insecurity all over the world exist due to the lack of appropriate distribution of food into the world by businesses and the food industries. To cater to this issue individually, the food industries of numerous countries have to highlight this issue and start working on it to reduce food wastage in their countries.

Furthermore, Baig et al. (2019) demonstrated that food wastage in the world is contributing to food poverty and food insecurity. However, it is also influencing the global environment. the greenhouse gases are being generated by the wasted food of people from all over the world, which is increasing the adverse impacts on the environment. Exposure to greenhouse gases is similarly damaging the natural environment along with the natural resources and the water. In contrast, Boliko (2019) argued that if the food industries all over the world make some strategies towards the reduction of food wastage in their countries, they could benefit from the reduction of food wastage as they could get the opportunity to develop food security and also, they could motivate the healthy food system in their countries. Other than that, Guo et al. (2020) pinpointed that it is not that the food industries and the governments of different countries all over the world are ignoring the issue of food wastage in their countries. However, the food industries of the entire world have started working on food wastage and finding out the solutions towards the reduction of food wastage in their countries.

Additionally, the research done by FAO (2024) indicated that it had been identified that environmental sustainability is linked with food wastage. The increment in food wastage by global countries could adversely impact the sustainability of the environment all over the world. In contrast, Dou et al. (2016) claimed that there are numerous countries such as the UK, USA, China, and Finland which are already focused towards sustainability in the environment and food wastage is grabbing back these countries from being concentrated towards the improvement of their environment among the world.

Munesue et al. (2015) pinpointed that there are several countries in the world including China, India and Finland, that are a major contributor to food waste. These are the huge contributors in relation to food wastage all over the world. Alsaffar (2016) criticised that China is wasting approximately 92 million metric tons of food on a yearly basis which is the highest ratio of food wastage all over the world. Other than that, India wastes around 69 million metric tons of food yearly, which can be counted as the second-highest ratio of food wastage in the entire world. However, Schott et al. (2016) argued that when it comes to food wastage in China and India, Finland is also a contributor to food wastage in the world. Every year, Finland wastes approximately 160 million kilograms of food, which is the major cause of food poverty and food insecurity in the country.

2.3 Growth of the Finnish Food Industry

Finland is well known for the quality of its food products, especially when consumers demand healthy and organic food products from the Finnish food industry. The Finnish food industry is expected to grow with a Compound Annual Growth Rate (CAGR) of 4.11% from 2024 to 2028 and currently amounts to around $18.48 billion. In addition, the largest segment of the Finnish food industry is Dairy and Egg products, which amounts to around 3.61 billion (Statista, 2024). Moreover, Finnish food production is based on sustainable practices, which support the production of high-quality food, whereas the climatic condition of Finland reduces the risk of diseases in plants and damage of pests, due to which the pesticide residue is lower, increasing the quality of food. However, despite keeping high standards for producing quality food, the industry is challenged by the waste of food, which impacts the sustainable measures of the food industry. However, Lehtokunnas et al. (2022), on the basis of the conducted study, highlighted that the Finnish food industry is contributing positively to the management of food in Finland. However, the Finnish food industry is catering to issues which are arising on a regular basis regarding the management of the food in the country. Contradictorily, Heikkilä et al. (2016) argued that the Finnish food industry is growing day by day and expanding the circle of delivering services. It has become the largest exporter department of Finland's government and collects huge revenues for Finland, assisting the food to be exported to Europe. The growth of the Finnish food industry can be analysed by the revenues which are being collected by the Finnish food industry through exporting food items to Europe. Furthermore, Lehtokunnas et al. (2022) pinpointed that it has been noticed that, in the year 2022, around 20% of exports of the Finnish food industry increased as compared to the year 2021. The total exports done by the Finnish food industry in the year 2022 were counted as approximately 2.1 billion Euros. In this manner, the growth of the Finnish food industry is clear, and it is protecting the entire food Finnish food industry from going towards the crises as the previous years.

Moreover, Jeswani et al. (2021) identified that, despite all the positive points, the Finnish food industry has continued to fail in order to stop food wastage in the country. This is leading Finland towards becoming a huge contributor to global warming as the greenhouse gases extracted from the wasted food heavily damage the environment. In addition, Jörissen et al. (2015) claimed that the total food wastage all around the world is 30%, and this is being increased by the Finnish food industry as they are wasting approximately 25 to 30 kilograms per person on a yearly basis.

The above-listed results are considered interesting and relevant in terms of this thesis because it has been identified by various researchers that Finland has their own food industry, which was established in order to cater for the different issues related to food and manage food management effectively. Also the identified studies also indicated that the Finnish food industry showed a drastic increase in 2022 when compared to the previous year, 2021, and it was around 20% of the exports of the Finnish food industry, which was approximately 2.1 billion Euros. This also increases the positive point for the Finnish food industry to manage the entire food management and food industry in an appropriate way in order to maintain such an increasing trend. The Finnish food industry, while growing, still has challenges when it comes to food wastage. Lastly, it was identified that, despite these opportunities, the Finnish Food Industry has seemed to fail in stopping food wastage in the country. This is leading Finland towards a huge contributor to global warming as the greenhouse gases extracted from the wasted food damage the environment heavily, which was taken politely by the Finnish food industry previously and would trigger the industry to work more on food wastage and maintain the global warming factor from their food management procedure.

2.4 Degree of Food Wastage Food Industry

Närvänen et al. (2020) completed a study in which it has demonstrated that the habit of wasting food simply contributes towards unsustainability. This is because of the adverse influences of food as a substantial material and similarly because of the procedures through which the raw material of the food should have to go through. In addition, food production is impacting around 30% of the climate change in Finland. Other than that, Malefors et al. (2019) claimed that in the year 2015, the United Nations (UN) reported that except for China and the USA, all the other countries are heavily contributing to climate change and having an adverse influence on environmental sustainability. This is because the countries which exist in the world except China and the USA are becoming the reason for the emission of greenhouse gases which are generated through food wastage.

Furthermore, Kymäläinen et al. (2021) pinpointed that the food produced and not eaten in Finland under the supervision of the Finnish food industry produces around 3.3 billion tons of greenhouse gases, which are heavily damaging the environment. Hartikainen et al. (2018) claimed that, to an extended degree, the Finnish food industry is wasting food and damaging the sustainability of the environment. It has been observed that, in the year 2017, around 890,000 people were surviving food poverty in Finland, which is approximately 16.4% of their total population. Differently, Närvänen et al. (2020) argued that it had been noticed that the Finnish food industry is wasting food hugely, as on a yearly basis, the Finnish food industry is expected to waste around 139084.025 tons of food. This is because it is being claimed all over the world that after China and India, Finland is the country which is wasting a huge amount of food yearly.

Beretta & Hellweg (2019) pinpointed that the UN has assessed that, primarily, greenhouse gases are generated from different regions, which include the North American region, Europe region, and Asian region. Within the Asian region, the emission of greenhouse gases is very low because there is high food poverty and food insecurity, specifically in sub-Sahara Africa. However, Kuokkanen et al. (2018) argued that the emission of greenhouse gases is high in the European region because Finland is a European Union country member, and it is highly wasting food while having the supervision of the Finnish food industry. The food material is based on vegetables and meat, which produces greenhouse gases in Finland. Tikka (2019) criticised that when it comes to the degree of food wastage, the UK cannot be ignored as they are also a contributor to global warming food wastage. The UK also exist in the European region along with Finland and produces approximately 170 million tonnes of greenhouse gases each year, which is a huge contribution towards global warming.

Silvasti (2015) argued that if food wastage is an economic issue, then it must be considered a social issue in Finland. The excessive degree of food wastage in Finland is creating social inabilities among the people. Additionally, there are numerous people living in Finland who are surviving due to food poverty, and in this manner, food wastage is affecting the people living in Finland socially. Differently, Sala et al. (2017) pinpointed that the population all over the world is increasing at a high pace, and this needs countries all over the world to produce goods in high quantities. In this manner, if Finland did not reduce food wastage, they could face a high ratio of food poverty and food insecurity in their country. Other than that, Rohr et al. (2019) criticised the global forums that are responsible for measuring and managing the population all over the world have provided an alert to the world that the population is increasing at a high pace, and this will lead the world towards having approximately 9.8 billion population. This increment in the population will obviously need more food, and this could be done by the countries of the world if they can reduce their food wastage, which is affecting the human, economic, and social environments of numerous countries.

2.5 Challenges of Food Management in the Finnish Food Industry

Mancosu et al. (2015) identified that, despite all the advantages which the Finnish food industry provides to the government of Finland in terms of revenue. It has been observed that there are numerous challenges, such as "changes in consumer preferences and habits", "weak supply chain", "inappropriate data regarding food consumption", and "Lack of efficiency to invest" regarding food management in the Finnish food industry because of the wastage of food. In addition, Silvennoinen et al. (2015) claimed that the challenges which are being faced by the Finnish food industry are restricting them from reducing food wastage in the country and also leading them towards an undesirable way, which is the unsustainable environment.

2.5.1 Changes in Consumer Preferences and Habits

The study completed by Samberg et al. (2016) has highlighted that the production of food items is completely based on the demand created by the consumers. However, in this current era, it has become a challenge to analyse when consumers ' preferences and habits can change accurately. In this manner, it has become a challenge for the Finnish food industry in relation to food management due to the food wastage issue. Other than that, Kirchhelle (2018) argued that the consumer's preferences and habits could be changed in the period time between the production and the distribution of the goods. Once the consumers' preferences and habits change, the food industries related companies could have to stop procuring the same food items. Otherwise, they might face the challenge of change in the consumers' preferences and habits as faced by the Finnish food industry. In addition, Berners-Lee et al. (2018) claimed that the consumers who exist in Finland are broad-minded and choosy individuals who can change their minds to buy the products within a few days. Due to this challenge, the Finnish food industry is facing a huge contribution to food wastage by their country. Primarily, the time between production and distribution is creating this challenge for the Finnish food industry in relation to food management due to food wastage issues.

2.5.2 Weak Supply Chain

Crist et al. (2017) conducted research and also identified that there is the huge importance of a strong supply chain network by food manufacturing companies. This is because, after producing the food items, the food industry-related companies left the very short period of time in which they have to distribute all the goods which they have manufactured. Otherwise, the manufactured items would reach their expiry date, and the food industry must have to waste them. Similarly, Ray et al. (2019) highlighted that the Finnish food industry is facing the major challenge of having a weak supply chain network, due to which they are becoming contributors to wasting food in their country. Additionally, Schader et al. (2015) argued that the Finnish food industry could reduce food wastage by supplying the produced food items more days before their expiry date. However, this will require them to have more financial resources, which they are currently lacking.

2.5.3 Inappropriate Data Regarding the Food Consumption

Manzocco et al. (2016) completed a study that also identified that the accuracy of the data could be considered the most important information through which the Finnish food industry could have remained protected from the issue of food wastage. In addition, this has not been done by the Finnish food industry, and they have not collected accurate data about the market consumption, due to which they are currently facing challenges in relation to food management. However, Misiak et al. (2018) argued that the data accuracy could completely change the scenario of the Finnish food industry regarding the issue of food wastage. The right data collected from the market about the consumption of the products by individuals within Finland restrict the Finnish food industry to the specific limit of producing food-related items.

Dou et al. (2016) identified that the change in consumer preferences and habits could lead any industry, such as fashion, food, automobile, and healthcare, towards the wastage of their manufactured products. This is because the producer of the goods makes the products in bulk quantity to fulfil the demand of the consumers, and if they change their preference and habit of buying the same products, the products will be wasted by being on the shelves of the supermarkets. Differently, Munesue et al. (2015) claimed that the Finnish food industry is facing the challenges of changes in the preferences and habits of consumers regarding the products related to the food. In this manner, they must have to adopt the strategy which can be called the frequent collection of market data. In addition, Alsaffar (2016) highlighted that the frequent collection of data could lead the industry towards accurate data collection, which can be helpful in making the appropriate decision making.

Betz et al. (2015) further highlighted that, only by collecting the data from the market, the Finnish food industry could not reduce the issue of food wastage, and similarly, they were not able to appropriately complete the task regarding food management. In addition, the Finnish food industry needs to adopt some strategy regarding the issue of food wastage while facing the challenge of inappropriate data regarding market consumption. However, Caldeira et al. (2019) argued that the Finnish food industry lacks the appropriate market consumption data, which is leading them towards food wastage in their country. In this manner, to overcome the challenge of inappropriate market consumption data, the Finnish food industry must adopt a strategy which can be called the use of data analytics. Furthermore, Mancosu et al. (2015) pinpointed that data analytics could help the Finnish food industry reduce food wastage by providing an accurate interpretation of the collected data. This can similarly be helpful for the Finnish food industry in order to recognise the changes in the preferences and the habits of the individual which exist in Finland's market.

Lastly, Samberg et al. (2016) identified that the Finnish food industry is lacking in investment through which they could make amendments to the operations regarding food wastage. Additionally, Silvennoinen et al. (2015) claimed that the Finnish food industry should collaborate with the government in order to enhance their efficiency in investing in the operation regarding food wastage. In this manner, they could reduce food wastage by minimising the challenges faced by them.

2.5.4 Lack of Efficiency

Baig et al. (2019) pinpointed that for the purpose of changing the system within the entire industry, the industry needs the appropriate investment, which can help them to make strategies as the resource. In this manner, the Finnish food industry is currently facing a lack of efficiency which is related to the financial conditions. Basically, the Finnish food industry is currently dependent on the exports of the food-related items they are exporting in Europe and gaining revenues. In addition, Boliko (2019) argued that to be efficient, the Finnish food industry must have to generate revenue from numerous sides. In this way, they could become able to invest in making the issues regarding food wastage in Finland.

2.6 Strategies Adopted for Reduction of Food Wastage in the Finnish Food Industry

Guo et al. (2020) study claimed that food wastage in the Finnish food industry is increasing frequently, which is impacting Finland's environment and also challenging their decision-making regarding food poverty and food insecurity within the country. Other than that, FAO (2024) pinpointed that, despite all the challenges, there is a chance for the Finnish food industry to grow and reduce food wastage in the country, which can be majorly significant for the environment, society, and the entire world. The way through which the Finnish food industry can get out of this situation is directed towards the adoption of some strategies which can be suitable for the Finnish food industry regarding the reduction of food wastage in their country.

2.6.2 Improvement in Supply Chain Network

Schott et al. (2016) also highlighted that a strong supply chain could be considered the strongest part of the food industry. This is because, within the food industry, the food must be distributed within a short period of time, and a strong supply chain can play a role in distributing the goods quickly to the market. However, Kymäläinen et al. (2021) claimed that the Finnish food industry is currently facing the challenge of a weak supply chain, which is becoming the reason for the high ratio of food wastage in the country. Additionally, this challenge needs to be catered to appropriately by the Finnish food industry through the adoption of a long-term strategy. Furthermore, Lehtokunnas et al. (2022) argued that the best strategy that can be adopted by the Finnish food industry towards the challenge faced by the Finnish food industry named as weak supply chain would be the improvement in the supply chain network. Additionally, while adopting this strategy, the Finnish food industry would keep its focus on making improvements to its supply chain network and distributing its products within the least period of time from the production unit to the market. However, Heikkilä et al. (2016) pinpointed that keeping the focus on supplying the goods early to their final stage will provide the opportunity for consumers to buy their choice of products with high quality and have long expiry dates mentioned on them. In addition, if this strategy of improvement in the supply chain network is adopted by the Finnish food industry, this industry could be the leading one as they are being appraised in Europe already and earning huge revenues from there.

2.7 Key concept: Systems Management Theory

According to the research finalised by Kirchhelle (2018), it has been identified that there are numerous theories regarding the management of the organisation, such as "scientific management theory", "system management theory", "contingency theory of management", and "Theory X and Theory Y". However, Crist et al. (2017) claimed that the system management theory is able to cater for the issue which is being faced by the organisation. Moreover, this theory suggested a substitute strategy towards the management and planning of the organisation regarding the challenges and problems faced.

According to the study completed by Ray et al. (2019), it has been highlighted that the system management theory mentioned that businesses are similar to the human body, as there are numerous body parts in the human body which work combined to complete the task. Similarly, there are several components of the business which have to be managed to complete the task combined. In addition, Baig et al. (2019) pinpointed that, according to the system management theory, the different components of the business include the marketing department, finance department, supply chain department, and production department. Primarily, they all must have to work together in order to overcome the challenges faced by the business.

According to the studies done by Purwanto (2020), Żmieńka and Staniszewski (2020), it could be said the Finnish food industry could use the system management theory in order to reduce issues such as food wastage regarding the food management. Purwanto (2020) states that the management of systems which process foods and mix all the ingredients necessary to be maintained properly could result in the prevention of food wastage. On the other hand, Żmieńka and Staniszewski (2020) state that food wastage could be reduced efficiently by managing the food processing systems. Additionally, the system management theory identified that the different components could work together to achieve a specific task. Similarly, the Finnish food industry could use the finance, planning, and supply chain departments altogether in order to reduce food wastage by managing the production and consumption of food items. The system management theory defines processes, for instance, like a human body, comprised of several components that perform their work simultaneously and harmoniously so that the human body can work properly and optimally (Knyazeva, 2020).

There are several strategies that are available for the Finnish food industry to prevent food wastage and overcome the challenges as identified from the responses of participants, such as product planning, inventory management, raw material sourcing and collaboration. These strategies are well aligned with the Systems management theory, which promotes collaborative working to overcome the issues faced by industries, organizations and sectors. The collaborative possibilities which are being emphasised by the systems management theory are as follows. Collaboration between food manufactures and food retailers, which could be defined as that the food retailers can tell the food manufacturers to produce only the required amount of the food products and goods, which could result in the reduction of food wastage. Collaboration between the food retailers and consumers, which is defined as the consumers can only buy the required amount of the food without overstocking and the food retailers can also help the consumers by putting sales on the food products.

In my thesis, I am using this system management theory for the reason that system management theory would be considered helpful in identifying the various aspects of the food management industry and issues, challenges and factors concerning food wastage and management. Therefore, these theories are taken into consideration. On the basis of these theories, Finances, planning and supply department settings can be made in the Finnish food industry for the reduction of food wastage by managing the production and consumption of food items, especially in Finland within the Finnish food industries.

3 Research Methodology

3.1 Research Philosophy

According to Tamminen & Poucher (2020), when it comes to the completion of the study, the research philosophy can be considered the most crucial component of the study as this could help the author to find the appropriate belief regarding the phenomenon in relation to the topic, which can assist the entire study in attaining the research questions by collecting the relevant data. To select the research philosophy, there are numerous ways, which include "realism research philosophy", "pragmatism research philosophy", "positivism research philosophy", and "interpretivism research philosophy". These research philosophies could help the author to collect the different natures of data, such as subjective and objective data, in relation to the topic (Nguyen et al., 2021).

With the aim to complete this study in the right way, the author has chosen the "interpretivism research philosophy", as this study aims to explore the way through which food wastage can be reduced within the Finnish food industry with the assistance of production and consumption. The exploration can be done easily while using the interpretivism research philosophy, and this was the major reason behind the selection of this research philosophy at the time of completing the study (Jandrić & Knox, 2022).

Similarly, the author of this study has analysed numerous justifications for using interpretivism research philosophy in this study. As Al-Ababneh (2020) highlighted, subjective data collection could be close to reality because it is based on the multiple perspectives of the author, which have been mentioned in the previously completed studies. Also, Jandrić & Knox (2022) pinpointed that the use of interpretivism research philosophy can lead the study towards the actual experiences of the individuals, which helps in understanding the current study's topic.

3.2 Research Approach

There were different choices that could have been made by the author to select the right research approach, which includes the "inductive", "deductive", and "abductive" (Fardet et al., 2021). The author has made the most suitable choice of research approach among the choices, and that was the "inductive research approach". This choice of inductive research approach was made to plan the procedure regarding the exploration of the ways through which food wastage can be reduced within the Finnish food industry with the assistance of production and consumption (Gupta et al., 2022).

As Liu (2016) claimed, the inductive research approach could be a meaningful approach in order to gather the data from the bottom to narrow the study's topic. However, Fardet et al. (2021) highlighted that with the use of an inductive research approach, the study could lead towards the desired findings with flexibility, as this approach can closely link the study towards the collected data.

3.3 Research Design

According to Liu (2016), when the study needs to be completed in a proper manner, the research design must have to be selected appropriately. Research design can be known as the techniques, tools, and methodology that could be used within the study. In order to select the research design, there were several choices which could have been made by the author, including "explanatory research design", "exploratory research design", "descriptive research design", and "action research design". All of these kinds of research designs could be used by the authors in order to gain information by using different tools, techniques, and methods (Thomas & Lawal, 2020).

In order to collect the right information regarding the study's topic, the author chose the "exploratory research design". It was the most suitable choice towards the aim of this study which was to explore the way through which food wastage can be reduced within the Finnish food industry with the assistance of production and consumption. Other than that, the exploratory research design helped the study in relation to the data collection according to the study's topic by covering the research objectives and research questions (Singh, 2021).

According to Thomas & Lawal (2020), for the appropriate selection, it is compulsory to select the justified method while finalising the study. In addition, the selection of the research design was appropriate as it was completely rationalised by observing the claims made by the previous authors. As Lo & Hew (2017) claimed, exploratory research design could remain helpful in discovering the information in relation to the topic of the study by catering for the research questions of the study. Other than that, Singh (2021) highlighted that while having a challenging data collection procedure, the exploratory design helps in gathering complex data in relation to the topic.

3.4 Research Strategy

Research strategy is referred to as activities of the research that support the researcher to achieve their proposed aim and objectives (Saunders et al. 2015). Therefore, by developing a research strategy, researchers are able to organize their collected data, report their findings and answer their research questions. There are several research strategies available for a researcher to select from, such as case studies, interviews, surveys and observations, which support the researcher to answer research questions. Therefore, the researcher in this study opted for interviews as a research strategy as it was the best fit for this research as it supported gathering in-depth information related to food wastage in the food industry of Finland. Roberts (2020) has discussed the benefits of the interviews as a research strategy, stating that they provide access to detailed information. Similarly, Döringer (2021) discussed that through interviews different perceptions and views can be explored by the researchers. However, Knott et al. (2022) argued that conducting interviews requires communication, listening and social skills, which can be challenging for many researchers. At the same time, Osborne & Grant-Smith (2021) argued that interviews are time consuming and are always at the risk of respondent biases and require appropriate planning for selecting participants.

3.5 Choice of Research Method

The author has used the qualitative research method in a mono manner. Moreover, the study, throughout the procedure of completion, used the qualitative research method individually and collected the primary data, which was in the form of subjective data, to accomplish the aim of the study by exploring the topic of the study (Hennink et al. 2020).

However, the selection of the research methods for the study must be justified, and by observing this, the author has initially analysed the justification that had been provided by the past studies regarding the use of qualitative research methods in the study. As Busetto et al. (2020) pinpointed, the qualitative research method could be the most viable and suitable method as this can directly focus on collecting the subjective data only, which can provide in-depth information regarding the study's topic. Also, Hennink et al. (2020) claimed that comprehensive data could be gathered regarding the study's topic with the use of qualitative research methods.

3.6 Selection of Data Collection Method

Furthermore, with the aim to explore the numerous ways which can minimise food wastage in the Finnish food industry with the help of the production and consumption of food, the study has revealed that the primary data collection method had been used for the purpose of collecting the first-hand information from the participants. The author has used structured interviews as the data-gathering strategy among the various available options. This is because the study needs to extract subjective data only, which consists of the experiences, opinions, and phenomena in relation to the topic to explore it appropriately. The use of structured interviews as the data gathering strategy helped the study completely accomplish the research questions and objectives of the study (Mottron, 2021).

In addition, Salīte et al. (2016) claimed that the researchers must use rationalised methods that can assist them rightly in order to compete for the research in the right manner. This is because the author has initially observed the justification that has been provided by the previously completed study regarding the use of structured interviews as the research strategy. As Huynh et al. (2018) highlighted, interviews could be considered a useful data-gathering strategy while finalising the study as this could provide flexibility in gathering the subjective data in an authentic form directly from the participant. Other than that, Salīte et al. (2016) identified that it permits the author to alter the research questions according to the requirement of the study in relation to the data collection.

There was a total of ten participants through which the interviews were conducted and lasted for 30 minutes. The author conducted the interviews and collected the most relevant and authentic data from the participants associated with the study's topic (Busetto et al., 2020). Participants were interviewed and collected the data concerning the study's topic. Furthermore, the participants were contacted through Linked In, and interviews were taken through face-to-face interaction. The interviews were conducted in 2023, in which ten questions were asked from the participants which can be seen in Appendix 1.

The findings were extracted from the interviews with seven respondents. However, initially, 10 participants were selected but due to different commitments, only 7 participants showed their availability. The respondents were contacted through LinkedIn, and face-to-face interviews were conducted with them after obtaining their consent. In addition, each interview took 15-20 minutes of participant's time.

Table 1 Participant Characteristics

Participant Code	**Company**	**Interview Duration**	**Role**
Participant 1	Reste	15 mins	Employee
Participant 2	Compass-Group	15 mins	Employee
Participant 3	Saarioinen Oy	15 mins	Employee
Participant 4	Paulig	15 mins	Employee
Participant 5	Vaasan Oy	15 mins	Employee
Participant 6	Kotipizza Group	15 mins	Employee
Participant 7	SOK	15 mins	Employee

3.7 Eligibility Criteria

According to Tamminen & Poucher (2020), the eligibility criteria are known as the setting of standards for the inclusion and exclusion of the participants while considering their eligibility for the study according to the need of the study. This study needed authentic and relevant data, which could have been provided by the actual participant and could be considered as the closest to the study's topic. This is because the study has set some principles for the inclusion and exclusion of the participants, which include ***Specific Age*** was one of the eligibility criteria which was set out by the author while finalising the study. In this manner, the study has set that the participant's age must be above 18 years while responding to the interview questions. Less than 18 years of age, the participants will not be eligible to provide responses to the interview questions (Nguyen et al., 2021).

Spoken Language was another eligibility criterion which has been set out by the study regarding the collection of primary data aimed at the study's topic. Furthermore, the study has set the English language as the eligibility criteria for the data collection by the participants. The reason behind the eligibility criteria for Language was that English is considered the most readable and understandable Language in the world, and collecting the data within the English language can help the study interpret the data easily (Jandrić & Knox, 2022). Also, the ***experience*** was also set as the eligibility criteria of this study in order to select the participants for the data collection within the study. The participants were asked about their experiences, and the individual who had less than one year of experience was rejected. Only the participants who had around the experience of between 1 to 10 years of experience were selected for the data collection regarding the topic of the study (Fardet et al., 2021).

3.8 Analysis of Collected Data

According to Williamson (2021), analysis of the collected data must be appropriate as the analysed data could reach the study towards the desired outcomes. Furthermore, different options are available that can be selected as the data analysis technique, for example, "content analysis technique", "thematic data analysis technique", "grounded theory analysis", "Statistical Package for the Social Sciences (SPSS) software", and "E-views". All of the mentioned data analysis techniques could provide assistance in order to analyse the collected data. However, the study selected the thematic data analysis technique (Williamson, 2021).

The thematic data analysis technique helped the study interpret the data collected from the interview participants. Other than that, thematic data analysis has made the interpretation easy by providing a way of interpreting the collected data with the help of six specific steps. There are numerous stages, which include "becoming familiar with the data", "generating initial codes", "Searching for themes", "reviewing themes", "defining themes", and "write-up" (Al-Ababneh, 2020). Through the analysis of the data gathered from interview responses, the researcher was able to develop four mains identified for the extraction of information. These main themes were Food Production and Consumption, Food Wastage, Challenges of Food Management and Strategies Adopted for the Reduction of Food Wastage. These were organized to answer the proposed research questions of the research.

Table 2 Themes

Objectives	Research Questions	Main Themes	Sub-Themes

To identify food production and consumption patterns in the Finnish food industry	What are food production and consumption patterns in the Finnish food industry?	Food Production and Consumptions	Food Needs of the Population
To explore the degree of food wastage in the Finnish food industry	What are the challenges of food management in the Finnish food industry due to food wastage?	Food Wastage	Demand of Food Products
To evaluate the challenges of food management in the Finnish food industry due to food wastage		Challenges of Food Management	Supply Chain Inefficiencies and Consumption
To identify the strategies adopted for the reduction of food wastage in the Finnish food industry	What are the strategies adopted for the reduction of food wastage in the Finnish food industry?	Strategies Adopted for the Reduction of Food Wastage	Strategies for Reducing Food Wastage.

3.9 Limitation

The limitations within the study can be related to the different tasks, for instance, the limit of using the research method, the limit of using the data collection method, and the limit of covering the topic by collecting the limited data concerning the study's topic. Similarly, the study, while finalizing, has faced different limitations which have restricted the current study from exploring the study's topic more comprehensively. However, the major limitation was the use of only qualitative research methods. This study has used only qualitative research methods in which the primary data was collected, which were in the subjective form. If the study had used the quantitative research method along with the qualitative research method, the study could have been able to gather more comprehensive data concerning the study's topic. Other than that, the study must have been completed within a short period of time, which was one year. These were the limitations which restricted the study from being completed by having more comprehensive results.

3.10 Ethical Considerations

According to Young et al. (2020), applying the appropriate ethical rules to protect human participants is typically considered essential in any research. However, the research for which the ethical consideration is considered relates to the qualitative study. Ethical issues are considered very prominent once in-person interviews with professionals and individuals are directed. As a result, they might feel uncomfortable talking about their feelings during the interview sessions.

In this study, consideration was given to the following list of significant ethical issues, which includes, according to Liu (2016), the following prerequisites must be satisfied to obtain consent: the consenting party must be competent to provide their permission, and the participant must give voluntary consent. In other words, participants in a study must be sufficiently educated about the research, comprehend the subject matter, and have the option to decide to participate in the interview sessions.

For the ***informed consent***, the criteria would be set in which all the participants would be required to provide their personal information with written and informed permission to each that information for the research purpose only. Every participant would be considered voluntary towards explaining the study's objectives and the data collection procedure. They were given enough time to ask questions and express any concerns Oliva (2019). The importance of their voluntary engagement was emphasised. It was clear that the participants withdrew from the interview at any point if they felt uncomfortable with the questions asked during the interview sessions. The flexibility to leave the study at any moment, even after signing the informed consent form, was fully disclosed to potential participants. They were also asked for their consent to record the interview on camera. The participant consent sheet and the informed consent form were available in English (Hammarberg et al., 2016).

Moreover, Huynh et al. (2018) define ***confidentiality*** as eliminating or changing any personally identifying data provided by participants. On the other hand, ***anonymity*** denotes the absence of any information that could be used to identify a specific individual. In contrast, during the data collection, analysis, and information related to the study results, the respondent's confidentiality and anonymity remained safe and protected by hiding their personal and confidential information and identities. The environment of the interview sessions ensures confidentiality and privacy are strictly upheld throughout the sessions, data analysis, and overall study findings. This way, the research will maintain anonymity and secrecy, and the participants' private information will also be secured (Gupta et al., 2022).

4 Findings and Discussion

4.1 Findings

The discussion in this section is divided into four categories and presented as main themes for extraction of findings from the responses of the interviews. 4.1.1 is the first main theme that discusses Food Production and Consumption Patterns, and 4.1.2 is the second main theme discussing Food Wastage. Moreover, the next main theme, Challenges of Food Management, is discussed in 4.1.3, and the last main theme is discussed in 4.1.4, which covers Strategies Adopted for the Reduction of Food Wastage.

4.1.1 Theme 1: Food Production and Consumption Patterns

The Finnish Food Industry has been catering to the food needs of the population of Finland, resulting in the growth of the food industry in Finland due to rising demand for food products. However, the food industry of Finland is challenged with the management of food production and consumption. The major food production of the Finnish food industry is meat, eggs, milk and potatoes. On the other hand, most of the food products consumed in Finland are not native or local products. Therefore, to identify the food production and consumption in the Finnish food industry to explore its development, the following questions were asked from the participants.

> *Over the last decade, how would you describe the development of the overall Finnish food industry?*

> *As an employee at your Company, what have been the key sectors of development in your company? If you think the last 5 years, are there issues where the company has made larger changes because of the demands raising from the Finnish society?*

Through these questions, the researcher aimed to explore the food production and consumption patterns in Finland while exploring the development of the food industry linked with food production and consumption. Participant 1 said:

> *The Finnish food industry has maintained a strong focus on food safety and quality, which has contributed to its positive reputation both domestically and*

> *internationally. Digitalization has increasingly made its way into the Finnish food industry, with companies adopting new technologies for production, distribution, and marketing. This included innovations in food processing, supply chain management, and Electronic-Commerce (E-COM). We also see that food industry has experienced some major development from health and sustainability perspective. Like many other countries, Finland had seen a growing emphasis on healthier and more sustainable food options. Consumers were increasingly interested in locally sourced, organic, and environmentally friendly products. This has led to increased demand for organic and sustainably produced foods.*

Similarly, Participant 4 said:

> *Sustainability is on top of the agenda in most food & beverage companies. The change has accelerated during the past five years after the Paris Agreement and UN Sustainable Development goals. Also, the upcoming regulations related to sustainability and consumer awareness are driving the change.*

Participant 5 said:

> *Food industry has taken, e.g. climate change strongly on the agenda, as we can see from the carbon neutrality and emissions reduction targets. Also, more focus on sustainability issues, food loss, etc., partly due to demand from the customers such as the big retailers SOK and Kesko. Plenty of companies communicate more about their sustainability, even in marketing campaigns. Healthiness of products has also risen to the agenda stronger. Brands are being challenged by private labels, especially during past few years.*

At the same time, Participant 6 said:

> *The rise of sustainability – consumers think about packaging and are showing rising interest of vegan and vegetarian options.*

These responses determine that in the last decade, the food industry of Finland has observed significant development in terms of food production and consumption. However, most of the participants agreed that sustainability was a major development in the food industry of Finland. The participants also agreed that consumers these days demand sustainable food products which resulted in significant changes in the food industry of Finland. Whereas to explore the sectors of development in the companies of respondents different perceptions of participants were explored. For instance, Participant 7 said:

> *Sustainability, digitalization, online store, and delivery concept development have all became increasingly important, due to the economic situation and inflation, maintaining cost-efficiency and to be able to provide consumers products with low prices is very important.*

Participant 1 said:

> *Some major sectors of development related to food that we use in order to keep the business running, has risen from sustainable development discourse. It has created a need to evaluate our internal processes from sustainability viewpoint together with business plans and strategies. While the work is still undergoing and is continuously under development it has created changes, e.g., related to employees and how we address and organize introduction to sustainable practices and how these relate to existing practices. Also, it has affected to supply, product development, customer touchpoints and brought overall new layer of governance related commitments and policies which have been created.*

Participant 5 said:

> *Cost efficiency in terms of energy, food loss, materials and resources. Centralizing production, committing to sourcing domestic flour for products baked in Finland.*

Participant 6 said:

> *In the production of Kotipizza food products, waste is rarely generated because at Kotipizza, products are always made to order. However, occasionally a wrong topping might end up on a pizza, and these pizzas are then sold in the*

ResQ Club. The ResQ Club app is also used in situations where, for instance, a bag of ham is close to its expiration date. In such cases, for instance, a double ham pizza can be created for sale to prevent food waste.

Participant 6 further said:

Food waste is a more relatable and straightforward concept for many people, making it easier to recognize and address compared to complex issues like climate change. I think this is the more contributing factor to make changes and easy topic to communicate to consumers.

From these responses, it is determined that sustainability, digitalization, online store sales, and cost efficiency were the major developments in different food-producing companies addressing the rising demands of Finnish society. Therefore, it can be extracted that people in Finland are concerned about sustainable food consumption while reducing the waste generated from irresponsible consumption of food such as food waste.

Thus, the major findings from these responses are that people in Finland have exerted pressure on the food industry to incorporate sustainable practices in their food production processes so that waste in production is reduced or eliminated. At the same time, due to this demand, the food industry has been focused on digitalization, sustainability, cost efficiency and online sales to reduce food wastage.

4.1.2 Theme 2: Food Wastage

Food wastage mostly occurs when the food is not appropriately consumed or excessively produced, exceeding the demand. As a result, food wastage is not just about wasting food. It impacts on the environment, raising the concerns over sustainability. Food production is not an easy process; it requires many resources, and when it is wasted, resources such as efforts of producers, water, growing and harvesting, transportation and packaging all are wasted too. At the same time, with increased wastage of food environmental pollution also increases as food wastage increases production of methane. Therefore, to explore the degree of food wastage in Finland, the following questions were asked from the participants:

From your viewpoint, how do you see Finnish food industry is approaching the issue of balancing the production and consumption of food?

The global statistics of food wastage are 30% of production. How do these differ from that of Finland?

These questions were asked from the participants to observe the differences between Finland and the world in terms of food wastage to identify the efforts being placed by the food industry of Finland to maintain the balance between consumption and production of food while comparing the figures of wastage from the world. The responses of participants in this regard were different; for instance, Participant 1 said:

Balancing food production and consumption is a complex challenge, and it requires a multifaceted approach involving various stakeholders. The Finnish food industry, like many other food industries around the world, have been addressing the issue of balancing food production and consumption through a range of strategies and initiatives aimed at sustainability, reducing food waste, and promoting responsible consumption.

The perception of Participant 4 was quite different, whereas the response was:

Excess production of food is not the key driver to food waste if that is what you mean. Production is always based on demand from our customers.

Participant 5 said:

Managing food waste carefully. Many companies are committed to the target to cut food loss in half by 2030. Food waste is a cost, so it makes a lot of sense to minimize it. Of course, it needs to be balanced with customer demand.

Participant 6 said:

Companies do a lot to avoid food waste (still a lot to do), but I think the biggest problem is probably with the consumer throwing away food. For companies, there is clear business incentive to avoid food waste, why companies may be taking the topic more seriously.

These responses supported in determining that the Finnish Food industry is focused on reducing food wastage by maintaining the balance between production and consumption and managing the food wastage. However, participant 4 provided a different perception as they believed that food wastage can be reduced when it is produced as per the demand of the customer. Therefore, the view of Participant 4 is much more acceptable as wastage is reduced when the demand arises. As a result, the risk of food wastage during production is mitigated, and the food is consumed appropriately. In addition, Participant 5 also agreed with the notion that production and consumption can only be balanced when demand is increasing. As a result, the production is only increased when the demand is high, which is not only cost-effective but reduces the wastage generated from overproduction. Moreover, when the participants were asked with the comparison of global food wastage with respect to Finland. Participant 7 said:

> *According to an expert institution in Finland, Luke, the percentage of food waste is slightly smaller in Finland than globally. There are a lot of good food waste data and information from the Finnish context, provided by Luke. In Finland, the biggest share of food waste is created in homes. Therefore, we as a society, must focus also on education and understanding ways to tackle food waste at homes.*

However, Participants 5 and 6 shared similar responses:

Participant 5 said:

> *I don't recall seeing such a figure for Finland since it's challenging to estimate as we both import and export food. I believe the Natural Resources Institute in Finland is developing data collection and conducting research around it as part of the requirement to report food loss and waste also to the EU going forward.*

And Participant 6 said:

> *I don't know what the statistics for food waste in Finland are. Probably much more as Finland is a welfare state, and therefore food is maybe taken for granted and not appreciated as much.*

The responses of Participants 5 and 6 demonstrate that due to the welfare nature of Finland, food wastage is higher as people take the food delivered to them for granted. However, it was observed that none of the participants was able to provide a response in detail as there was no such data available in terms of food wastage in Finland. Therefore, the findings from the responses determine that there is limited data available which could determine the contribution of Finland to global food wastage. Hence, to mitigate and control food wastage in Finland, it becomes important that food production is balanced with the demand of customers rather than producing in bulk quantities, which ends up as wastage.

4.1.3 Theme 3: Challenges of Food Management

The food industry globally generates a significant quantity of food waste, resulting in a major challenge in food management. In Finland, food wastage is one of the major problems, in which the major contributors are Finnish households. At the same time, food wastage contributes to climate change due to consumption of resources. Thus, when food is wasted, it results in environmental degradation and the generation of methane gas, resulting in global warming. Therefore, when food wastage is reduced, it supports managing the need for agriculture, leaving room for land, water and other types of resources. Moreover, the food industry also contributes to generating food wastage by producing excessive demand due to many reasons, such as the short expiry of products or the short shelf life of the product. Resulting in massive food rotting and filling of land sites. Therefore, to evaluate the challenges associated with food wastage in Finland, the following questions were asked from the participants:

> *In your opinion, what are the reasons for a gap between the production and consumption of food in Finland?*
>
> *Lastly, how do you see supply chain developments for reduction of food wastage both globally and in Finland?*

Through these questions, the researcher tried to identify the challenges that the Finnish food industry faces when dealing with food wastage. These challenges were important to explore as their solutions required strategies to mitigate them. Therefore, the exploration of challenges was important to develop strategies for reducing food wastage. In this regard, the response of Participant 1 was:

The biggest reasons for a gap between production and consumption of food in Finland are supply chain inefficiencies in the food supply chain. These inefficiencies can lead to losses at various stages, from harvesting and processing to distribution and retail. Factors such as transportation delays, inadequate storage facilities, and improper handling can result in food spoilage and waste.

Participant 1 further said:

Seasonal variations in the availability of certain food items can lead to fluctuations in supply, potentially resulting in surpluses or shortages, both of which contribute to waste. Secondly, consumer behavior plays a significant role in the food waste gap. Consumers may purchase more food than they can consume, leading to leftovers that eventually go to waste. Misunderstanding date labels, overbuying during sales, and reluctance to use imperfect or near-expiration products contribute to this issue. This might also involve with lack of awareness. Some consumers and businesses may not be fully aware of the environmental and economic consequences of food waste, leading to a lack of motivation to reduce waste.

Participant 2 said:

Yeah, I think there are. There are many reasons to basically that you know the demand and the offer don't meet for one reason or another. If I think about food service providers, I think the most important thing is to plan carefully so. If we look forward of what the actions might be to resolve the issue is that you know it's very important that we plan carefully whether a grocery store or a food service provider is what is actually what will be considered.

Participant 5 said:

Plenty of reasons concerning the full value chain with consumers playing a key role in being aware of the food waste they create at home, e.g. by not knowing what they have in the fridge before buying something new. Also, retailer's ability to manage the demand.

However, Participant 4 was unaware of the gaps in production and consumption, as evident in their response:

> *I am not aware of the gap you are referring to and therefore, I am unable to answer this question. In our operations, there is no gap between the production and consumption of food. We produce food products only based on demand.*

These responses demonstrated that supply chain inefficiencies are the major challenges that disturb the patterns of food consumption and production. The factors that contribute to inefficient supply chain systems and disturbing production and consumption gaps are transportation delays, inadequate storage facilities, improper handling, seasonal variations, consumer behavior misunderstanding date labels, overbuying during sales, and reluctance to use imperfect or near-expiration. As a result, the customers make excessive purchases which they are unable to consume appropriately resulting in increased wastage of food products. Thus, these were some challenges of the gap between production and consumption of food in Finland. As a result, the participants were asked about supply chain developments of the future to reduce food wastage in Finland and globally. The responses of participants in this regard were;

Participant 2 said:

> *I think co-operation is the key. It's what we for us and what we order from our suppliers, what kind of amounts do we expect to purchase so that we cooperate all the way through that for us as if we don't expect to purchase something, it won't be produced because you know for us, for us the biggest amount of ours. Carbon footprint is generated from food products, of course. And the most important issue is to or one of the most important issues there are. There are several of those, but managing our climate footprint is also reduction of food waste so that the food is not produced at all. So, it goes all the way through that food chain from the plate to suppliers.*

Participant 7 said:

> *The co-operation in the supply chain is very important. For example, a company's waste, could turn out to be other company's valuable ingredient. Also, in order to develop planning and estimations that fit every store's individual*

needs, we need a very close communication with the suppliers of those products.

Participant 4 said:

Side streams of food production could be used more and thus, more value could be created from the raw materials that the food production gets from the nature. Side streams could be used for upcycled food products but also other products such as cosmetics and textiles.

Participant 5 said:

A lot of companies have the issue on their agenda, but the collaboration and data sharing between companies needs to be tightened and better to be able to tackle the issue as a whole.

These responses determine that collaboration and co-operation between producers and suppliers are important to eliminate food wastage and balance the gap between production and consumption of food in Finland, as inefficiencies in the supply chain create a gap in supply and demand due to which people often purchase more than their requirements. In addition, the responses determine that when inefficiencies in supply chain systems are reduced, production can be started as per the demand. Thus, it can be determined that when supply chain disruptions are observed, food wastage in the food industry is increased, whereas consumer behavior also contributes to increasing food wastage.

4.1.4 Theme 4: Strategies Adopted for The Reduction Of Food Wastage

It is observed that nearly one-third of the food that is produced for consumption ends up in wastage every year. As a result, it not only loses the natural resources used for production purposes but also increases the risk of food insecurity. However, the wastage of food is common at the end of consumers, especially in developed countries as compared to low-income countries. Therefore, there is a need to implement strategies that prevent food wastage and sustain the balance between production and consumption while reducing environmental impacts. Moreover, with the wastage of food, economic benefits are also reduced as the wastage is unable to generate profits for the producers. Thus, to identify the strategies adopted for food wastage reduction in the food industry of Finland, the following questions were asked of the participants:

> *Currently, there are several strategies being implemented to reduce food wastage in the global food industry. In what ways is your company and the Finnish food industry in general contributing to this reduction?*
>
> *Referring to the strategies you have identified, what future challenges does your company face concerning the management of food wastage?*
>
> *If you were part of the top management, which other strategies would you propose besides the identified ones for responsible food production and consumption?*

These questions supported gaining information related to the strategies that are beneficial for food wastage reduction. In addition, it was important to explore these strategies to understand the efficiency and effectiveness of these strategies in overcoming food wastage in Finland. Therefore, in response to these, different strategies were identified contributing to overcoming food wastage.

Participant 1, in this regard, said:

> *The Finnish food industry from my perspective, is quite active related to food waste reduction. For example, an interesting development have been in the packaging innovations. The industry has explored innovative packaging solutions that help extend the shelf life of products, thereby reducing food spoilage. Also, cross-sector collaboration between industry, government agencies and non-governmental organizations has been instrumental in driving efforts to reduce food wastage in Finland. It is also worth mentioning that circular economy initiatives (e.g., Motiva's material efficiency commitment) emphasize continuous work with food waste.*

Participant 2 said:

> *I think we're contributing a lot. We have. We are very conscious of food waste and we cooperate with our suppliers and our contract clients and our*

consumers. For instance, we do food waste management and reduction. All the way from creating a new recipe into reducing plate waste. So, we target storage waste. For instance, storage waste, we target kitchen waste so that where we prepare the food, we target buffet. Waste when we have food, we serve mostly food on the face, and then of course, we target the weight waste and we have specific actions in each of these areas. So, I think, the Finnish market is very conscious about food waste and it's very important that each of the US operators in the in the field.

Participant 7 said:

S Group actively develops its product planning, estimations, and supply chain efficiency, with an aim to also reduce food waste. We have concepts, that reduce food waste in stores, such as discounts (-30% and -60%) for products that are about to expire. We also sell veggies, fruits and bread, that do not anymore fit our quality level, with a very low price in boxes or bags. These kinds of concepts are very much liked by our customers. Also, we communicate about the importance of reducing food waste and try to help our customers in their daily life, for example by offering a lot of "food waste recipes" online. Our company's food waste has decreased by 18%, when comparing to year 2014.

Participant 6 said:

In our company – we combat food waste by carefully planning recipes, sourcing raw materials (e.g. changing the sourcing country based on seasonality), and managing inventory turnover to prevent waste during earlier stages of food preparation.

These are some responses that provide an understanding of strategies that are currently applied in the food industry of Finland. The perceptions and effectiveness of strategies are presented differently, but they all were contributing to the reduction of food wastage. The strategies applied in the food industry that were explored are packaging innovations, cross-sector collaboration, product planning, estimations, supply chain efficiency, planning recipes, sourcing raw materials, and managing inventory. Thus, these are some strategies that the Finnish food industry is applying to minimize food wastage. However, it was important to explore the challenges associated with these strategies, so the participants were asked about the future challenges referring to the strategies in food wastage management. In response, Participant 1 said:

> *There are many challenges we have recognized. Probably main issues we have currently discussed relate to awareness and education about the food waste. Continuing to raise awareness and educate consumers, employees, and stakeholders about the importance of reducing food waste can be a long-term challenge. Sustained efforts are needed to maintain the focus on this issue. Some other issues we might encounter is with logistical and distribution challenges. In this globalized food market, we like many other companies may face logistical and distribution challenges, especially in regions where access to certain products is limited. These challenges can increase the risk of food spoilage and waste (amongst other risks).*

Participant 2 said:

> *Well, the majority of food waste is generated from our buffets. So, from the food that is on display and buffets, and it's not consumed. I think I'm not sure if it's a challenge, but maybe an opportunity is to increase the communication.*

Participant 4 said:

> *Reducing food waste requires actions and collaboration from all value chain partners (raw material producers, food manufacturers, consumers and out of home channel operators (e.g. hotels, restaurants, cafes, workplaces, hospitals, schools). Biggest challenge is to change consumer behavior. Food manufacturers do not produce food to be wasted.*

Participant 5 said:

> *Making sure that the food loss minimization does not result in loss in sales.*

The responses of participants determine that strategies applied for reducing food wastage are likely to challenge the Finnish food industry in terms of changing consumer behavior, raising awareness and educating consumers, employees, and stakeholders about the importance of food wastage reduction to protect the environment. However, the perception of Participant 5 in terms of challenges associated with the applied strategies for reduction in food wastage was about the loss in sales. Therefore, it can be determined that the food industry is at risk of making losses with the reduction in food wastage strategies. In addition, changing consumer behavior is also a challenge to reducing food wastage in the Finnish food industry. Therefore, to further explore other strategies that could be applied to overcome the identified challenges with respect to already applied strategies, the participants were asked to propose strategies for responsible food production and consumption. The responses of participants in this regard were quite different from one another. Participant 7 said:

> *Active follow-up of existing concepts and an active follow-up and enough resources to develop new innovative food waste products or concepts.*

Participant 5 said:

> *Our top management plays a key role making sure that our equipment, systems and processes are in place to minimize food loss and that every employee knows their role and has relevant skills and possibilities to affect in waste prevention on their part.*

Participant 6 said:

> *For our company, improving the data quality and accuracy (which we are doing constantly).*

Participant 4 said:

> *We could do more in driving sustainable consumption of food e.g. through packaging, recipes and marketing.*

Participant 1 said:

> *I would probably give some attention to data analytics and Artificial Intelligence (AI) and what these can offer, how these technologies could help companies better predict demand, optimize inventory, and reduce food spoilage through data-driven decision-making. Advanced data analytics and artificial intelligence*

> *have been increasingly used in supply chain management globally but in food service, these are still not widely in use.*

Participant 2 said:

> *First of all, food waste is one of our key strategic Key Performance Indicators (KPIs) for our company, so it is at the core of our business strategy already and you know the way that we manage it is of course that we go. Deep into the details of the food process. Yes, and then we monitor, I think one of the key issues is that we already actually do is monitoring food waste and reacting on those results. So, measuring food waste and understanding for instance, which food is more popular than the other.*

The responses of the participants supported in determining that participants suggested to utilize data analytics to overcome the challenge of food wastage while setting systems and processes leveraged from AI. For them, it is one of the best strategies to bring precision to the efforts of reducing food wastage in the Finnish food industry. Therefore, with the data analytics and use of AI, the strategies applied to overcome food wastage can be further improved and the strategies that are not efficient and effective and raising the challenges can be eliminated from the practices.

4.2 Discussion

4.2.1 Food Needs of Population

Food is one of the major and important global needs of people, but the imbalance between its demand and supply is a major issue that is dealt with by many underdeveloped and developing countries (Kirchhelle, 2018). The countries that are well-developed are somehow managing their food requirements by focusing on reducing the gap between demand and supply of food for the population. Furthermore, food sustainability is one of the major concerns that is focused on when food production and consumption are discussed (Misiak et al., 2018; Boliko, 2019; Guo et al., 2020). In addition, food production and consumption are playing an important role in the economic development of a country, and it is not limited to food production but also represents the quality of food of the population of the country. Despite the fact that most countries are profoundly growing ten times more food than they actually need for their population. However, unequal distribution of resources is affecting the distribution of food in developed and developing countries.

The food industry in any country plays an essential role in catering to the food needs of the population. At the same time, many countries are producing surplus quantities of food which has the potential to feed billions of people around the world (Rohr et al., 2019). Despite surplus production of food in many countries, the issue of poverty and food insecurity is still present which raises concerns over the utilisation of food, its production and consumption. These concerns are directly linked to the ways food is consumed and wasted due to irresponsible consumption. Moreover, Lehtokunnas et al. (2022) found that nearly 2.5 billion metric tons of food were consumed alone in 2021 in the world. Therefore, the figure demonstrates that with this much consumption, the wastage of food has also increased. At the same time, in Finland, 135 Kgs of milk products are consumed, 77 kgs of meat, 15 kgs of fish, 85 kgs of cereals, 11 kgs of eggs, 64 kgs of vegetables and 55 kgs of fruits are consumed on an average (Mikkola, 2023).

Meanwhile, the food industry is observing growth and development due to the changing consumption and production patterns of the Finnish population. For instance, in 2022, 3kgs of consumption for cereals increased, 48kgs of wheat consumption increased, and 8kgs for rice increased (Mikkola, 2023). On an average, it has been observed that Finnish households generate around 25 kg of food waste per person, and the amount that is wasted on food wastage is accounted to be around 500 million euros annually. Therefore, the consumption and production of food products have a great impact on the environment. In addition, dairy products and vegetables are mostly thrown out as compared to any other food product due to short shelf life and expiry dates. As a result, the food industry is developing itself to cater for the needs of the population.

The findings of this study also indicate that the rising demand for food products is exerting pressure on the Finnish food industry to increase its production so that the rising food needs of the population are addressed. However, the responses revealed that sustainability is a prime focus for the Finnish food industry to support consumption and production patterns while reducing the wastage of food. Moreover, according to the interviews, the food industry in Finland is increasing digitalization in its operations to support food demands and address wastage. Moreover, it was found that several food-producing companies in Finland are focused on online sales to address the demand for food products while ensuring that everything that is produced is consumed appropriately by Finnish consumers. The interviewees demonstrated that significant changes are taking place in the Finnish food industry in the production and consumption patterns of consumers in Finland, reflecting the changes in their behavior while working on preventing wastage through cost efficiency.

However, Raheem (2020) found digitalization has been implemented in the Finnish food industry to optimize its value chain and maintaining the balance between consumption and production patterns. Further, it was noted that the Finnish food industry produces high-quality food products and has a keen focus on environmental protection, representing efforts for sustainability. Thus, the quality and high food security are supporting the Finnish food industry in other countries importing food from Finland, resulting in the development and growth of the Finnish food industry. Lehtokunnas et al. (2022) explored the development of the Finnish food industry and found that exports of the food industry increased by 20% in 2022. Therefore, it is determined that the Finnish food industry is sufficient in producing enough food that is able to cater for the demand of the Finnish population and their consumption; in addition to self-sufficiency, the food industry is producing surplus quantity that is exported to other countries supporting the economic growth of Finland.

4.2.2 Demand of Food Products

Food wastage is a major issue in Finland, which is identified from the views of respondents of the industry as the food products that are produced in Finland are either not consumed fully or they are overly purchased by the consumers, resulting in their wastage. In addition, the responses of participants also indicated that when the demand from consumers is overlooked, it often ends up in excessive production of food, which results in wastage if the product has a shorter shelf life. As a result, the wastage of food impacts the environment by generating methane gases, affecting the sustainability of the environment. These findings align with the previous findings of Hartikainen et al. (2018), who also reported that food wastage, which results in harming the environment, is common in the Finnish food industry. A similar finding was also reported by Närvänen et al. (2020), who also found that the food wastage generated by the Finnish food industry accounts for 139084.025 tons. Due to which, the risk of food insecurity is increasing and might end up in food scarcity in Finland.

At the same time, the interviewees also indicated that food wastage is increased when the production is higher than the demand. Therefore, when the demand is lower, the buyers are relatively smaller and after completing the shelf life, the product is discarded as it is no longer consumable. At the same time, when the demand is higher, and production is lower, it also results in wastage as some customers often make bulk purchases in fear of a shortage of product. Thus, with bulk buying, they are unable to consume every product they purchase and end up in wastage, increasing the burden on the environment. However, from the responses, it is clear that food wastage can only be reduced when the demand from consumers is well-identified. The wastage of food in Finland is raising the challenge of food poverty linked with the rising population. The study by Sala et al. (2017) also indicated that with the rise in global population, the need for food production is increasing, but with the waste of food production, the risk of food insecurity is increasing. Further, the responses in this study determined that Finland is a welfare country, due to which people here take food for granted and often waste it by not consuming it appropriately.

Moreover, the answers indicated that Finland is both an importer and exporter of food products, due to which it is quite challenging to determine the food wastage in terms of local production and outside production, as most of the food products consumed in Finland are not its native. The products that are imported from other countries are always at the risk of ending up as a wastage due to inefficiencies in the supply chain system. Therefore, most of the products are damaged when they reach the consumer market, and consumers are often reluctant in buying those food products that are damaged. These waste of food ends up polluting the environment and filling the land sites from where the harmful gases are generated, affecting climate change.

However, the study by Beretta and Hellweg (2019) argued that greenhouse gases generated from food wastage are a global issue, and there is no single country exempted from its contribution to environmental damage. Previously, the study by Kuokkanen et al. (2018) stated the European region is among the largest contributors to food wastage, and its contribution to environmental harm is higher than any other region. Regardless of the contribution, it is obvious when the food is wasted, it not just wastes the food, but it also wastes the resources that were used for its production, such as the efforts of the producers and natural resources like water. As a result, the impact on the water system is immense, affecting the supply of water. However, the respondents of this study indicated that there is no such availability of information regarding food wastage in Finland as there is limited availability of exact figures, but efforts are being made to identify the contribution of Finland in global food wastage and environment harm.

4.2.3 Supply Chain Inefficiencies and Consumer Behavior Increases Food Wastage

Food wastage is becoming a global issue that has profound impacts on the environment, communities and economies as food wastage significantly wastes the resources utilized for its production. In addition, the landfills due to food wastage contribute to climate change, which is indeed a major challenge in terms of environmental protection and sustainability as landfills with food wastage generate nearly 8% of greenhouse gases emitted from the decomposition of food (UN Press, 2020). Moreover, the quantity of food that goes to waste during production and consumption is sufficient to feed millions of food-insecure people.

Despite the fact that Finland has the world's most resource-efficient system in terms of controlling food wastage it is still challenged with the challenge of food wastage from its food industry. However, major contributors to food wastage in Finland are households that make bulk purchases and do not consume it appropriately. Silvennoinen et al. (2015) also presented a similar perception by discussing that the Finnish food industry is still challenged with food waste management even after implementing measures of controlling food wastage.

The findings of this study also indicated that the Finnish food industry is under pressure of placing efforts of food wastage reduction and facing several challenges in food waste management. The findings demonstrated that seasonal variation, supply chain inefficiencies, consumer demands and consumer behavior are the significant challenges faced by the Finnish food industry. Moreover, the interviewees were agreeing with the fact that supply chain inefficiencies and delays in transportation are major contributors to food wastage, even if the industry is applying different efforts to prevent the wastage of food.

In their study, Mancosu et al. (2015) also explored supply chain inefficiencies and consumer behavior as a challenge to increasing quantities of food waste. Therefore, Crist et al. (2017) discussed the importance of a strong supply chain network to reduce the risk of food wastage, as food products are always at the risk of rotting, leading to disposal. Similarly, Ray et al. (2019) also identified that a weak supply chain system increases the risk of wastage of food products. The food industry is one of those industries whose products have relatively short expiries and short shelf lives. Therefore, inefficiencies in the supply chain system make it challenging for the industry to sustain the life of the food product as customers are often reluctant to buy products with near expiry. As a result, those food products are thrown into wastage even if they are in consumable condition. Moreover, the respondents provided the perception that transportation delays, storage facilities and improper handling of food products make it challenging for the food industry to sustain the life of the food products coming to them for processing. Since Finland has the world's best food security system, the food industry is bound to use materials that are not near their expiration or are rotten.

At the same time, consumer behavior itself is a major challenge for the Finnish food industry to reduce food wastage as most consumers make bulk purchases during sales or events like these for food products which they cannot consume fully, resulting in unused wastage. In addition, consumer demands also contribute to food wastage as the food production processes are mostly initiated with demands. Therefore, when consumers are demanding some food products the food industry has to address the demand as they have to generate profits from raised demands. The study by Samberg et al. (2016) has also discussed the role of consumer demand in terms of production processes.

However, consumer preferences and demands in the current era are always changing, and the demands they raise for products also change constantly, which makes it challenging for the food industry to meet and match the consistency with the demands and changing preferences. These findings also align with the findings of Kirchhelle (2018), who stated that consumer demands can change suddenly during the production process. As a result, the food industry is challenged to decide whether to continue the production that was in process or to move to new demands. Moreover, the challenge with consumer behavior in Finland is challenging as the Finnish population is quite choosy when it comes to preferring products for purchasing. Similar findings were also observed in the study by Berners-Lee et al. (2018), who found customers in Finland are challenging to understand as they can change their minds suddenly, which results in the wastage of products that have already been produced. Thus, these were some identified challenges that contribute to food wastage as these challenges are beyond the control of the food industry and their efforts in reducing and preventing food wastage.

Moreover, the study by Manzocco et al. (2016) previously indicated the lack of availability of data related to food consumption patterns is a challenge faced by the food industry of Finland. Therefore, with the limited availability of data, it is difficult to identify exact figures that could support the Finnish food industry in understanding the behaviors and patterns of Finnish consumers. However, the study by Misiak et al. (2018) agreed with the fact that having data regarding food consumption patterns is important for the Finnish food industry in order to develop strategies to overcome the challenge of food wastage. Thus, data accuracy is important to enhance the efforts of the Finnish food industry to prevent food wastage by producing only when the need and demand for products arise from the end of customers.

However, the demand of customers can be due to the season or any festival, as extracted from the responses of the participants. For instance, during Christmas breaks or Halloween, the consumer demand for food products increases, but it is only limited until the season is celebrated. Therefore, during these times, the demands are at their peak and due to the lack of availability of data on food consumption patterns, the food industry is challenged to produce food products in a way that not only addresses the demands but does not contribute to wastage of food due to overproduction. Therefore, it can be determined that the challenges in terms of reducing or preventing food waste in the Finnish food industry are beyond their control, but they can overcome it if they are provided with the data on food consumption in Finland so that production can be based on the demand and food wastage in the food industry is prevented.

4.2.4 Strategies for Reducing Food Wastage

Food wastage is one of the major stressors for the Finnish food industry in terms of its consequences. The developed countries are the major contributor to food wastage, especially in the consumption stage, where the food industry holds the responsibility for nearly one-third of total food wastage produced by their consumers. However, most of the food wastage is avoidable if it is appropriately tackled. In this regard, the study by Guo et al. (2020) has identified that due to food wastage, the environment of Finland is impacted, and the risk of food insecurity and food poverty is increasing for the Finnish population. Moreover, in the food industry, up to 28% of food that is cooked goes to wastage in Finland, which not only affects the supply chain but also contributes to environmental harm. However, food wastage can be divided into different categories such as rotten, food trimmings and peeling and improperly prepared food which results in wastage of food.

The findings of the study also determined that the buffet system in the food industry increases food wastage as people take more than what they can consume, and once the food is taken, it is spoiled even if it is not eaten. At the same time, buffet systems tend to overproduce the food without observing the demand pattern from the customers, and at times, it is likely that buffet systems do not have many customers who can consume all the products that are produced. However, not every buffet system contributes to wastage, where sometimes individual serving also contributes to food wastage as customers order more than they can actually consume. Therefore, there are several strategies that are available for the Finnish food industry to prevent food wastage and overcome the challenges as identified from the responses of participants, such as product planning, inventory management, raw material sourcing and collaboration. These strategies are well aligned with the Systems management theory, which promotes collaborative working to overcome the issues faced by industries, organizations and sectors.

The Finnish food industry has several components that support it in producing food products and implementing strategies that are beneficial for preventing food wastage. Therefore, one of the important functions of the food industry is supply chain and production, which align together to make food products addressing the food demands of consumers. Thus, when the supply chain system of the Finnish food industry is integrated, it is likely to support the industry in production planning, inventory management, and raw material sourcing. The findings supported in determining that through these strategies, the Finnish food industry is somehow managing to overcome the challenge of overproduction, consumer behavior and prevention of food wastage.

However, the study by Alsaffar (2016) has previously identified that market data collection is an effective strategy that could support the food industry in identifying the demands of the products at specific times or in specific seasons. A similar strategy was also reported by the respondents, who suggested that data collection and data analytics are essential for the industry to overcome the challenge of food wastage and formulate different strategies, such as production planning. However, the respondents also emphasized using artificial intelligence to increase the precision of the production process while planning for inventory management and production planning and integrating supply chain networks. The study by Schott et al. (2016) has also revealed the integration of supply chains based on market data for accurate planning of production so that overproduction is controlled and managed.

In addition, the findings also revealed that some companies in the Finnish food industries have developed strategic KPIs to monitor food wastage generation and make strategies for preventing food wastage. However, some respondents revealed that marketing, packaging and recipes are important strategies to prevent food wastage. Simultaneously, the findings determined that creating awareness among consumers is an essential strategy to prevent food wastage, as consumers are the major contributors to food wastage in Finland. Similarly, it was identified that consumer behavior is a major issue that cannot be changed by the implementation of the strategy of awareness programs unless there are other ways applied to change the behavior of the customers. However, for some participants, overcoming losses by implementing fines on unconsumed food to reduce food wastage was an effective strategy to prevent food wastage. It is an effective strategy as consumers are likely to take only what they are able to consume in fear of fines. In addition, it was found that some companies were working on reducing food wastage by adding food items that are closer to expiry through online channels in the products that are high in demand. As a result, consumers are able to get more value for the money they are paying, and the food item that could have been thrown in wastage is saved from wastage. Thus, it can be determined that there is still room for improvising strategies to overcome food wastage and prevent food wastage in the Finnish food industry.

4.3 Summary

In the findings, it was found that as the population of Finland is increasing, the demand for food products is increasing due to an increase in consumption, resulting in the development of the Finnish food industry. In addition, it was also found that the Finnish food industry is contributing to the economic development of the country by exporting food products. However, it was found that with the rise in demand, the wastage of food is also increasing due to over production and improper consumption from consumers. At the same time, the Finnish food industry is challenged with consumer behavior, supply chain inefficiencies and seasonal variations, due to which efforts for reducing food wastage are impacted. Further, supply chain disruptions and improper handling of food products increase the risk of food wastage. Thus, to overcome the challenge of food wastage, different strategies are applied by the Finnish food industry, such as gathering market data, data analytics and AI-based decision-making for production planning and integrating the supply chain.

5 Conclusion and Recommendations

5.1 Conclusion

Technological advancements are being implemented by the Finnish food firm to enhance its value chain and maximize the utilization of production and consumption patterns. It is also well-known that Finland produces food of high quality while simultaneously placing a significant emphasis on the preservation of the environment. As a consequence of this, Finnish cuisine is gaining popularity with people all over the world, which is beneficial for the food industry. In addition, it was claimed that Finland's food exports increased by twenty percent between the years 2021 and 2022, as indicated by a study that examined the expansion of the country's food business exports (Lehtokunnas et al., 2022). Considering that this is the case, it is reasonable to expect that the food sector in Finland is capable of producing a large quantity of food that can be sold to contribute to the expansion of the Finnish economy while simultaneously satisfying the dietary requirements of the Finnish people.

In addition, the findings demonstrated that Finland is a market for both imports and exports of food items. Because the majority of the food that is consumed in Finland is not grown or produced in Finland, it is difficult to compare the amount of food that is wasted between local and foreign production. As a result of inefficiencies in the way the supply chain is organized, commodities from other countries may wind up being wasted. Because of this, a significant number of products are destroyed before they are transported to the market for purchasers. As a result, consumers typically do not purchase food that has been damaged.

In the end, food waste contributes to climate change by polluting the ecosystem and filling up the space where harmful greenhouse gases are produced. This is a major contributor to the problem. Food waste, on the other hand, is a source of greenhouse gases that have an impact on the entire planet; no nation is exempt from the damage that these gases cause to the Earth. A significant amount of food is thrown out by Europeans, which is another reason why they cause more damage to the environment than individuals in any other region. Regardless of the function that it serves, it is evident that throwing away food not only wastes the food itself but also the resources that were used in its production. These resources include the labor of those who worked hard to produce the food as well as the raw materials, such as water. As a consequence of this, the significant alteration that has been made to the water system has an immediate impact on the water supply. The individuals who participated in this research stated that there is a lack of knowledge regarding food waste in Finland because it is difficult to obtain precise data. People have made numerous attempts to determine the extent to which Finland is responsible for the waste of food and the damage it causes to the environment; nevertheless, they have not been successful.

Moreover, the food industry in Finland is experiencing difficulties due to the lack of information regarding the eating habits of the population. Because there is a limited amount of data that is readily available, it is difficult to provide precise numbers that would assist the Finnish food industry in gaining a better understanding of the behaviors and preferences of its customers. Nevertheless, to devise effective solutions to the issue of food waste, the food industry in Finland requires access to precise data regarding the eating habits of the population. A significant amount of importance is placed on maintaining data integrity to assist the Finnish food industry in reducing food waste by only producing when end customers specifically want it.

On the other hand, the responses from the participants would seem to indicate that the season or any occasion could potentially influence what people want to purchase. It is common for consumers to make a temporary increase in their food purchases during holidays such as Christmas and Halloween; however, this urge typically decreases once the holiday has passed. Because many people do not have sufficient knowledge of how they typically consume food, it is difficult for the food business to produce commodities that keep up with demand while also lowering the amount of food that is wasted as a result of overproduction. As a direct consequence of this, demand is currently at its highest point. Therefore, it is acceptable to assume that the issues that make it difficult for the Finnish food industry to get rid of or avoid food waste are beyond their control. However, if you provide them with information regarding the amount of food that people in Finland consume, they will be able to circumvent these issues and ensure that supply meets demand, which will result in a reduction in the amount of food that is wasted in the food industry.

In addition, the findings demonstrated that several businesses operating in the food industry in Finland have implemented KPIs to monitor the amount of food that is thrown out and to devise strategies for reducing this amount. The majority of those who were interviewed, on the other hand, stated that strategies for marketing, packaging, and the creation of recipes are essential to reduce the amount of food that is wasted. In addition, the findings indicate that increasing buyer knowledge is an essential method for combating food waste, given that the majority of the responsibility for this issue lies with individual consumers in Finland.

During the same period, it was also determined that the behavior of consumers is a significant issue that cannot be resolved solely by the dissemination of information; to alter consumer behavior, further actions are required. On the other hand, some of the members discovered that an effective approach to compensate for losses and reduce the amount of food that was wasted was to punish those individuals who brought food that did not sell. People tend to only take what they can eat because they are terrified of being caught using their possessions. As a result, the plan is successful. Additionally, it was discovered that a great number of companies were attempting to reduce the amount of food that was wasted by including perishable items in their extremely popular online offerings. Goods that spoil rapidly are prevented from spoiling, which results in customers saving money and reducing the amount of food that is wasted. In conclusion, it is possible to assert that the food business in Finland still has an opportunity for innovative approaches to combat food waste and reduce it to a minimum percentage.

5.2 Recommendations

From the findings of this study, it was identified that the Finnish food industry has the potential to improve its strategies to prevent food wastage so that its efforts for overcoming food wastage management are enhanced. Therefore, based on this conclusion, several recommendations are developed for the Finnish food industry.

The data revealed that data analytics is playing an important role in overcoming the issue of food wastage. Therefore, the first recommendation is for data collection in terms of food that was produced on demand and consumed. As a result, it is likely to support in identifying the patterns of food consumption based on the dietary intake of the Finnish population. In addition, the data collection system is likely to support in improvising waste management by identifying which waste is consumable so that it can be donated to shelter homes or to the people living in poverty on the outskirts of Finland.

Moreover, in the findings, it was found that inefficiencies in the supply chain are a major contributor to food wastage due to improper handling of food items and shorter life of food products. Therefore, it is recommended to shorten the supply chain by purchasing the raw material for production purposes from local suppliers. In addition, the just-in-time concept should be applied in the supply chain system to reduce the risk of products getting rotten and ending up in wastage. The shortening of the supply chain will likely support getting food products in a shorter time with better preservations. At the same time, it is also recommended to package the food products in vacuumed packaging to avoid the risk of oxidation.

Further, it was found that buffet and individual serving of food also contribute to food wastage, resulting in environmental harm. Thus, to overcome this impact, it is recommended to decompose waste material in organic composites to increase the quality of food products and reduce the risk of chemical usage in the production process. In addition, the composite is a good source of nutrition for plants. At the same time, it is recommended that rather than filling the land sides, food wastage should be fed to animals to provide them additional sources of nutrition for better production of milk and eggs.

Lastly, to minimize food wastage, it is recommended to develop public awareness programs that portray sustainability. As a result, it is likely that it will change the behavior of consumers in terms of bulk buying. It is also recommended that production staff is provided with training on maintaining sustainable practices by effectively utilising the wastage generated in the food industry. Thus, these recommendations are likely to support the Finnish food industry in sustaining its efforts for preventing and reducing food wastage.

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Appendices:

Appendix 1: Interview Questions

Interview Questions

1. Over the last decade, how would you describe the development of the overall Finnish food industry?

2. As an employee at (your Company), what have been the key sectors of development in your company? If you think the last 5 years, are there issues where the company has made larger changes because of the demands raising from the Finnish society?

3. From your viewpoint, how do you see Finnish food industry is approaching the issue of balancing the production and consumption of food?

4. The global statistics of food wastage are 30% of production. How do these differ from that of Finland?

5. Currently, there are several strategies being implemented to reduce food wastage in the global food industry. In what ways is your company and the Finnish food industry in general contributing to this reduction?

6. In your opinion, what are the reasons for a gap between the production and consumption of food in Finland?

8. Referring to the strategies you have identified, what future challenges does your company face concerning the management of food wastage?

9. If you were part of the top management, which other strategies would you propose besides the identified ones for responsible food production and consumption?

10. Lastly, how do you see supply chain developments for reduction of food wastage both globally and in Finland?