



LUT School of Business and Management

Bachelor's Thesis

International business

**Hedelmien ja vihannesten pakkausjätteen vähentäminen hankinnan
näkökulmasta**

**Packaging Waste Reduction of Fruits and Vegetables from Procurement's
Perspective**

6.1.2019

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Tutkielman nimi:	Hedelmien ja vihannesten pakkausjätteen vähentäminen hankinnan näkökulmasta
Akateeminen yksikkö:	School of Business and Management
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Hakusanat:	Hankinta, Vastuullisuus, Hedelmät ja Vihannekset, Pakkausjäte

Tämä kandidaatintutkielma käsittelee hedelmien ja vihannesten pakkausjätteen vähentämistä hankinnan näkökulmasta. Työn tarkoituksena on tutkia, kuinka pakkausjätteeseen voidaan vaikuttaa hankinnan keinoin sekä tunnistaa erilaisia tapoja pakkausjätteen vähentämiseksi. Lisäksi työssä tutkitaan vaihtoehtoisia pakkausmateriaaleja muoville sekä tämänhetkisiä käytäntöjä pakkausjätteen hallintaan. Pakkaus on tärkeä osa tuotteen vastuullisuutta ja erityisesti muovijätettä on käsitelty paljon julkisuudessa. Tämä kandidaatintyö on toteutettu laadullisena tutkimuksena ja se sisältää myös tapaustutkimuksen. Tapaustutkimus keskittyy suomalaiseseen elintarvikealalla toimivaan tukkukauppaan. Työn tulokset perustuvat kolmeen puolistrukturoituun haastatteluun ja aiempaan akateemiseen kirjallisuuteen.

Tutkimuksen tulokset viittaavat, että pakkausjätteeseen voidaan vaikuttaa monilla hankinnan keinoilla. Tärkeimmät tavat pakkausjätteen vähentämiseksi näyttäisivät olevan tiedon lisääminen käytettyjen pakkausten kierrätettävyydestä, ohuempien pakkausmateriaalien käyttäminen ja pakkaamisen tarpeellisuuden huolellisempi arvioiminen sekä neuvottelemine toimittajien kanssa vaihtoehtoisista pakkaustavoista. Lisäksi tulokset osoittavat, että vaikka ympäristöystävällisempien pakkausmateriaalien kuten biohajoavien materiaalien käyttö on lisääntynyt, muovin käytön lopettaminen pakkaamisessa ei ole mahdollista ainakaan lähitulevaisuudessa. Näin ollen muovin kierrätys ja uudelleenkäyttö ovat nykytilanteessa parhaita keinoja hallita pakkausjätettä.

ABSTRACT

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Title: Packaging Waste Reduction of Fruits and Vegetables
from Procurement's Perspective
School: School of Business and Management
Degree programme: Business Administration / International Business
Supervisor: Anne Quarshie
Keywords: Procurement, Sustainability, Fruits and Vegetables,
Packaging waste

This thesis concentrates on packaging waste reduction of fruits and vegetables from procurement's perspective. The aim of this study is to examine how procurement can affect packaging waste and identify different ways for packaging waste reduction. In addition, this thesis presents alternative packaging materials for plastics and what current policies are used for packaging waste management. Packaging is important part of product's sustainability and especially plastic waste is a widely-discussed topic in the media. This thesis is conducted as a qualitative research and it includes a case study. The research focuses on a Finnish wholesaler operating in the field of grocery. The results of this study are based on prior academic literature and three semi-structured interviews.

The findings of this study indicate that procurement can affect packaging waste in various ways. The most important practices for packaging waste reduction seemed to be increasing knowledge of used packages' recycling, using thinner packaging materials, considering the needs for packing the products more carefully and negotiating with the suppliers about alternative packaging options. Additionally, the results imply that despite the growth of environmentally friendly packaging materials such as biodegradable materials, ending the use of plastics in packaging is unlikely in the short-term. Therefore, recycling and reusing plastics are currently the most viable ways for packaging waste management.

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1. INTRODUCTION

Environmental issues are nowadays part of our everyday life. Media publishes constantly news relating to global warming, overpopulation, climate change, food consumption, animal extinction and plastic rubbish in the oceans. Ecological consumption patterns and sustainable development are topics that are gaining more attention around the world (Williams & Wikström 2011). Consumption of commodities especially food products has increased explosively in multiple countries due the growth of our living standards (Seale et al. 2003). This increment comes with consequences: limited amount of resources will force consumers and companies reassess their consumption habits. Food production and distribution have extensive influence on the global environment impacts where also packaging plays important role (Williams et al. 2012). Packaging in many cases is considered as an inevitable evil from the environmental point of view (Paine 2002). Therefore, packaging is perhaps one of the most controversial topics: it faces much resistance but it also has its advantages.

Packaging is a major part of product's sustainability. Food packages create plenty of plastic waste which is sometimes necessary for the better preservation of the products. Not packing the products can also make them go off more quickly. Therefore, packaging has significant impact on the food waste reduction as well (Williams et al. 2012). In addition, packages usually contain important information about the product and help to make it more appealing to the customers. This causes a dilemma in the food industry because consumers are continuously getting more aware of the harms of plastic packages, but packaging can also save extra food waste and increase profits this way (Williams & Wikström 2011). On top of that legislation is also considering packaging waste more strictly than before. For example, European Commission's strategy for plastic waste is forcing companies to rethink their products and supply chains (European Commission 2018a). Therefore, it is important to examine the reasons behind packaging and the ways to reduce packaging waste in which this study concentrates. More specifically the focus is on reducing packaging waste of fruits and vegetables. Another important aspect that needs to be taken into account is to analyse whether the product needs packaging at all. Hence, this study also aims to find ways to reduce unnecessary packaging.

There are prior studies conducted in themes of packaging fruits and vegetables and the packaging waste in general in the food industry. Previous literature focuses highly on different packaging techniques and materials used in the field of packaging and how those materials could be replaced with different alternatives (e.g. Vermeiren et al. 1999; Ahvenainen 2003; Ozdemir & Floros 2004; Dainelli et al. 2008; Rojas-Graü et al. 2009; Dhall 2013; Siddiqui & Rahman 2014) Additionally, multiple papers are made of preservation techniques of fruits and vegetables which usually include packaging in some way (e.g. Debeaufort et al. 1998; Marsh & Bugusu 2007; Olivas et al. 2007). Plastic waste in general is widely covered topic but articles about packaging waste of fruits and vegetables are not that common. The examined themes relating to fruits and vegetables consider more the food waste aspect rather than packaging waste even though they go hand in hand.

Moreover, the academic discussion of packaging waste has circled around the consumer packaging and its influence on the environment rather than companies' ways to affect packaging waste (Verghese & Lewis 2007). Companies have to evaluate whether they want to outsource certain processes such as packaging or distribution and these decisions typically belong to procurement department (Sarkis 2002). Therefore, it is reasonable to consider procurement's actions relating to packaging and packaging waste reduction. Furthermore, previous literature relates more on the negative impacts of packaging instead of suggesting ways to reduce it. Additionally, the focus in prior studies has been more on the other areas of the product such as advertising and models of pricing rather than in the packaging aspect (Underwood & Klein 2002). Therefore, this thesis concentrates on what sort of practices and policies there is to reduce packaging waste. To get better understanding of the issues and solutions relating to this theme this study focuses on packaging waste reduction of fruits and vegetables. Fruits and vegetables are unique product category because of their packaging opportunities and easy perishability. To provide a deeper viewpoint for the topic, this thesis includes a case study. The case company operates in a few different fields but this thesis concentrates its grocery business in Finland.

1.1 Research objectives and questions

The aim of the thesis is to get better understanding of the ways to reduce packaging waste of fruits and vegetables. The focus is on the procurement's policies and practices that can be used to reduce packaging waste. In addition, the purpose is to examine different alternatives for waste reduction. The main research question is therefore:

“How can procurement reduce packaging waste of fruits and vegetables?”

Additionally, it would be meaningful to clarify how the case company is currently handling packaging waste and what different alternatives there is for plastics in packaging. Thus, additional sub-questions relating to this theme are:

“How do company's current procurement policies and practices consider packaging waste?”

“What possible alternatives there is for plastic in packaging of fruits and vegetables?”

This study is a qualitative research and it is carried out as a case study. A Typical characteristic for a qualitative research is that it analyses the phenomenon from different points of views (Alasuutari 1999). Therefore, qualitative research suited well for this topic because this study focuses on different policies and practices for packaging waste reduction which can use multiple viewpoints. A case study was also selected because it concentrates on different activities present on a certain setting (Eisenhardt 1989). This case study includes one case company and it consists of semi-structured interviews which are explained more exactly in chapter three.

This study considers procurement's ways to affect and control packaging waste and it tries to advance the understanding of packaging in general and packaging waste reduction. Assessment of alternative packaging materials is also important because it has practical impacts on the wholesale and the packaging industry as well as to consumers. Therefore, this study contributes to the wholesale and retail industry by providing practical examples of one company's ways to reduce and control packaging

waste. In addition, this study can also be beneficial for packaging material manufacturers and procurement personnel because the results are presented in general level and thus they can be useful for other product categories and businesses as well. The results of this study suggest that packaging offers various benefits such as better product preservation, consumer convenience and decreases food losses. On the other hand, it has serious impacts on the environment despite the continuous packaging material development. In addition, the results indicate that alternative packaging methods are not always better compared to the traditional ones and in many cases further research is still needed.

1.2 Scope of the thesis

The thesis has carefully selected scope which is narrowed to one product category fruits and vegetables and one case company. The case company has multiple product lines but focusing only on fruits and vegetables gives a more explicit picture of the packaging waste and ways to reduce it in one limited area. Fruits and vegetables are quite unique product category because it does not contain packaging the same way than other product lines. For example, industrial products almost always need a package, but fruits and vegetables can be delivered with or without it for the most parts. This way the consumer has the final decision whether to choose packed or unpacked product.

The case company is one of the biggest operators in the grocery field in Finland which means it has significant impacts on the environment and several policies in procurement. Additionally, sustainability is a core value in the case company's business which suits well for this topic. Only one case company was chosen due the limited time and resources. Geographical scope in the empirical part is in Finland where the case company mainly functions. The suppliers of the case company come from all around the world but the customers are in Finland where the products are sold via its retailers.

1.3 Structure of the thesis

The study is divided into two parts: theoretical and empirical. The theoretical part starts at chapter two and it explains relevant prior literature. In addition, the chapter two includes a summary at the end which explains the important insights from the theory part shortly. Methodology and data collection process are presented in chapter three. The empirical results are discussed in chapter four where also the findings of the interviews are compared to the theory. Lastly, conclusions are drawn and the study is summarized in chapter five.

2. THEORETICAL BACKGROUND

This chapter consists of six subsections. Firstly, important concepts are presented and previous literature of closely related themes is reviewed and discussed. These themes start from broader topics such as sustainability and quality attributes of fruits and vegetables and move towards packaging and packaging waste which are the main focus of this study. In the end of this chapter the theoretical insights are summarized.

2.1 Sustainability in supply chain

Nowadays people are more aware of the importance of the whole supply chain instead of focusing solely on the final product. This has forced companies to re-evaluate their suppliers and develop new ways to monitor their supply chains. The terms sustainability and supply chain have been covered in prior studies for over decades but the more focused research about these areas together is relatively new (Seuring et al. 2008). According to Stevens (2016) supply chain consists of multiple united activities which include planning and handling the materials, parts and the final products that are delivered from the suppliers to the customers. Besides the traditional material flow, supply chain includes information flow as well. These distinct flows in organisation can go up and down in the supply chain. (Seuring & Müller 2008)

Sustainability is a broad definition and the meaning varies in the academic literature. Sustainability relates to the scarcity of resources, therefore the interest to examine the topic has been there for long time (Kuhlman & Farrington 2010). Dyllick & Hockerts (2002, 131) define sustainability in corporations:

"Meeting the needs of company's stakeholders such as customers, employees and shareholders without risking the future stakeholder's needs."

To be able to do that corporations have to maintain and increase their social, environmental and economic resources (Dyllick & Hockerts 2002). Corporate Social Responsibility (CSR) is a term that is often linked to sustainability. More specifically CSR is related to integrating sustainability's social and environmental dimensions into the company's operations (Baumgartner 2014). CSR is not the only term that is linked closely to sustainability. Sustainability has other titles as well such as triple bottom line (TBL or 3BL) which emphasises that company's success should not be estimated by the financial profit but also with its social and environmental contribution (Norman & MacDonald 2004).

When defining sustainable supply chains, we cannot forget sustainable supply chain management (SSCM) whose target is to fulfil sustainability's economic, social and environmental dimensions (Beske et al. 2014). Seuring & Müller (2008, 1700) define sustainable supply chain management as the control of material, information and capital along with embracing collaboration with the companies in the supply chain while taking sustainability's dimensions into account. The aim of controlling supply chain is to integrate customer's needs with the material flow in a way that is the most efficient for the company (Stevens 2016).

Procurement is a vital part of supply chain and it also has important role when applying sustainability into the policies and practices in the organisation (Meehan & Bryde 2011). The National Procurement Strategy (NPS) (Office of the Deputy Prime Minister/Local Government Association, 2003, 17) defines procurement as the process of acquiring products, labour and services. Typically procurement and purchasing functions relate to buying processes that include for example decisions about suppliers, supplier selection, specification, supplier agreements, delivery and supplier assessment (Miemczyk et al. 2012). In addition, procurement can also be linked to company's make-or-buy decisions (Murray 2009). According to Walker & Brammer (2009, 2) sustainable procurement can be defined as procurement that is coherent with sustainability's principles. Therefore, sustainable procurement incorporates sustainability's environmental, economic and social aspects through the supply and purchasing actions (Walker & Phillips 2009). A company can only be as sustainable as

its suppliers (Krause et al. 2009). Hence, this emphasises the importance of procurement and supply management on a mission to obtain sustainability in organisations (Miemczyk et al. 2012).

While sustainability in supply chain and in procurement is gaining more and more attention simultaneously also management practices are changing. For example, green supply chain management (GrSCM) is getting growing attention in the academic community and among supply chain professionals. GrSCM focuses on the link between supply chain management and the environment (Srivastava 2007). In addition, environmental management systems (EMS) are growing their popularity in companies. EMS is a strategical management approach which helps companies to deal with their impacts on the environment. (Darnall et al. 2008)

Increased focus on the sustainability aspects in the supply chains is a progress towards broader acceptance and improvement of sustainability (Linton et al. 2007). According to Ageron et al (2012) sustainability is important part of successful supply chain management. The modern business environment highly emphasises international trade where outsourcing is vital part of supply chain and it needs different management practices to help the supply chain remain in competition (Ageron et al. 2012). In addition, climate change and energy challenges increase the importance of sustainable supply chains and SSCM. Communities are demanding cleaner environment while individuals are gravitating higher quality products with wider assortment and decent delivery times and prices (Beamon 2008). All these variables are challenging the future of supply chains and supply chain management.

2.2 Quality of fruits and vegetables

Fruits and vegetables are often assessed by their appearance. Important features of a fruit or vegetable according to Cubero et al. (2011) are size, shape, weight, ripeness and colour. Quality refers to product's excellence or capability to fit to a certain purpose (Abbott 1999). Consumers use all their senses when assessing the quality of a product. Using senses for example vision, hearing, touching and smelling when assessing quality is called sensory evaluation (Abbot 1999). Abbot (1999) states that usually in research instead of sensory evaluation is used instrumental evaluation. Instruments

give more accurate results about the quality because they diminish the variability among people (Abbott 1999). For example, use of machine vision for quality inspection has increased because it offers more specific and objective results compared to trained experts (Cubero et al. 2011). However, both evaluation methods are important when analysing the quality of fruits and vegetables.

Barret et al. (2010) consider other additional characteristics being important for the quality of fruits and vegetables such as flavour, texture and nutritional content. Flavour related qualities affect the emotions during the eating process signalling whether the product tastes good or bad. Aroma is more specifically the smell of a product whereas flavour consist of both taste and aroma. (Barrett et al. 2010) Fruits and vegetables are also rich in nutrition and the health benefits that they cause are widely studied. Colourful fruits and vegetables are full of antioxidants which help to prevent certain diseases (Kaur & Kapoor 2001).

Before consumers can buy fruits and vegetables from the supermarket they must be delivered. According to Shwefelt & Prussia (1993) crucial for the preservation of the fresh produce is the time between the harvest and consumption where transportation plays important role. Necessities to consider during the delivery are temperature, packaging and product combability (Shewfelt & Prussia 1993). Product combability means for example that ethylene sensitive products such as lettuce should not be delivered with products such as apples, bananas, melons, pineapples or tomatoes which need or produce ethylene (Watada 1986). Ethylene can be used to help fruits and vegetables for example with ripening, softening the tissue, flavour development or tannin elimination (Saltveit 1999, Watada 1986).

Before getting to the shelf in the retail market happens other steps besides harvesting and transportation. Usually, fruits and vegetables are placed in a storage at some point of their life cycle. The time spent in a storage varies among fruits and vegetables and storage conditions (Shewfelt & Prussia 1993). Fruits and vegetables are sensitive to microbial spoilage and therefore processing, packaging and storing should be done correctly in order to maintain the quality of the products (Siddiqui & Rahman 2014, 3). The quality can be maintained during storing by keeping the products in optimal temperature and in relative humidity (RH). Additionally, chemical preservatives can

help to retain the environmental conditions in the storage. (Shewfelt & Prussia 1993) Shelf life is important term which relates to storing. According to Shewfelt (1986) shelf life is the time period that the product is expected to last under specific storage conditions. There are multiple factors that are affecting the quality of fruits and vegetables. The final quality is dependent of the whole supply chain and the quality of the product can only be as good as the weakest link in the chain (Shewfelt 1987).

2.3 Packaging in the food industry

The food production in the world has more than doubled during the last 50 years. Technological advancements in the food production have enabled mass production of packed goods where packaging plays important role in the whole food supply chain. (Coles et al. 2003, 5) Generally, packaging eases delivery and distribution. Significant development has happened in the food packaging over time. This is due the increased requirements in product safety, consumer satisfaction, environmental issues and cost reduction (Ahvenainen 2003). According to Prendergast & Pitt (1996) the core function of packaging is to protect the product during the delivery process, for example decrease contamination and damage. Another core function of packaging is marketing which helps to gain attention and stand out in competition (Prendergast & Pitt 1996). Bram et al. (1983) are on the same level and define packaging as a marketing and industrial method to contain and protect different products to facilitate distribution and sales. Rundh (2005) considers packaging as an essential part of marketing because it promotes the company and the product and it provides protection as well which makes the product more convenient to handle. Packaging can this way include both logistic and marketing aspects (Prendergast & Pitt 1996).

Packaging has important role in providing information about the product. Typically, a package contains information about product's weight, ingredients, labelling, contacts of the manufacturer and nutritional content (Marsh & Bugusu 2007). Ahvenainen (2003) classifies other general demands for packaging to being quick access to the product (easy to open), technical suitability, decent price and recycling aspect. In addition, packaging has important impact on the food preservation because it secures the safety of the product and this way it can for example reduce allergies and the risk for food poisoning (Ahvenainen 2003). It would be almost impossible to distribute and

sell commodities without a package due to these various demands and regulations. In addition, packaging can be a competitive advantage for companies especially in the food industry which consumes approximately 50% of the total sales in packaging. Therefore, packaging can be major cost or a benefit. (Coles et al. 2003, 1; Marsh & Bugusu 2007)

According to Saphire (1994) packaging can be divided into three categories or levels which can often overlap. The first category is primary or consumer packaging which is a simple package that surrounds the product for example, a glass bottle. The main task of the primary package is to protect the commodity and attract customers. The second level is secondary packaging which makes the handling of the product more convenient and for example may protect the product from thieves or demonstrate the use (e.g. six-pack carrier). (Saphire 1994) The secondary package is usually tossed away when the package is opened and it can include multiple primary packages (Robertson 1998, 3). The last category according to Saphire (1994) is transport also known as distribution packaging which is the package that holds the product during the delivery for example from the manufactory to the retailer or to the customer. In general, transport packaging includes boxes, baskets and pallets and they are usually referred as shipping containers. The focus is in the product's protection and shipping conditions during the transportation. (Saphire 1994).

Different packaging technologies have been covered in the academic literature. Multiple terms have been created to describe packaging for example, passive, interactive, active clever or smart (Dainelli et al. 2008). According to Siddiqui & Rahman (2014, 36) passive packaging is used for products that are not easily contaminated and therefore it is not often suitable for packaging fruits and vegetables which are sensitive to spoilage. Passive package functions as physical barrier between the product and the environment. Passive packaging protects the product but it cannot affect the conditions inside the package. (Siddiqui & Rahman 2014, 36) Active and interactive packaging instead can change the circumstances inside the package and this way maintain the quality of the product longer (Ahvenainen 2003). Active packaging is an innovative packaging method that has reformed food packaging and its main target is to prolong product's shelf-life. Interactive packaging instead monitors product's quality and freshness. (Dainelli et al. 2008) Typically active packaging

technologies focus on substances that absorb or release for example ethylene, oxygen, carbon dioxide, moisture, flavours and antimicrobial agents (Vermeiren et al. 1999; Ozdemir & Floros 2004). These active packaging methods are more suitable for packing fruits and vegetables.

Selection of packaging materials and methods is crucial for the safety and the quality of the products especially when considering minimally processed food which fruits and vegetables typically are. According to Siddiqui & Rahman (2014) the aim of packing minimally processed food is to maintain the quality with using only little external treatment on the products. Minimal processing focuses on the microbiological and chemical safety of the food (Siddiqui & Rahman 2014).

The use of plastic in packaging and in production has been increasing alarmingly around the world for in the past 30 years. Piringer & Baner (2008) define plastics as polymer-based materials which are easily processable. Plastics can be altered into finished packaging materials such as bottles, containers and films (Piringer & Baner 2008). The success of plastics relies on its versatility. Plastics are easily modified into different forms and it can be processed in wide range of temperatures. Plastics are also low in cost and can for example resist chemicals and different light conditions. (Andrady & Neal 2009) However, the most popular plastics such as polyethylene, polystyrene and polypropylene are dangerous to our planet because they exist multiple years after their disposal (Gross & Kalra 2002; Tokiwa et al. 2009). This is due the fact that majority of the used plastics in the packaging industry are made of fossil fuels which are non-decomposable (Sorrentino et al. 2007).

The concern of the environment has moved the research towards biodegradable and bio-based materials which are an alternative for traditional polymer materials (Avella et al. 2005). Together these biomaterials can form bioplastics. Bioplastics can be biodegradable, bio-based or both. There are three classifications in bioplastics; biodegradable and bio-based plastics, plastics that are completely or partly bio-based and biodegradable plastics that are based on fossil fuels. (European Bioplastics 2018) Bio-based plastics are made completely or partly from renewable materials which have a biological origin (Mikkonen 2017). Usually, bio-based materials cannot degrade naturally without favourable conditions for instance if there is not enough light and in

these cases they have to be recycled mechanically in the existing recycling systems (European Bioplastics 2018). Therefore, bio-based materials are primarily meant to be composted and typical bio-based materials are for example polyethylene (PE), polyethylene terephthalate (PET) and polyvinyl chloride (PVC) (Mikkonen 2017).

Biodegradable materials instead are designed to decompose as water and carbon dioxide after the use by the living organisms such as enzymes and microorganisms (Mikkonen 2007; Tokiwa et al. 2009). Typical biodegradable materials are for example starch, lactic acid and cellulose and their usage for example in the packaging industry has been increasing steadily (Gross & Kalra 2002; Tokiwa et al. 2009; Mikkonen 2017). There are biodegradable materials in the market appearing in different forms such as films, pouches, packaging tressles, cases and boxes (Helén 2007). However, there are still certain limitations in biodegradable packaging materials compared to traditional plastics such as higher cost, average performance and challenges in processing (Sorrentino et al. 2007). In addition, it is difficult to make completely biodegradable package where all the components even labels, stickers, glues and colours are biodegradable (Helén 2007). Nevertheless, bioplastics and biodegradable materials are continuously developed and they are already performing as well as regular plastics if not better in many cases (Finnish Plastics Industries Federation 2018a).

2.4 Packaging materials and techniques of fruits and vegetables

Fruits and vegetables rot easily as they include up to 90% water (Dhall 2013). Therefore, there are important characteristics to consider when packing fruits and vegetables such as the control of the temperature, mechanical damage and moisture (Kerry & Butler 2008). Fruits and vegetables are typically packed for example in corrugated fibreboards, wooden crates, bamboo baskets or metal trunks during the transportation (Ščetar et al 2010; Agriculture Information Bank 2015). However, this type of packaging is usually not enough to protect the product during the delivery and therefore additional internal cushioning such as tissues, pallets, hay and pads is needed (Ščetar et al. 2010). In addition, typically some fruits and vegetables such as grapes or kiwis are packed in individual product packages and these packages can be for example bags, pouches, films, boxes, tray-packs, sachets, cups and moulded trays (Kirwan & Strawbridge 2003; Ščetar et al 2010; Agriculture Information Bank 2015).

Typical packaging materials of fruits and vegetables are different plastics and wood-based packages such as paper and mesh-bags (Boyette et al. 1996). Plastic films and bags are the predominant packaging form with fruits and vegetables because they are cheap, light, protect the commodity well, help to maintain wanted atmosphere levels and are also transparent which help customers to inspect the products and ease the buying decision (Boyette et al. 1996; Kirwan & Strawbridge 2003). These films and bags are typically made from thermoplastic polymers such as polyethylene, polypropylene and different polyesters (Kirwan & Strawbridge 2003). Wood is another material which is often used in packaging of fruits and vegetables. Corrugated fibreboard is a great example of wood-based material and it is popular due to the relatively low cost and its easy modification (Boyette et al. 1996). According to Boyette et al. (1996) another favoured wood-based package is paper and mesh-bags which are used specifically to pack root vegetables such as potatoes and turnips.

Various types of papers are used in the packaging such as kraft paper, sulfite paper and parchment paper. Plain paper is not suitable for protecting the food for long time periods because of its weak barrier qualities. Therefore, paper is often coated, treated or laminated with different materials such as waxes to improve its barrier protection. (Marsh & Bugusu 2007) Mesh-bags are inexpensive and enable continuous air flow. However, these bags do not protect the product from harsh treatment for example during the delivery. Other wood-based packaging options are for example wooden crates, baskets and pulp containers. (Boyette et al. 1996) Additionally, rigid plastic packages are also popular in packaging of fruits and vegetables and these packages typically have a top and a bottom which can be separate plastic parts or heated together. These packages suit well for high value products such as mushrooms and berries and they are very convenient for consumers to handle. (Boyette et al. 1996) However, the environmental concern of these packages has increased over the years due to the awareness of plastic's environmental impacts (Boyette et al. 1996; Kirwan & Strawbridge 2003).

Packaging of fruits and vegetables must follow certain rules and regulations that are set in the law. One of the most important principles for packaging of fruits and vegetables is that the packaging material has to be suitable for physical contact with the product. In addition, materials used for food packaging have to be clearly marked.

Additionally, the importer and manufacturer are responsible of having a monitoring system for their product's standard assurance which also includes knowing all the used packaging materials (Finnish Plastics Industries Federation 2018b). In addition, European Union has multiple directives and regulations that affect packaging of fruits and vegetables such as plastic regulation 10/2011, regulation of recycled plastic 282/2008, GMP regulation 2023/2006, regulation of active and intelligent materials and articles 450/2009 and the newest plastic strategy which was accepted in January 2018 (Evira 2018; European Commission 2018a). Despite all these regulations there are still multiple packaging methods available for fruits and vegetables such as modified atmosphere packaging, active packaging, vacuum packaging, edible films and coatings, microwave packaging and the list goes on (Dhall 2013; Siddiqui & Rahman 2014, 40).

Modified atmosphere packaging (MAP) is one packaging technique which is highly researched method in packaging of fruits and vegetables. MAP technique enables modification in the atmosphere inside the package (Mangaraj et al. 2009, Siddiqui & Rahman 2014, 40). The aim of MAP is to control O₂ and CO₂ levels in the package in a way that it prolongs product's shelf life (Mangaraj et al. 2009; Kader et al. 1989). Suggested atmosphere with fruits and vegetables is typically low O₂ and/or high CO₂. MAP replaces the air inside the package with one or multiple gases. (Mangaraj et al. 2009) Typical packaging materials used with this method are different plastic films such as polyethylene and polypropylene which together form polyolefin (Mangaraj et al. 2009; Kader et al. 1989). The selection of appropriate materials in MAP is crucial for its success. The plastic film has to be durable, nontoxic, resistant for chemicals and to be able to maintain the wanted temperature (Mangaraj et al. 2009). Atmosphere control reduces product transpiration and production of ethylene and this way it reduces also enzymatic browning, product deterioration and firmness (Rojas-Graü et al. 2009).

Similar to MAP is vacuum packaging (VP) which is relatively old technique that can be applied to multiple food products (Siddiqui & Rahman 2014, 40). In VP the product is exposed to atmospheric pressure. Low pressure enables constant flow of air inside the package which helps to control product's metabolic activity and reduce pathogens and spoilage (Gorris & Peppelenbos 1992; Siddiqui & Rahman 2014, 40). Despite the benefits of these packaging methods some limitations still occur. Adoption of MAP has

not been very fast and easy in many countries due the lack of appropriate machinery and knowledge. The requirements in MAP are high which means that single polymer films cannot fulfil the needed demands in the packaging. (Mangaraj et al. 2009) MAP and VP also increase costs of packaging significantly which is perhaps the main reason behind the slow adaptation (Mangaraj et al. 2009; Kader et al. 1989).

Another approach in packaging of fruits and vegetables are edible coatings and films which can be used together with MAP or individually (Rojas-Graü et al. 2009). Edible coatings can be applied to fruits and vegetables to prolong the shelf life by reducing moisture, browning and cellular respiration and help to maintain the flavour and freshness of the product (Olivas et al. 2007; Dhall 2013; Siddiqui & Rahman 2014, 50). Edible films are delicate layers of materials which function as a coating to the food or it can also serve as a barrier between different components inside the product for example inside a cake (Debeaufort et al. 1998; Marsh & Bugusu 2007; Mangaraj et al. 2009; Dhall 2013). Coating can be done with different ways such as brushing or spraying it into the surface of the product but the most used method for fruits and vegetables is dipping (Dhall 2013; Siddiqui & Rahman 2014, 50).

Edible coatings and films are not a new innovation even if it may seem that (Debeaufort et al. 1998). Wax was one of the earliest forms of coatings used for example in China to citrus fruits (Guilbert & Biquet 1986). Edible materials are originated from animal- and plant-based sources such as gelatin, collagen, whey and corn protein (Marsh & Bugusu 2007). Edible films are great option for packaging because they do not harm the environment. The coatings are made of biodegradable materials and therefore they also reduce synthetic plastic waste (Dhall 2013). However, there are still major limitations in application of edible films and coatings. The biggest issue is lack of information because most of the coatings and films are still in research state (Dhall 2013). In addition, there is a safety concern because these edible materials are originated from sources that might cause allergic reactions to consumers even though they are generally said to be safe (Siddiqui & Rahman 2014, 50; Dhall 2013). Hence, increasing research and development of these materials is still needed (Dhall 2013).

2.5 Policies and practices for packaging waste reduction

Packaging waste is significant part of the total municipal solid waste (MSW) (Kale et al. 2007). In 2015, the EU countries alone were generating approximately 163 kg of packaging waste per person and together the amount was over 84 million tonnes. Plastic, glass, wood, metal, paper and cardboard were the most used packaging materials. Plastics were the second most used material with total of 19% after paper and cardboard 41%. Altogether plastic waste was generated a bit under 16 million tonnes whereas paper and cardboard reached almost 35 million tonnes in 2015. (Eurostat 2018) The EU has had procedures to manage packaging waste since 1980's but today's environmental condition has forced it to tighten its regulations (European Commission 2018b; Aguado et al. 2007). The newest version of packaging and packaging waste directive was published in April 2015 which included new directive considering reduction of plastic bag consumption (European Commission 2018b). The EU has also set targets for waste recycling and recovery due the impacts that packaging waste has on the environment and for example to landfills. The aim is to benefit from the waste by using it as a potential resource and avoid unnecessary use of raw materials. (Da Cruz et al. 2014)

There are various ways to reduce packaging waste. Reusing the package is one way to affect accumulation of packaging waste. Reusing suits especially well for example bags, containers and bottles. In general, plastics applied in packaging and agriculture are meant to be used less than year which is not sensible from sustainability's point of view (Aguado et al. 2007, 14-16). Unnecessary packaging is also one aspect that needs to be taken into account in the product development phase. Packages are usually tossed away either by the consumers or distributors which is waste of resources and costs (Porter & Van der Linde 1995). Therefore, it is useful to consider using fewer packaging materials if it is possible because it also helps to lower the product costs and saves the environment from excessive harm (Lange & Wyser 2003). Thinner materials for example thin plastic films are one example of using less materials in packaging. However, at the end of the day these thinner materials have to be as strong as the thicker materials which puts pressure on the material development (Lange & Wyser 2003). Other ways to reduce redundant packaging is for example

simplifying the design and assessing alternative packaging materials (Porter & Van der Linde 1995).

It would also be useful to evaluate whether the product needs packaging in the first place, for example in Finland majority of the fruits and vegetables are sold loose without the package which decreases the packaging waste vastly. However, transportation packages are something that cannot be given up and the role of packaging is usually much more than just protection (Silayoi & Speece 2007). Packaging is one of the features that the consumers notice right away which makes it important part of the product's marketing (Rundh 2005). In addition, the significance of packaging increases when the distribution route is long because the risk for spoilage and damage is higher.

One of the most discussed topics relating to packaging waste is the recyclability and disposal of plastics. Against the common belief, plastics can be recycled and plastic waste has been recycled since 1970's but the amounts of recycled plastics vary in different countries (Hopewell et al. 2009; Ross & Evans 2003). Despite the recyclability major part of the packaging waste including plastics is still disposed to landfills which is not the best option due the increasing green-house gases it creates and contamination of the land (Kale et al. 2007). Plastics are highly resistant to biological degradation which means that they exist in landfills a long time filling out the landfill's capacity. Plastics from roughly about 25% of the total solid wastes in landfills. (Aguado & Serrano 2007, 18; Aguado et al. 2007) Better alternatives for plastic disposal compared to landfills are for example different recovery methods such as recycling, composting or incineration (Kale et al. 2007).

Recycling is one of the most important ways to reduce the burden of our landfills where the non-recycled plastics end up (Ross & Evans 2003; Hopewell et al. 2009). Plastics can be recycled with multiple ways depending on the polymer and product type and the model of the package. (Hopewell et al. 2009) According to Aguado & Serrano (2007) there are three approaches for plastic recycling: mechanical recycling, energy recovery and feedstock recycling. Mechanical recycling refers to melting of the used plastics whereas feedstock recycling also known as chemical recycling can transform the plastic into raw materials and chemicals which can be reused again to make

secondary plastics or other chemicals (Aguado & Serrano 2007, 19-22; Aguado et al. 2007). Energy recovery is used when there is no use for the plastic materials anymore and therefore it is not technically a recycling method (Aguado & Serrano 2007, 17). The idea in energy recovery is to incinerate the waste which generates energy from the process of burning (Hopewell et al. 2009; Aguado & Serrano 2007, 17). Energy recovery is the most used approach in Europe (Hopewell et al. 2009).

Despite continuous on development of different recycling alternatives, there are still certain limitations in these existing recycling methods. Concerns with mechanical recycling are on the mixed polymers which can be difficult to transform into useful applications because of their diverse content (Aguado & Serrano 2007, 19). Feedstock recycling instead is quite expensive and therefore the amount of plastic waste recycled through the feedstock method is relatively low (Aguado & Serrano 2007, 20). The concerns with energy recovery are placed on dangerous substances that might be released in the atmosphere during the incrementation and therefore it is not socially accepted in many countries (Hopewell et al. 2009; Aguado & Serrano 2007, 17). However, the core issues with recycling plastics and the packaging waste problem lie within the social and economic reasons. Lack of information about the recycling options and higher cost of environmentally friendly alternatives such as biodegradable materials are greatly affecting the packaging waste problem. (Hopewell et al. 2009)

2.6 Theoretical framework

To conclude the theoretical section, table 1 summarizes the key findings from prior literature. The main themes on the left-hand side of the table correspond to the research questions and to the research problem. The table is also useful when comparing the empirical results to the previous literature. Therefore, this summary table functions as a base for the empirical part and also provides a synopsis of emerged viewpoints.

Table 1: Key Findings in Prior Literature

Theme	Key findings	Source
Practices and policies for packaging waste reduction	Reusing the package is one way to affect accumulation of packaging waste. Reusing suits especially well for example bags, containers and bottles.	Aguado et al. (2007)
	Unnecessary packaging is one aspect that needs to be taken into account in the product development phase. Other ways to reduce redundant packaging are e.g simplifying the design and assessing alternative packaging materials.	Porter & Van der Linde (1995)
	The main way to control packaging waste is recycling. However, lack of information about recycling and higher cost of ecological alternatives such as biogradable materials are still major problems.	Hopewell et al. (2009)
	Consideration of using less packaging materials or thinner materials is relevant for manufacturers as it helps to lower the costs and saves the environment.	Lange & Wyser (2003), Porter & Van der Linde (1995)
Procurement and packaging	Typical packaging materials of fruits and vegetables are different plastics and wood-based packages such as paper and mesh-bags. Plastic films and bags are the predominant packaging forms.	Boyette et al. 1996; Kirwan & Strawbridge (2003), Marsh & Bugusu (2007)
	Despite regulation there are multiple packaging methods available, such as modified atmosphere packaging, vacuum packaging, active packaging etc.	Ahvenainen (2003), Dhall (2013), Siddiqui & Rahman (2014)
Alternative packaging materials	Alternative packaging materials appear in the market in different forms such as films, pouches and cases. Biodegradable materials are e.g starch, lactic acid and cellulose and their usage in the packaging industry has increased steadily.	Gross & Kalra (2002), Helen (2007), Tokiwa et al. (2009), Mikkonen (2017)
	There are still limitations in biogradable materials compared to traditional plastics such as higher cost, average performance and challenges in processing. It is difficult to make completely biogradable package where all the components are biogradable.	Sorrentino et al. (2007), Helen (2007)
	Edible coatings and films can be used in packaging of fruits and vegetables. They prolong the shelf life by reducing moisture, browning and help to maintain the flavour and freshness.	Olivas et al. (2007), Rojas-Graü et al. (2009), Dhall (2013), Siddiqui & Rahman (2014)

3. EMPIRICAL RESEARCH

This chapter explains the empirical research process of the thesis. The empirical part starts with introduction of used methodology and a brief case company presentation. Lastly, formation of the interview frame and selection of the interview questions is discussed.

3.1 Methodology

This study is a qualitative research and it includes a case study. According to Flick et al. (2004, 18-20) qualitative research defines phenomenon or a topic “from inside out” i.e. from the participant’s point of view. The main reason for this is to get better understanding of the social factors, meaning patterns and processes (Flick et al. 2004, 18-20). Qualitative research is the best alternative for examining different policies and practices to reduce packaging waste because it offers various viewpoints. In addition, this topic would have been difficult for quantitative analysis because there are no available public data of packaging waste of fruits and vegetables. Moreover, the research problem does not have right solutions and therefore qualitative research is more suitable option because it examines the topic from multiple standpoints. A case study is selected to find more specific information about the topic and it helps to narrow the research’s focus. Case study has two distinct parts where the first part is the subject of the research and the actual case itself whereas the second part is the object which is the theoretical frame that helps to examine the subject (Thomas 2011). In this case study the subject is the case company and the theoretical frame is the summary table 1.

The case company is an international corporation that functions in a few different fields. In this study the focus is on the company’s grocery business which is mainly in Finland and more precisely its procurement policies and practices with fruits and vegetables. The company is one of the biggest wholesalers in the grocery business in Finland. Fruits and vegetables are important product category for the company because their sales are significant part of the total revenue and fruits and vegetables create important image to the consumers relating to company’s product quality and assortment. The company also has multiple own products among fruits and vegetables which makes this product category even more important.

The research method in this study is a semi-structured interview. Semi-structured interview, also known as theme interview focuses on certain central themes that are selected beforehand. Theme interview emphasizes interviewees’ interpretations of the topics and what meanings they give to certain subjects (Hirsjärvi & Hurme 1991). The aim of the theme interview is to get meaningful answers to the research problem and

to the research's purpose. Selected themes are based on the theoretical framework, but they can vary depending on how strict the interview frame is. (Tuomi & Sarajärvi 2009, 75)

3.2 The Interview frame and analysis

The data was collected from three semi-structured interviews. All interviews were conducted separately. Two of the interviewees are experts of purchasing fruits and vegetables and they know a lot about the case company's procurement policies. They are referred as interviewee A and B and those interviews were done face-to-face. The interview with the interviewee A lasted 43 minutes and with the interviewee B 52 minutes. The last interviewee works in the product research department and it is referred as interviewee C. The last interview was carried out via phone due the busy schedule of the interviewee C and it lasted 83 minutes. Questions were the same in all of the interviews except a few additional questions were added in the last interview due the special industry knowledge of the interviewee C.

Interview questions were formed by following theme interview's structure. Important part of planning was creating the interview themes. Theme interview is flexible which means that the questions cannot be too strictly formulated. According to Hirsjärvi & Hurme (1991, 41) interview themes represent fields in which the questions relate and the discussed themes should be simple and clear. In addition, in the actual interview the interview themes are operationalised which means that the themes are put in measurable form by forming questions. One theme usually includes multiple questions which can relate to for example subject's known facts, appraisals, attitudes, values, social relations or opinions (Hirsjärvi & Hurme 1991, 41). The interview frame in this study included three themes and they were selected based on the research questions. The used themes were background information, packaging waste and packaging of fruits and vegetables including alternative packaging materials. The appendix 1 presents all the interview questions.

The interviews were recorded which made analysing the results significantly easier. After the interviews the records were transcribed and collected in the same file under the interview questions. This way it was easier to follow what each interviewee had

answered to every interview question. The similarities and differences were also simple to spot when the answers were one below another. The first step when analysing the results was to find out whether the interviewees had similar opinions about the important themes. All these similarities were underlined and when the writing process started they were summarized in the results. It was also important to seek out different viewpoints. They were also highlighted in the transcription and later written in the results.

4. RESULTS

In this section the results of the interviews are presented and discussed. The interviews resulted various viewpoints to the research themes. Important topics that occurred during these interviews were current policies to manage packaging waste, alternative packaging materials including the pros and cons of these materials, regional differences in packaging, costs of packaging and possible ways to affect packaging waste from procurement's as well as from consumer's perspective.

4.1 Company's current policies for packaging waste management

The case company currently addresses the packaging waste problem by using only recyclable plastics in packaging of fruits and vegetables. This means that for example PVC has not been accepted in 20 years because it cannot be recycled or processed properly after the use. Both interviewee B and C emphasised the importance of the packaging material eligibility; the material has to be suitable for packaging food and the food must also sustain eligible in the package. According to interviewee C when considering the recyclability of the package, other materials compared to plastics are easy because they can be recycled conveniently, the biggest problem has been the plastics. The case company monitors packaging waste in a couple of ways. Firstly, they keep on track what products and how many of them are sold. The interviewee A explained it this way:

“When we are selling for example a box of grapes to the store, the product information tells us how many grams there is corrugated cardboard and how many grams does the carton include plastics and what plastic material is in

question. These are used for our own reporting so that we know how much of these materials have been sold.”

In addition, the company follows closely its own stock where comes multiple products everyday which create packaging waste along. The waste comes especially from transportation packages. The interviewee C stated that most of the packaging residues in the stock are cardboard boxes which are collected separately as well as all the excess plastics and after they have been collected everything is recycled. The interviewee C also added that some parts of the packages such as gussets are given to Finnish farmers in order to minimize the waste of packaging materials. Despite the careful monitoring and recycling of their own packaging waste, the company cannot follow consumers' behaviour. According to interviewee C it is extremely difficult to keep track on single product's packaging waste in the consumer level because there are no simple ways to measure it.

Typical packaging materials of fruits and vegetables are different cardboards and plastics. Both interviewees A and B mentioned that the corrugated cardboard is usually used in transportation packaging and therefore it is not often suitable for consumer packages. Interviewee A also revealed that the cardboard is best for products that do not trickle liquids such as plums and nectarines. Hence, cardboard is not good packaging material for example for berries. Transparency of the package seemed to be essential to all of the interviewees. Most consumers want to be sure that the product is in good shape and therefore seeing the product is crucial. The package should also evoke interest. Interviewee A described the importance of the see-through packages as follows:

“Fruits and vegetables which are easily perishable, it is important that the product can be seen. For this purpose, plastic is quite supreme because it protects the product but at the same time you can still see it.”

The best types of packages are according to interviewee C the ones where you can see the product and maybe even smell its natural aroma. To interviewee C it is also important that the packages are well thought and specifically made for the product. Other packaging methods that are used alongside with cardboard and plastics are

recyclable boxes and mixed packages that can include for example both cardboard and plastic film. Interviewee C explained that recyclable boxes are transportation boxes that are delivered to the stores and when the products are sold, the box is sent back to the company's stock. Recyclable boxes are typically used for root vegetables such as potatoes. According to interviewee B these recyclable boxes have their own limitations because they have to be transported back and forth and washed after every use. Both interviewees A and B also emphasised that the mixed packages are a good option because usually these packages contain less plastics and this method is probably going to be even more used in the future. However, consumers cannot necessarily see all the products inside the package when some parts of the package are covered for example with paperboard.

Packaging of fruits and vegetables is rather different compared to other product lines. According to interviewee A other product categories have a great variety of big brands that have a lot of power on their products which usually includes the product's appearance and packaging as well. With fruits and vegetables, the situation is simpler because great amount of their sales comes from the company's own products that can be easily controlled. Interviewee B also pointed out that besides the environmental viewpoints it is relevant to take into account how the retailer is going to handle the product and how consumer sees the product qualities.

4.2 The use of plastics and alternative packaging materials

The use of plastics overall in packaging and how it could be decreased or replaced was also discussed with the interviewees. All of the interviewees agreed that it is important to decrease the use of plastics in packaging. However, food waste is still important factor which needs to be addressed when discussing of removal and diminishing plastics in packaging. Interviewee A stated the problem this way:

“In a sense, food loss is still a major problem that cannot be allowed to get out of hands. We definitely have to have procedures but anything radical such as not packing anything anymore is not possible due the food loss dilemma.”

All the interviewees had similar opinion about the fact that there are no right answers when packaging products because even the best packages can create negative side effects. The interviewee A explained that the company wants to have influence on the use of plastics by providing also other options to consumers. Alternative packaging materials such as biodegradable materials have been tested and used in the company before. According to interviewee C the previously used biodegradable material was wood-based and it was used with few different vegetables for quite some time but it was not a success amongst consumers. Therefore, the production of those packaging materials was stopped. According to the interviewees biodegradable films have typically been dimmer which has caused problems with its saleability. Interviewee B also pointed out that the main problem with this certain biodegradable material that was used related to the visual aspects; it did not look as good as regular polypropylene. In addition, the price was also significantly higher.

The interviewees were unanimous about the fact that the excessive use of alternative packaging materials such as paper or cardboard is not necessarily better for example due of the loggings of the forests which also increases climate warming. Naturally the world runs out of oil at some point and perhaps it is not wise to use it for making plastics but the interviewees also pondered that is not necessarily meaningful to replace plastics with something else that is almost equally harmful only with different way. Interviewee C noted that biodegradable materials also require resources, for example cornstarch is one material that is used as a base for some biodegradable materials and it needs cultivation of corn which takes extra acreage. Interviewee C explained that if the biodegradable materials do not need excessively much resources and capacity it is not a problem but if it does consume resources, considering something else would also be useful. In addition, all the interviewees agreed that it is important to seek other alternatives and test new materials alongside with plastic and this way maybe cut down the use of plastics without taking the risk of overusing other materials. However, the interviewees also addressed that ending the use of plastics entirely at once is not sensible because the negative impacts of plastics are well known and it has many good qualities, for example it can be often reused and recycled. The interviewees did not seem to consider the use of plastics as bad as many consumers and media portrays it. In addition, the interviewees thought that the key focus should

be on developing plastics' reusability even further and increase knowledge about recycling.

4.3 Practices for packaging waste reduction

There are various options for packaging waste reduction. From procurement's perspective both interviewees A and B emphasised the ability to make their own choices when it comes to packaging material selection because when deciding what to buy it is also possible to say how to pack it. Interviewee B stated that if the supplier cannot deliver the product with wanted package the company will buy the product from someone else. Additionally, both of them discussed the benefits of thinner plastic materials. The interviewee B mentioned that for example cucumber's plastic wrapping has got significantly thinner during the past years and in many products this will be the goal when packaging technology develops even further.

Another aspect that was brought up in the interviews was assessing the need for packaging. Interviewee B stated that if the product itself does not require a package then why pack it at all. However, interviewee B also pointed out that when packaging food the situation is usually a bit different compared for example clothes because most of the groceries need a package. One problem that the interviewees stated that occurs in the grocery stores is when products are sold without packaging, consumers have a bad habit of putting the products in small bags that the stores usually have in their fresh produce department. Previously these bags were all plastic but in these days there are luckily other options available such as paper and biodegradable bags. However, what is the use for unpacked products if consumers are still wrapping them in something. Interviewee A proposed that if these small plastic bags were chargeable consumers would probably have second thoughts about using them regularly.

New packaging arrangements are also one way to affect packaging waste. According to interviewee A the company's supplier who delivers grapes previously packed 10 cartons of grapes in one transportation box, but when they started to put the cartons in the box in different angle they realised that 11 cartons could fit in. A little change that can save excessive amounts of additional boxes in year and this way the consumer still gets the same number of grapes with lesser containers on the sea. However,

packaging cannot be the only determinant criteria when buying fruits and vegetables. Interviewee B explains how important the whole life cycle is when purchasing products:

“Primarily we focus on the product and its life cycle. We cannot consider only the accumulation of packaging waste or plastics. We have to think broader than the environment alone which includes the environment impacts of the production, environment impacts of the possible product’s spoilage, environment impacts of the product’s transportation and all this.”

Another not as direct way to reduce packaging waste is to affect consumers’ recycling habits. In order to increase the recycling rates, it would be useful for consumers to have clear instructions how the package should be recycled after the use. Interviewee C stated that there are no plain instructions available for consumers and therefore the company’s target is in the next years to create simple recycling and sorting guidelines for the customers. These straightforward instructions could help the everyday-life of consumers. Interviewee C also added that this could also speed up the deliberation of the issues that plastics create among packaging material manufacturers because at the end of the day if the consumer does not know where the package should be recycled it is insignificant what material is used for the package. Interviewee C also pointed out that increment in recycling plastics would help the entire world to move forward with the environmental issues.

The importance of the suppliers’ actions came up during the interviews when considering packaging and packaging materials in procurement. According to the interviewees A and B the procurement unit has continuous conversations with its suppliers about the desirable packaging materials and suppliers’ abilities to pack products. Usually the suppliers have their own proposals ready when offering new products and the procurement personnel decide what packaging option is going to be chosen. Typically import products’ suppliers have more options compared to Finnish small business owners. According to interviewee A suppliers are also very welcome to come and present their own alternatives to the procurement personnel and active interaction is considered important. However, interviewee A also mentioned that the suppliers themselves are not necessarily very keen to be pro-active on developing new

materials but that is why retailers and wholesalers have important role on putting a little pressure on them.

Lastly, the obligation of government and legislation to control packaging waste was discussed. Interviewee C stated that the packaging waste affects globally so many parties that parliaments and tax collectors should start taking more actions for its management. Interviewee A described how one consumer can change his/hers habits but changing habits of consumer masses is slow. This is due the fact that it is difficult to change consuming habits if the price is not changing. Price is the ultimate motivator. Ecologically packed products are still more expensive compared to traditional plastics which also shows in their consumption. The interviewee C also added that change could be done by including environmental protection tax on basic plastics or alternatively have tax reliefs for environmentally better options such as biodegradable packages.

4.4 The costs of packaging

The costs of packaging come from the packaging method and material. According to the interviewees packaging by hand is always more expensive compared to automatic packaging machines. The expenses of packaging vary with different products. According to Interviewee A the costs are dependent on what needs to be done to the product, for example closed carton packages have to be weighted because the minimum weight has to be announced on the package. Weighing is always one extra stage more which increases expenses. Labour costs are another factor that needs to be considered when calculating packaging costs. The differences with wages are notable, for example packing the products in South-Africa is way more inexpensive compared to the Netherlands.

The packaging's share of the product's total price also varies greatly. Interviewee B mentioned that cartons that use various materials such as cardboard and films cost multiple times more than simple plastic bags. However, typically the difference is measured in cents which is not necessarily much when considering one item. Nevertheless, biodegradable packages can cost approximately eight to ten cents more compared to the cheapest material polyethylene and when this difference is applied to multiple products and in mass production, the gap is significant. In addition, according

to interviewee B when deciding the packaging method, the prices of raw materials and the product itself are regarded. Usually more expensive products can also use a bit more expensive packaging solutions whereas with cheaper products it is not reasonable to add pricy packaging to increase the product's low price.

4.5 Cultural differences of packaging

All the interviewees brought up the packaging culture in Finland which is quite different compared to other countries. In Finland many of the horticulture products are sold loose without a package. Interviewee A described the packaging culture as followed:

“Here we sell quite a lot of products loose and consumers accept it. When the product preserves well during transportation and there are no other reasons for packing, then we aim to deliver the products without packages.”

When it comes to packaging, the Scandinavia is completely different even when compared to the rest of the Europe. In many areas it is common to pack for example apples in styrofoam and plastic films. In some countries the fresh produce departments in grocery stores are full of plastics and other packaging materials. The interviewee C supposed that this difference could be due the regional attitudes. The interviewee C also added that not all the consumers want to buy unpacked products because they might think that these products are not microbiologically as good as packed ones. Microbiological acceptability can deteriorate when consumers are testing the ripeness of the fruits and vegetables by touching them. According to interviewee C other factors that may affect the packaging culture are social behaviour and convenience. Interviewee C suggested that crime rate could be one variable that is causing vendors to pack their products. Packaged products can be more difficult to steal than loose ones. Other aspect is the simple monitoring of the packed commodities. Interviewee C mentioned that usually packages include best-before-dates which is easy for the store and staff to obey.

The amount of different packaging methods that are used around the world is also remarkable. Interviewee C pointed out that vacuum packaging, shielding gases and edible coatings are not commonly used in Finland. Vacuum packaging in Finland is typically used only for readily cooked or hashed products such as parsnip and celery.

The purpose of vacuum packaging is to enhance the preservation of the product. Interviewee C also stated that vacuum packaging is not a bad thing if the used plastics are appropriate and not for example PVC. Shielding gases are also rarely used, typically in few types of salads due their colour sensitivity. The gas helps to maintain the green colour longer. Interviewee C believed that reason for not using for example edible coatings in Finland is simply relating to consumers' attitudes. The interviewee C also added that Finns do not want to have anything additional in their food or packaging if it does not have any visible and positive impacts.

4.6 Future trends in packaging

The future trends in the field of packaging and packaging materials were quite similar from all the interviewees' perspectives. All interviewees are expecting the growth of sustainable options in packaging such as biodegradable materials and bioplastics in the future. There are currently some sustainable packaging forms with fruits and vegetables also in Finland. The interviewees emphasised that the company will definitely test and try these new materials with different products hopefully in the near future. As mentioned before the company has had experience with biodegradable materials even though not necessarily with the best outcome. However, new materials are continuously developed and the new films that the company is going to test are clearer and the appearance of the films is almost identical with the regular plastic films. In addition, the company currently has a few biofilm products in its assortment as well as wood-based products such as net which is used for example for packaging onions.

Nevertheless, biodegradable alternatives are not necessary as green as people would think. It is important to all of the interviewees that the biodegradable materials will not decompose as tiny particles and this way cause harm for example oceans' ecosystem. Therefore, the materials that are going to be considered have to decompose as water, biomass and carbon dioxide. According to interviewee C biodegradable plastics are temporary phase because everyone should aim to have biodegradable plant-based materials. In addition, interviewee B and C both mentioned that in the future it could be possible to pack food in reusable plastics which is not currently done due the risk of contamination. It is safe to say, that development in the packaging sector is happening and manufacturers are constantly considering and testing new alternatives.

4.7 Contribution to the existing literature

The empirical results advance the theoretical findings by substantiating that the packaging waste can be controlled with various ways from procurement's perspective. The empirical results show that in practice the usage of thinner materials in packaging, considering the need for packing the products more carefully and continuous conversations with suppliers about joint development projects relating to packaging are useful. These practices are also present in the prior literature. The importance of packaging in marketing the product appeared during the interviews which is also highly examined topic in the field of packaging. Despite all the similarities, some new proposals for packaging waste reduction was also discovered. These were for example clear instructions for consumers relating to recycling and sorting packages as well as changing the packaging routines by packing the products from new viewpoints. The core issues with recycling were also emphasised in the empirical results. The theoretical insights included economic and social factors as the main barriers for recycling. These were also addressed in the interviews. The lack of knowledge relating to recycling and the difficulty for recycling plastics were also severe problems from the interviewees' perspectives.

The benefits from biodegradable materials were also discussed and the noted environmental advantages and limitations such as higher cost and not performing as well as regular plastics were stated by the interviewees. However, the empirical results suggest that bioplastics and biodegradable materials are not necessary as green as people would think which is not often mentioned in prior studies. In addition, the development of these materials is still needed e.g. due to inferior visual quality.

5. CONCLUSIONS

The aim of this thesis is to gain understanding of how to manage packaging waste and identify different options for packaging waste reduction. The objective is to examine these themes especially from procurement's perspective and answer the research question: How can procurement reduce packaging waste of fruits and vegetables?

Monitoring packaging waste is not easy. On a consumer level it is practically impossible. The case company has a few different ways to monitor and measure their

own packaging waste such as following closely packaging information that goes through the company and recycling and reusing the waste that comes to their stock. When packaging fruits and vegetables it is also essential to consider what packaging material suits best for the product. Alternative packaging materials such as biodegradable materials have already entered the market. These sustainable packages are a growing trend that can potentially change the course of packaging waste. However, the development of these environmentally friendlier alternatives is still an ongoing process and constant pressure is put on manufacturers and packaging material developers concerning these ecological materials.

Packaging waste can be reduced with various ways from procurement's perspective for example by using thinner materials, negotiating with the suppliers about new experiments, rearranging the packaging process, having printed packages with clear recycling instructions and by considering the need for packaging in the first place more carefully. Another possible way to control packaging waste is a modification of taxation which could help to change our consumption habits. In addition, perhaps the most important way to affect packaging waste is developing recycling methods and increasing awareness about recycling amongst consumers. Recycling currently used materials should be considered as important as developing new packaging materials because recycling is in general one of the easiest ways of controlling packaging waste. Plastics are not easily replaceable due to its multiple good qualities. In theory alternative materials may seem to be better but in reality the change to remove plastics from packaging is not realistic in the short-term.

The key insights of this study offer some new perspectives on packaging waste reduction. The results are especially useful for example wholesalers and retailers because these procurement's practices and policies can be applied to their packaging waste reduction as well. In addition, these findings could also generally benefit procurement personnel for example product managers and help them to control and monitor packaging waste with different ways. Furthermore, packaging material development and manufacturers could also have new perspective from this study from their customers' viewpoint which could be used to improve their customer service. Therefore, this study provides an overview of packaging requirements of fruits and

vegetables and presents practical examples of one company's packaging waste management in a general level.

However, the findings of this thesis cannot be generalized as the results are only based on three interviews from one company. A way to extend the study and make it more applicable would be to conduct more interviews in the case company and extend the scope to other relevant wholesalers in Finland. Interesting topics to examine further could be to analyse the packaging waste reduction of fruits and vegetables from retailers' perspective and find out consumers' attitudes towards loose products compared to packed ones and reasons behind these consumption habits. Another important topic to study further in the field of material development is to examine biodegradable materials' and bioplastics' impacts in the long-term and study how these materials affect the sales of fruits and vegetables.

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APPENDIX

Appendix 1: Interview questions

1. Background information

- How many years have you worked in the company?
- What does your job include?

2. Packaging waste

- How packaging waste is currently considered in the procurement of fruits and vegetables in your company? Is the recyclability of the package taken into account?
- How precisely is the overall packaging waste monitored? Does the assessment consider consumer's packaging waste as well or just the company's own?
- In which ways can procurement reduce packaging waste?
- What do you think that will happen with packaging and packaging materials in the future? (Will for example EU's plastic strategy have consequences?)
- How can the use of plastic in packaging be reduced or replaced with other alternatives? Is it worthwhile to even try to replace plastics?

3. Packaging of fruits and vegetables and alternative packaging materials

- How packaging and packaging materials of fruits and vegetables are considered in procurement?
- What sorts of materials are best for packaging fruits and vegetables?
- How packaging of fruits and vegetables differs from packaging other products? Are there special criteria?
- How packaging affects the cost of fruits and vegetables? Does it vary in different products?
- What sort of alternatives there is for plastics? How important it is to develop new packaging materials?
- How much does your company utilizes bio-based- and biodegradable materials currently in packaging of fruits and vegetables? What are the pros and cons of these materials? Do you believe that these materials will be more popular in the future?

ADDITIONAL QUESTIONS TO INTERVIEWEE C

- How new packaging materials and methods are tested and executed?
- Does this process vary with different products?