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SUSTAINABLE WASTE MANAGEMENT OF PERISHABLES IN A LARGE RETAIL

– case study on Intermarchè, France

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Waste has always been an inseparatable part of human existence and that is how waste management issue appeared. Waste surrounds us everywhere, but only a few thinks about what can be done to reduce or avoid this waste. Since the Industrial Revolution in the 19th century, people have an opportunity to profit from all possible kind of service, and one of those are supermarkets, - the invention of the post Second World War period, with "unlimited"choice of goods.

According to the national statistic services, only in France 7.1 million tons of food is wasted annually, representing up to €20bn of national costs. Unfortunately, food wastage is thought to be not harmful for the environment, since people tend to think that biodegradable is being turned into compost, while landfilling. However, it is not like this, and biowaste can be composted only when biologically treated; otherwise it emits very dangerous gases (methane), and contributes to green house effect. That is why waste management of perishables should become a prerequisite for the largest generators of this type of waste.

In an ideal situation, a retail chain should try to minimize its waste of perishables to the possible minimum, and treat those biowaste that nevertheless occurred. This thesis focuses of sustainability in purchasing and waste management of perishables in a large retail. This thesis is going to reveal the most sustainable purchasing and mechanical biological treatment options, and then analyze the current situation in the case company Intermarchè located in Aubenas, France. Based on this analysis, the case company will be advised on improvement opportunities.

KEYWORDS:

Sustainability, waste, waste management, sustainable purchasing, ASO, composting, anaerobic digestion

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LIST OF ABBREVIATIONS

AD	Anaerobic Digestion
ADB	Asian Development Bank
ASO	Automated Store Ordering
BCMs	Business Collaboration Models
BSCI	Business Social Compliance Initiative
CAO	Computer Assisted Ordering
CSR	Corporate social responsibility
DF	Days Fresh
FAO	Food and Agriculture Organization of the United Nations
JIT	Just-in-Time
PET	Polyethylene terephthalate
POS	Point of Sales
RDF	Refuse-derived fuel
RPP	Reoder Point Planning
SL	Shelf Life
WCED	World Commission on Environment and Development
WF	Weeks Fresh

1 INTRODUCTION

Waste and waste management has always been an inseparatable part of human's everyday life. Back to 8,000 to 9,000 BC., people learned to dispose their waste outside their settlements. At this time waste consisted of food scraps, shells, bones, broken household items, etc. People used to collect waste and than moved it outside their settlements, thus avoiding odor and wild animals, attracted by carrion (Bilitewski et al. 1997, 5). At this time and till the beginning of the 19th century, waste was biodegradable and the amount of it was small, that is why it was harming the environment to the minimum. However, later on, when the world faced industrialization, the phenomena of waste and waste management has become an issue: heavy industries waste, invention of polyethylene terephthalate (PET), extraction of natural resources, invention of cars and combustion engines, nuclear energy, and many other "products" of humans' industrialization progress are ruthlessly destroying our fragile environment.

To see harmful impacts of human activities one does not have to see globally and consider huge industries, such as natural gas extraction or nuclear generation; it is enough to take a closer look on local activities. This thesis focuses on operation activities of retail chains (supermarkets), which became a norm of people's conveniences, that all of us so used to. Unfortunately, a habit of throwing away or destroying food close to due-date became also a norm for both food destributors and consumers. According to the French Ministry of Environment, Energy and Sea (Ministère de l'environnement, de l'énergie et de la mer, 2015), an average French person throws away 20-30 kg of food a year, and 7 kg of this food is still packed; which represents up to €20 bn of national costs. Annually France wastes 7.1 million tons of food, of which 67% wasted by consumers, 15% by restaurants and 11% by shops (Ministère de l'environnement, de l'énergie et de la mer, 2015). France takes the forth place of Europe's biggest food wasters after Great Britain, Germany and Netherlands (The Guardian 2015).

There are often misconceptions about the environmental impact of food waste. People tend to think that organic food waste is not very harmful for the environment, because it is biodegradable and will go back to soil. Unfortunately, it is not true, since unless compost is created, a biodegradation is not possible; not mentioning a huge degree of methane emissions from uneaten food (FAO 2013, 21). To be sustainable is not longer a choice and everybody has to contribute to save our planet for future generations.

In addition, food wastage is not only harmful for the environment, but also does not add value to any business. Sustainability has several benefits for business, including economic, social and environmental benefits. Each business can greatly increase its profits with help of sustainability and a right use of waste management methods. Another contributing fact is that the community nowadays is becoming more “green-educated”, and concerned about the complexities of waste reduction. That is why a demonstrated commitment to increasing sustainability and being environmentally-friendly are a part of generally accepted corporate social responsibility (CSR), which is increasingly demanded by the community, share- and stakeholders (Government of South Australia 2007).

The topic of the following research is “Sustainable waste management of perishables in a large retail”. Waste management is a well-known term nowadays, and there is a lot of literature dedicated to this topic. However this literature focuses mainly on waste and environmental regulations of different countries; and describes mainly hazardous and industrial waste. Moreover, there are a few researches about sustainable purchasing, using computer systems, trying to find out a way how to optimize this systems for sustainable purchasing of perishables. However, a clear picture on how to manage waste within a large retail chain is missing, that is why the author feels a need for this research.

1.1 Motivation

The topic of this thesis research includes two fields of my interests: logistics and environmental pollution. Even though each topic is a huge issue itself, both of them are interrelating and interdepending, because sufficient logistics and supply chain management are the main factors influencing environment.

As an International Business degree student I became interested in this topic during my studies and professional practical trainings, while specializing in Logistics and Supply Chain Management. I have completed my practical training in the international corporate company, where logistics processes where highly standardized, and I became interested if those processes can be applied for a retail company.

Additionally, I am personally strongly committed to environmental issues and my future professional path will definitely go towards development of sustainable business. Thanks to this case study research I will be able to analyze how French retail works and what can be improved. Afterwards I aim to transfer this knowledge to my own country, Russia,

where those advanced technologies connected to waste management and environmental protection are less developed than in France. I believe that this thesis will give a start of my positive contribution to our environment.

1.2 The objective of the thesis and research questions

The objective of the thesis is to analyze the current situation of the case company in terms of sustainability, to find out its strength and weaknesses, and based on this give a recommendation for improvements. The research is going to answer the following research questions:

- How to reduce waste of perishables in a large retail?
- How to profit from waste of perishables in a large retail?
- What is the current situation in the case company, and what can be improved?

1.3 The structure of the thesis

The thesis starts with introduction and a literature review part. In the literature review part such terms as “sustainability”, “waste management” and “food waste” and “lifecycle of perishables” are defined. Waste management options are to be classified according to their sustainability level in the section 2.3. Due to the time limitation and research scope, this thesis will focus on two waste management options: Reduce and Recycle which are described in chapters 3 and 4 respectively.

In the chapter 5 the case company’s current situation will be analyzed in accordance with theoretical part of literature review. Based on this analysis it will be possible to define to which degree the case company is sustainable, and what can be improved in the waste management processes of the case company. The methodology chapter 6 describes how the research was implemented, which research approach was used; as well as it covers data collection techniques; reliability, validity and generalization of the research findings.

The chapter 7 “Research analysis” is aiming to analyze what can be improved in the case company in 2 aspects of sustainable management “Reduce” and “Recycle”, using

tools and methods described in the literature review part. This thesis finishes with a conclusion of research findings and suggestions for further research (chapter 8).

2 LITERATURE REVIEW

2.1 Sustainability

First of all it is necessary to define the term sustainability. Sustainability is not a “young” term, as it was defined in 1987 by World Commission on Environment and Development (WCED) as “a development that meets the needs of the present without compromising the ability of future generation to meet their own needs” (WCED 1987, 43). Nowadays the term has basically the same meaning, indicating an ability of something to sustain itself, meaning that one should take only what he needs to live now, not threatening the future generation to meet their needs (Farley and Smith 2014, 23). Thus sustainability is a creation of such conditions under which both humans and nature can coexist in harmony.

2.2 Waste and its types

According to United Nations Statistics Division (2016a), waste is a material for which a consumer (or a producer) “has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose”. Generally speaking, there are many types of waste produced by human beings. Those were described by Vaughn (2009, 5-9) in the book “Waste Management: A Reference Handbook” and include the following:

Household waste, waste produced by single- or multifamily homes, and includes generally biodegradable kitchen and food waste; as well as packaging waste, such as paper, PET, glass and metal waste. Sometimes this waste includes also bulky waste, such as obscelent electronic devices used in the households.

Commercial waste, produced by retail establishments, such as stores, supermarkets, hotels, restaurants, offices etc. Those establishments typically produce the same type of waste as households, but on a higher degree.

E-waste, waste of electronic sector, including all possible electronic devices (personal computers, TV, kitchen equipment, etc.). In the century of high technologies this type of

waste is produced everywhere, starting by private households, and finishing with commercial/ industrial establishments.

Hazardous waste, waste which possesses one of the following characteristics: it is ignitable, reactive, corrosivite, or toxic. This is normally waste from large industries, such as nuclear, pharmaceutical, chemical, etc., but can be also produced by private households, for e.g. utilization of batteries and accumulators.

Industrial waste, waste produced by building and construction industries, automobile industry, and all types of heavy industry.

Building waste, waste of construction and demolishing of any type of installation, including roads, bridges, buildings, etc. Building waste includes dirt, wood, steel, asphalt, etc.

Medical waste, waste produced by various medical institutions, and generated from human activity (for e.g. blood and urine tests, extracted teeth, etc.)

Agricultural waste, which also known as biomass waste, from agricultural activities, such as cropping and animals growing.

Universal waste, is waste wildly generated by both private households and businesses, excluding hazardous waste.

Since the case study company is a retail chain (a supermarket), it is possible to categorize its wastes as commercial waste, which will also include in a large scale e-waste, hazardous as well as agricultural waste (biomass waste). Due to the problematic limitation, this thesis will focus on biomass commercial waste (wastage of perishables) produced by a large retail chain. In the following, a term wastage of perishables will be defined.

2.2.1 Wastage of Perishables

According to estimations of FAO, in 2011 one third of all food produced in the world is lost or wasted (2013, 11). This wastage has three major consequences: (1) a negative impact on economy, (2) a negative impact on food availability and world hunger worldwide, (3) enormously negative environmental impacts. FAO (2013, 11) calculated that the direct economic costs of waste only in agricultural field, based on producers' prices, is about 750 billion USD, which is equal to the GDP of Switzerland.

Food wastage as such includes two terms: food loss and food waste. **Food loss** can be described the deterioration of food quality, and thus cannot be used anymore for human consumption. Food loss occurs mainly due to poor supply chain sufficiency, including poor infrastructure, transportation, lack of technology and skilled personnel. **Food waste** describes food which was appropriate for human consumption, however being discarded due to expiration of due-date. In large retail chains this typically happens because of oversupply (FAO 2013).

Since food wastage is associated with wastage of perishables, it is necessary to define it. According to van Donselaar et al. (2006, 2) perishables are the goods with a short Shelf Life (SL), measured in days, counting from the day a product is produced until the date the product becomes unacceptable for consumption or obsolete. A perishable product should either have a high rate of deterioration and require specific storage conditions; or can be characterized by the criteria that "the obsolescence date of the product is such that reordering for the products with the same date is impractical" (van Donselaar et.al. 2006, 2). Additionally it is necessary to notice, that perishables can also be categorized in two sub-groups, based on the amount of days in Shelf Life: Days Fresh (DF) with a shelf life of less than 9 days; and Weeks Fresh (WF) with a shelf life between 10-30 days (van Donselaar et.al. 2006, 5).

2.2.2 Lifecycle of perishables

Waste reduction can be implemented throughout the entire supply chain, during the entire lifecycle of a food product. According to FAO (2013, 16) the biggest environmental impact occurs on the production stage, and all other stages have additional impacts. As a consequence, the further in supply chain a product wastage happens, the bigger environmental impact it has. A classical view on the lifecycle of the product includes the following steps: production, storage, processing, transportation, wholesale/ retail, food services, consumption, and end of life.

Fehr et al. (2002, 249) offers another view of a lifecycle of perishables, which includes:

- (G) for growing (from soil preparation to harvesting);
- (M) for marketing (from farm to a retail sale);
- (C) for consumption proper (from retail purchase to garbage);

- (D) for after-consumption disposal of residues (from garbage to landfills).

The following figure discribes all steps of the lifecycle of perishables. What is more, from this figure it is absolutely clear that wastage can happen in (M) Marketing stage, without being ever consumed (C). It basically means that a retail produces waste; this kind of waste has a significant impact on environment since it had happened further in supply chain.

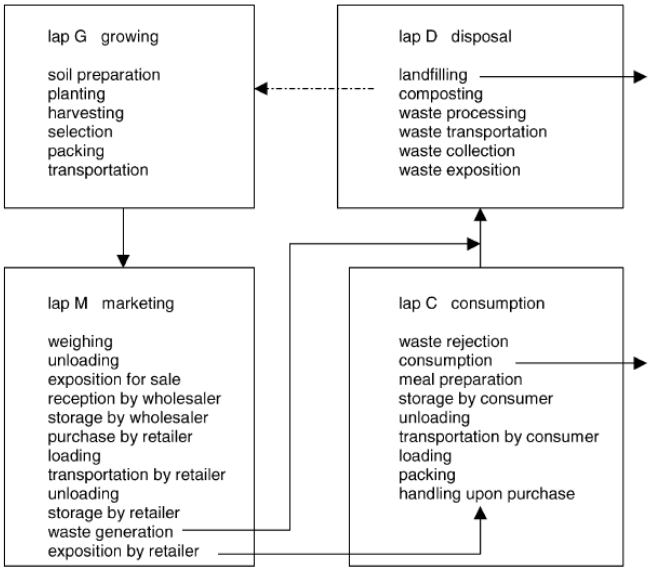

Figure 1 Lifecycle of perishables (Fehr 2002)

Since this thesis focuses on waste management of retail chains, the steps (M) Marketing and (D) Disposal are relevant to analyze. In the step (M) this thesis will focus on activities associated with retailers' activity, namely purchasing, warehausing and distribution; while for the step (D), the most environmentally-friendly disposal options are to be analyzed.

2.3 Waste management, options and their sustainability

It is evident that wastage is an international problem and it has become a world-wide recognized issue. That is how a term "waste management" appeared. United Nations Statistics Devision (2015b) defines "waste management" as following:

Waste management – are "characteristic activities, which include (a) collection, transport, treatment and disposal of waste, (b) control, monitoring and regulation of the

production, collection, transport, treatment and disposal of waste and (c) prevention of waste production through in-process modifications, reuse and recycling".

Waste management options can be classified according to their sustainability and a degree of environmental-friendliness. The most and the least desirable options are illustrated in the graphic below (FAO 2013, 12).

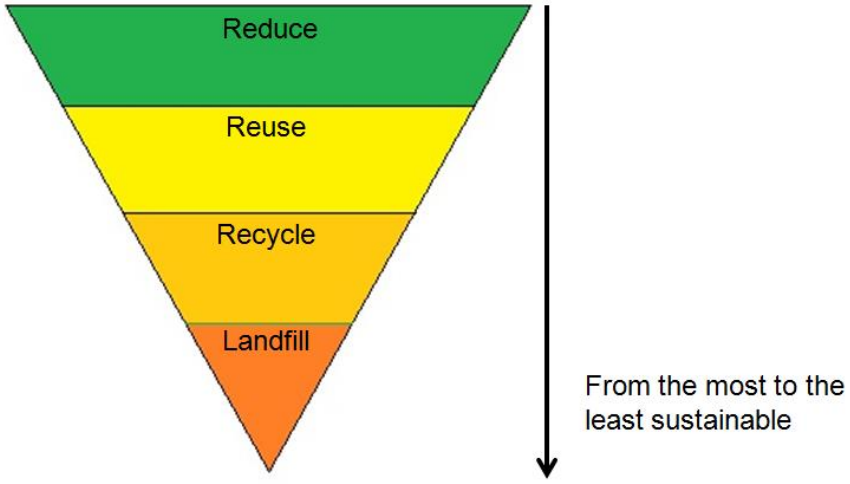

Figure 2 Classification of waste management options to the degree of their sustainability (FAO 2013, 12)

2.3.1 Reduce

As it is clear from the graph above, reduce is the most sustainable and environmentally-friendly option, also known as "source reduction", or in other words "waste prevention or avoidance". This option is one of the youngest methods of waste management, which aims to reduce volumes of waste, and/ or a level of its toxity. This option can be applied in every step of supply chain, and is indeed the best way of reducing the waste of natural sources (Vaughn 2009, 13). In large retail chains this can be achieved through special logistics methods, such as JIT (just in time) delivery; sustainable purchasing using ASO (Automated Store Ordering) or CAO (Computer Assisted Ordering) systems; and efficient inventory management methods (for e.g. FIFO).

2.3.2 Reuse

This option can be described as a second desirable choice of sustainable waste management; and means an actual use of a product or material again. Speaking about

perishable goods, this option typically include donating food, which due date is close to expire, for charities, or selling/ donating it to animal farms for feed (FAO 2013, 53).

The system of obligatory donation of quality food, which did not find its customer, and doomed for wastage, is applied or being under governmental consideration of many countries. Since the case company is a French retail chain, it is relevant to analyse the current situation in this country.

France became the first country in the World to prohibit supermarkets to throw away or destroy unsold food (Chrisafis 2016). According to the French Ministry of Environment, Energy and Sea (Ministère de l'environnement, de l'énergie et de la mer 2015), all retail stores of more than 400m^2 are obliged to donated food, which otherwise would be thrown away or destroyed, by signing a donation contracts with charities; otherwise it will face penalties. According to this commitment, it is forbidden to destroy unsold food which is still eatable; as well as it is forbidden for retailers to prohibit the donation of products having their brand name.

2.3.3 Recycle

Recycling, which also includes sortation of waste for those which can and cannot be reused. Recycling is considered as one of the best methods of waste management, because it reduces waste, and thus saves the place in landfills; and what is more it reduces the need for raw materials, which would be needed for production of new products/ packages (Vaughn 2009, 13). The main benefits of these options over landfills, is that they let energy to be recovered. Recycling includes several options, such as:

- By-product recycling; this method can be brightly illustrated by such European countries, as Germany and Finland, where recycling of plastic and glass bottles is a normal practice.
- Phytoremediation; which is a method of treatment of polluted waters, soils, air with a help of green plants, which take up polluting waste through their root systems along with water. This method is more relevant for air/water/soil polluting factories.

And technologies for treating biodegradable waste, including:

- Mechanical biological treatment, is a method which involves mechanical sorting of waste for organic and nonorganic, and a future treatment of biowaste, through accelerated anaerobic digestion. As a result, the end product can be used for producing biogas, or soil amendments.

- Composting; is a method of proceeding organic waste, which is more often associated with farming and agricultural industries.

- Incineration with energy recovery and rendering; is a process of controlled burning of waste. Some companies use this method to generate electricity, and this process is named waste-to-energy. In the USA this method is wildly used by operators, who started to sort the waste in two categories: recyclable (glass, metal) and the rest. The rest waste is than burned to produce refuse-derived fuel, which can be used in for e.g. power plants (Vaughn 2009, 11). However, it is important to mention, that this method is to be used only with nonhazardous waste, since when heating, hazardous waste can evolve gases dangerous for people.

According to Fehr et al. (2002, 248), those options of biological waste treatment, including composting and accelerated anaerobic digestion, are the most suitable ones, since they ”close” (unlike landfills) a natural lifecycle of a product. Since this thesis work is focused on sustainability, those two options are to be analyzed for the case company.

2.3.4 Landfills

This is the least desirable and the least environmetally-friendly option since it means actually disposal or “burial” of waste in special locations without any further treatment. According to Fehr (2002, 247) landfills does not close a natural life cycle of a product, that is why disposal of organic waste to the landfills causes emission of greenhouse gases, such as methane, and potentially pollute soil and water (FAO 2013, 13). What is more, landfilling includes additional costs assosiated with:

- Collection; meaning the transportation of waste from the places where it was produced to a place where it will be disposed. According to Vaughn (2009, 10), collection is “the most expensive element of waste management, accounting for between 50 and 70 percent of the costs for operations.”

- Waste transfer station; is a processing facilities for solid waste, when the waste is firstly transported to those facilities and stored there for a period of time, and afterwards transferred by a larger vehicle to a landfill (Vaughn 2009, 18).

Landfilling is undesirable solution of waste management in terms of sustainability (Fehr 2002, 247), that is why this method of treatment will not be considered to analyze for the case company.

2.4 Benefits of sustainable waste management

Waste management and waste reduction options are often assumed by businessmen as time-, and money-consuming. Eventhough, investments in waste management can be high in the beginning, the savings after are higher. According to the Government of South Australia (Zero Waste SA 2007, 13), good waste management is good business management, and that being “green” does not mean going into the “red”. The benefits of sustainable waste management were grouped in the following categories (Zero Waste SA 2007, 13; Crittenden and Kolaczkowski 1995, 7):

Overall benefits

- Improve overall management performance and overall operating efficiency, and employee morale;
- Reduce waste storage space, thus creating space for productive operations;
- Usage of best practice operating method;
- Reduce administrative and paperwork associated with waste disposal (such as waste transfer stations, collection);

The overall benefits are well presented in the case of ”Stop and Shop”, an american large grocery chain with more than 500 shops, which decided to optimize its operations by research of freshness, product loss and consumer behavior in departments with perishables. As a result the company has managed to save $100 million per year, by discovering that all stockkeeping units were not necessary and just caused product loss; the overfilled displays led to spoilage of products and that the customers were not satisfied by spoiled products. Additionally, the company had more costs for sorting out spoiled items. After the conduction of the analysis the stocklevels were reduced, and customers’ satisfaction increased, because products were three days fresher than before

(FAO 2013, 36). The company has succeeded to reduce administrative costs associated with waste disposal, reduced waste storage, and improved overall operating efficiency.

Economic benefits

- Increase savings from waste reduction, increasing thus profits;
- Reduce operating costs, such as: handling, pretreatment, transport and off-site disposal costs; in future, disposal costs are likely to rise, cause of decreasing capabilities of existing landfills and their remote from cities;
- Reduce analytical costs associated with waste sortation and identification;

An example of economic benefits can be illustrated by dairy production in Zambia. In this country there is a lack of refrigirating and pasteurization possibilities on farms, that is why ofter dairy products were spoiled and wasted. To solve this issue, some governmental bodies together with local businessmen have established a rural milk collection centers, equipped with fridges and pasteurization facilities. As a result, this initiative has not only decreased waste caused by diary products, but also significantly increased farmers' income and availability of local milk for citizens (USAID/Zambia 2005).

Social benefits

- Promote a positive "green" public image, which is very important because of "green" trends in society; concern for the environment are high within the community; customers are looking forward to "doing something for the environment";
- Increase CSR (Corporate Social Responsibility): companies with effective and sustainable waste management practices are seen as responsible, and thus can be attractive to customers sensitive for environmental issues;

A good example of benefiting socially of waste management sustainable solutions was a campaign, named "Feeding the 5000", founded by Tristram Stuart, in December 2009, in Trafalgar Square in the UK. 5000 people were given free food, which would be otherwise thrown away, such as imperfectly shaped fruits and vegetables. This campaign has spread overseas, including Dublin, Paris and Bristol, thus increasing awareness of food wastage problem, and had a huge media coverage. What is more, this campaign

has eased the high cosmetic standards of supermarkets towards shapes and sizes of fruits and vegetables (FAO 2013, 22).

Environmental benefits

- Improve commitment with environmental regulations on governmental level;
- Promotes better use and conservation of resources, thus reducing waste and decreasing pollution.

The environmental benefits are to be illustrated by an example of school competition in the UK, aiming to throw the less food possible. During the campaign, the food waste per portion has decreased to 13%. As the sample group consisted of 6.850 pupils which are served 173 days/year with 1.185.050 servings/year, it was calculated that 6.783 kg of waste were avoided thanks to this campaign. What is more, this campaign launched a political decision on necessity of weighting of food waste twice per year. In avarage, schools have decreased their wastage to 13%. According to Unilever, 1kg of school food waste equals to approximately 1 kg of CO_2. As a consequence, around 7 tons of CO_2 can be annually avoided (Prewaste 2012).

Thus the chapter 2 “Literature review” has fully described such terms as sustainability, waste, food wastage, as well as waste management options and their sustainability. Due to the time limitation, this thesis will focus mainly on two options of sustainable waste management: reduce waste in a retail chain, which is going to be implemented through sustainable purchasing; and recycle, where several option of recycling will be analyzed, and the most suitable is to be chosen for the case company. As a result, the research questions ”How to reduce waste of perishables in a large retail?”and ”How to profit from waste of perishables in a large retail?” are to be answered in the chapters 3 and 4.

3 REDUCE: SUSTAINABLE PURCHASING

For purchasing accurate ordering amounts, it is necessary to estimate customer demand. Demand-based ordering system, in other words pull system, is the key factor which helps to reduce inventory stock levels, thus making a supply chain more efficient, and purchasing more sustainable (Closs et al. 1998, 24).

According to van Donselaar et al. (2005, 10), logistics decisions can be improved by generally increasing:

- The level of differentiation of goods, when controlling the operations;
- The level of Sophistication in the Decision Support System;
- The level of integration of multiple decisions.

In the following chapters those options will be desribed.

3.1 The level of differentiation, ABC Classification

According to van Donselaar et al. (2005, 10), ABC Classification can be used as a tool, when increasing the level of differentiation when controlling the operations. ABC analysis is one of the basic principles of Inventory management. It was discovered by Vilfredo Pareto, an Italian economist, who explained “that a small percentage of a population always has the greatest effect” (Viale and Carrigan 1996, 36). This law was later expanded to ABC Analysis, claiming that there are:

- Products A: 20% of products create 80% of revenue; thus this is a group of products with a high consumption value, so it must be constantly controlled by management; must have a very accurate demand forecasting, as well as maximum efforts to reduce lead time (Rama 2009).
- Products B: 30% of products create 15% of revenue; this product type is of the moderate value, with periodic attention by purchase; require moderate control and the demand is estimated based on past data (Rama 2009).
- Products C: 50% of products create 5% of revenue; is a product type with low consumption value, consequently require lower control, rough estimate for planning (Rama 2009).

ABC classification of goods is vital for figuring out the products that are critical to control (A-level) for effective inventory management (Sukhia et al. 2014, 1). Based on this analysis, managerial staff of a large retail is able to apply selective control and to figure out which product types require more control. Consequently, waste reduction is to be achieved through a differentiated inventory control. According to Rama (2009), ABC analysis has helped many companies to improve planning and inventory turnover.

Van Donselaar et al. (2005, 10) offers to distinguish products in the following five main categories:

1. **Phasing-in/-out goods**; also with a short product Life Cycle, are the goods with insufficient demand history (phasing-in), or with a high risk of onsolence (phasing-out); that is why special attention is to be applied for demand forecasting. Possible improvements here are usage of similarities in forecasts made by different individual people; or usage of early sales data to improve demand forecasts.

2. **Promotion goods**; are goods of regular assortment, but offered temporary with a special price, or additional visibility. Optimization of demand forecast for this items can be achieved through marketing intelligence and econometric models to forecast demand; using push-strategy, and coordinating the promotions with suppliers. The demand forecast should not be based on previous statistics, but on marketing intelligence, price elasticity, and consumer behavior.

3. **Purchasing driven goods**; are goods from non-regular assortment, bought by Purchasing department by special buying or selling opportunity. A certain amount of goods is purchased, and when it is sold out, no replenishment occurs. The decision on purchasing amount is often based on for e.g. discount opportunities, not on demand forecast.

4. **Capacity driven goods**; are goods purchased by Operations department in order to smooth handling/ transportation capacities. For e.g. this are goods, which demand is different during the week.

5. **Regular goods**; are the goods which are not phasing-in/-out, not on promotion, not purchasing/ capacity driven. In the following section 3.2 purchasing options and practices of regular goods are to be described.

3.2 The level of Sophistication in Reoder System

The second two options of logistics decisions described by van Donselaar et al. (2005, 15) are the level of Sophistication in the Decision Support System and the level of integration of multiple decisions. The level of sophistication may vary due to automation of the system, the quality of input data, correct settings of logistics options in reordering systems, and the ability of personnel to deal correctly with the systems and make decisions (van Donselaar et al. 2005, 15).

Reorder decisions on perishables can be made manually (no computer support) by personnel with considerable experience in a product category, cause those items require additional intelligence, such as judgment on quality of inventory (van Donselaar et al. 2005, 16). Other reorder decisions can be ASO (Automated Store Ordering) and CAO (Computer Assisted Ordering). Ideally a computer based system should be able not only to determine an optimal solution of reoder time and quantity, but also offer insights on performance indicators. In the following sections 3.2.1 and 3.2.2 reorder systems are to be described.

3.2.1 Sustainable demand forecasting of regular goods via POS

POS (Point of sales), also named a check-out, literally means an area surrounding the counter where customers pay (Madaan 2009, 237). In a large retail chain a counter normally applies a method of barecode scanners in order to ”check-out” a bought product. According to Sukhia et al. (2014, 1), a modern POS must include advanced functions, including for e.g. inventory management, warehousing, customer relation management (CRM), etc. The main task of POS is to alert the retailer to reorder on time, to avoid stock-out. Basically an alert is set through RPP (Reoder Point Planning) meaning that when available stocks fall below the reoder level, an order proposal is generated (SAP 2016). RPP considers safety stocks, as well as forecasted consumption. That is why well done forecast is to minimize errors in demand, thus leading to success in supply chain and reduction of waste. Based on the efficient work of POS, a database is to be created, which should record statistical information on merchandise, thus enabling future forecasting.

According to Sukhia et al. (2014, 3) demand forecasting is done with help of statistical techniques, and the parameters used in each technique are quarters, unit sales of each quarter (a period of time), and seasonal effect. Like it was done in the section 2.3 ”Waste

management, options and their sustainability", it is possible to categorize three demand forecasting techniques in accordance with their sustainability level:

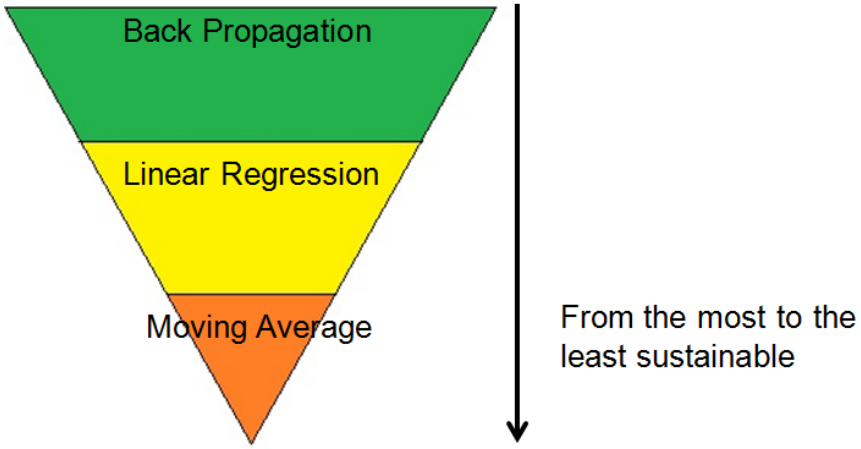

Figure 3 Demand forecasting techniques

- Simple moving average, which is widely used by retail industry, however considered to be as ineffective forecasting technique, because it does not consider variability (such as promotions, seasonal offers, etc.). this option allows many errors in demand forecasting, that is why it can be considered as not sustainable, because it increases waste;
- Linear regression, which is another forecast technique, considered to be more precise, and as a consequence, more sustainable, than "simple moving average", since it does not consider demand as constant form quarter to quarter, but considers seasonal index;
- Back propagation, this algorithm is considered to be the most precise, consequently, the most sustainable, since it takes into consideration quarters, sales and seasonal effect of the last two years to predict the demand. (Sukhia et al. 2014, 3-4).

3.2.2 ASO and CAO

ASO (Automated Store Ordering) and CAO (Computer Assisted Ordering) are systems created to improve the efficiency of inventory managament in retailing sector (Haijema 2011, 160). ASO is a software used by many retail chains for automated store replenishment, that automatically generates orders, when the level of shelf stocks falls

below a set level (Babylon 2001), by receiving a data of actual stock levels via POS. A system is set to order quantities, based on actual stock level and information on future demand (for e.g. historical statistics, promotions). The principle of CAO system is like ASO system, the main difference is just that generated by CAO order suggestions must be approved by a purchasing manager, while ASO automatically orders the goods to the store (Garry 2004, 65).

This research is going to be focused on ASO/CAO systems for perishables and will try to discover a possible way of optimization of ASO/CAO for perishable, since a good organized ASO/CAO will ensure a waste reduction. It is important to notice that an ordinary ASO/CAO system, designed for non-perishabes, is not acceptable for perishables, since it does not consider a number of factors, such as aging of products in stock and outdating of products, thus causing unnecessary high inventory levels or stock-outs (Haijema 2011, 160). ASO/CAO optimization for perishables is much more demanding than for non-perishables, since it has to consider such facts as promotions, product introductions and product declines, products which are being sold in a very short period only (promotions), or seasonally (van Donselaar et al. 2006, 8).

Referring to van Donselaar et al. (2005, 14), it is to mention that often ASO systems use traditional inventory control policy, which is described by:

(R, s, nQ)

Where ”R” is reviewed period, ”s” is reorder level, ”nQ” n times (the minimal integer number of case packs) of Q items (case pack size). With these traditional control policy it is still possible to differentiate replenishment strategies. For e.g. by reducing the reviewed period ”R” for perishables, thus increasing the delivery frequency (van Donselaar 2005, 14).

Van Donselaar et al. (2006, 11) describes the components that a sustainable ASO system should be able to define, including:

- An ability of differentiate between perishables and non-perishables;
- A usage of weekly-pattern analysis when ordering (for e.g. that the peak demand occurs on Friday and Saturday);
- Substitution effect for items with a short Shelf Life;

- Checking of the aggregate order level for a group of substitutable items;
- To register the exact time of a stock-out for a substitutable item, to be able to define the statistics;
- To register the daily amount of waste caused by perishable items;
- Possibly other aspects like: price elasticity, weather forecasts and seasonality.

This research is going to find out which ordering practices: automated, assisted or manual, are used by the case company. Additionally it will be analyzed which ASO software is used by the case company, and how sustainable its ordering forecasts are. Afterwards, there will be given some suggestion for improvements of the current system. This will be described in the chapter 7.

3.2.3 Options to reduce waste of perishables

According to van Donselaar et al. (2006, 4), it is wise to control the perishable inventories, since it can help to reduce the ”majour cost factor for perishables: waste”, and in case if there is no return policy from supplier, the financial consequences from waste for retailer are severe. There are three possible options that can help to reduce the amount of waste caused by perishables (van Donselaar et.al. 2006, 4; Taub and Singht 1998, 377):

- Reduction of lead time and review period; through a direct transportation or cross docking of perishables. This option is to be described in the section 3.4 “Sustainable Distribution”.
- Demand substitution; means to offer a customer an alternative product, if his/her preferred product is out of stock.
- Limited assortment; with a purpose to enlarge demand for one-two specific group of products, rather than forecasting demand for many different types of the same product. Thus a demand will become relatively certain and will help to reduce the overall waste in product category.
- FIFO (first-in-first-out)/ LIFO (last-in-first-out) as inventory management basics.

Speaking about the second option ”demand substitution” it is necessary to differentiate various types of products to their substitution rate. Such products as bread have really high substitution rate, so the method of demand substitution can be applied, thus helping

to reduce over-supply (van Donselaar et al. 2005, 15). However some other products have really low substitution rate. Based on the research of Corsten and Gruen (2003), only 26% of customers will substitute their preferred brand with a different one, and 15% will delay the purchaise, while the rest will buy item at another store or will not purchaise at all.

The third option is arguable, since the main idea of any large retail (supermarket) is to provide to its customer a large spectrum of choice and offer a wide range of products (Agarwal 2015). That is why many supermarket owners would rather throw spoiled food, than would not have it in a store (FAO 2013, 51).

Another option of waste management optimization is usage of basic inventory management principle FIFO (first-in-first-out)/ LIFO (last-in-first-out) (Taub and Singh 1997, 377). FIFO and LIFO principles are time-based criterion for perishable inventory management. Perishables must be stored using FIFO principle, so that older perishables do not end up with the older stock standing and rotting on the back side of shelves or refridgerators (Lodewyckx et al. 2007, 243), but must be sold at first.

3.3 Food wastage audit

This biggest problem within the food wastage issue is that there is no obligation for corporations to report the food wastage data (FAO 2013, 20). Thus it is difficult to calculate the real impact of food wastage, since data given by corporations is often underestimated. This happens because of lack of universal measuring mechanism of food waste. That is why there is a need to increase awareness of this issue among all stakeholders of supply chain.

Consistent food wastage audits are the best ways to analyse wastage and based on this find possible opportunities and solutions, make adjustments and reduce food wastage (FAO 2013, 21). This kind of audit should record the amount of waste, as well as types of waste, including types of food waste, and a reason of discard.

3.4 Sustainable distribution

Transportation of perishables is more demanding process than transportation of non-perishables. Transportation of perishables can require additional equipment, such as refrigerating. A correct transportation of perishable goods is a vital part of product life cycle, which helps to reduce wastage, caused by non-sufficient transportation. Some

possible improvement while transporting perishables are improvement of means of transport, improvement of transportation equipment, reducing the length of routes.

As it was discussed earlier, perishables are products with a Shelf Life less than 9 days (Days Fresh), and 10 – 30 days (Weeks Fresh), that is why a quick and precise transportation is a must. The section 3.2.3 ”Options to reduce waste of perishables”, describes 3 options to reduce waste of perishables, one of which is direct deliveries and cross docking (van Donselaar et al. 2006, 4). Those types of transportation can indeed prevent loss, and as a consequence waste during the transportation, since they will reduce a possibility of food spoiling.

1. **Direct delivery**, is a type of a delivery, when the goods are sent directly from producer to the retail chain, without being stored in any intermediary. Advantages of this method, is that a shortest route can be chosen. Direct deliveries can also simplify operations and delivery coordination (Hugos 2011, 90). However, this method is sustainable only when the economic ordered quantities (EOQ) equal the size of the track load (TL). The reason is that driving a LTL (less than trackload) has high environmental impact and additional financial costs. In the analytical part of this research it is will be analyzed if direct deliveries can be a sustainable option for the case company, or a “milk run”, a delivery method for mixed loads from different suppliers (Hugos 2011, 90), is more efficient method for it.

2. **Cross docking**, is a method of delivery, when full pallets are received from the vendor and moved to outbound docks for combination with similar pallets from other suppliers. Those pallets are then delivered together in 1 vehicle to the supermarket. The main advantage of this method is the reduction of costs and environmental impact, since it avoids LTL (less than trackload) (Ray 2010, 168). However it is necessary to consider, that different perishable goods from different suppliers may need different requirements for transportation (for e.g. temperature). That is why this method must be accurately planned; since incorrect transportation of perishables may cause a severe wastage.

In this thesis it is going to be analyzed which of the above mentioned methods can be more sustainable and waste-minimizing for the case company. However it is already clear that both methods have their disadvantages towards sustainable transportation of perishables. That is why it can be interesting to analyze a type of delivery, strongly

committed to waste reduction. This type of delivery is JIT (just in time), since the management philosophy behind JIT is “to continuously search for ways to make processes more efficient with the ultimate goal of producing goods or services without incurring any waste” (Lai and Cheng 2016, 12).

JIT principle means in general a production methodology, the main objective of which is to eliminate waste, thus to increase the overall productivity. According to Lai and Cheng (2016, 17), JIT delivery can be defined as following:

- **JIT delivery** is a “delivery of only the necessary quality parts, in the right quantity, at the right time and place, while using a minimum of facilities, equipment, materials and human resource”. Thus this method aims to fulfill customer requirements through the production of high-quality goods, and at the same time eliminating waste, reducing lead time, increasing productivity. From these definitions it is clear that this method requires establishment of close and stable relationships with suppliers.

This thesis is going to figure out if JIT deliveries can increase sustainability of above mentioned methods of deliveries, and if it can be applied to some of perishable good types of the case company.

4 RECYCLE: MECHANICAL BIOLOGICAL TREATMENT

As it was mentioned before, recycling is the third desirable option according to its sustainability and environmental-friendliness of waste management. The waste should be reduced to the minimum, however, being realistic, it is clear that for a large retail chain this is hardly achievable. The main reason for this is the principle of any supermarket – to provide to a customer a variety of products and a wide choice. That is why recycling as a waste management option must take place in this research. The idea is that a supermarket must try to reduce its waste to the lowest amount possible, and than recycle the rest.

The best practice example in the field of retail can be the case of the UK supermarket chain ”Sainsbury”. This company has decided to become energy independent, using its biowaste residues as a source of biogas production. Through a partnership with the UK’s largest waste management company ”Biffa”, ”Sainsbury” delivers its food waste from all over the UK to ”Biffa”, where it is being treated and processed into biogas, which is later used to produce electricity for the agreed location (Sainsbury 2013). However, before implementing biological treatment (recycling), the company searches the ways to ”reuse”, by donating unsold food to charity organisations for poor people or animal care centers (Feldman 2014). The case company can consider an example of ”Sainsbury” as benchmarking.

In the following, options of biologocal treatment will be discussed and analyzed. Based on that, the best option will be recommended to the case company.

4.1 Technology options

Mechanical biological organic waste treatment includes several options, including aerobic composting, anaerobic digestion, landfill gas extraction, and refuse-derived fuel (RDF). The following figure illustrates possible treatment methods (ADB 2011, 15):

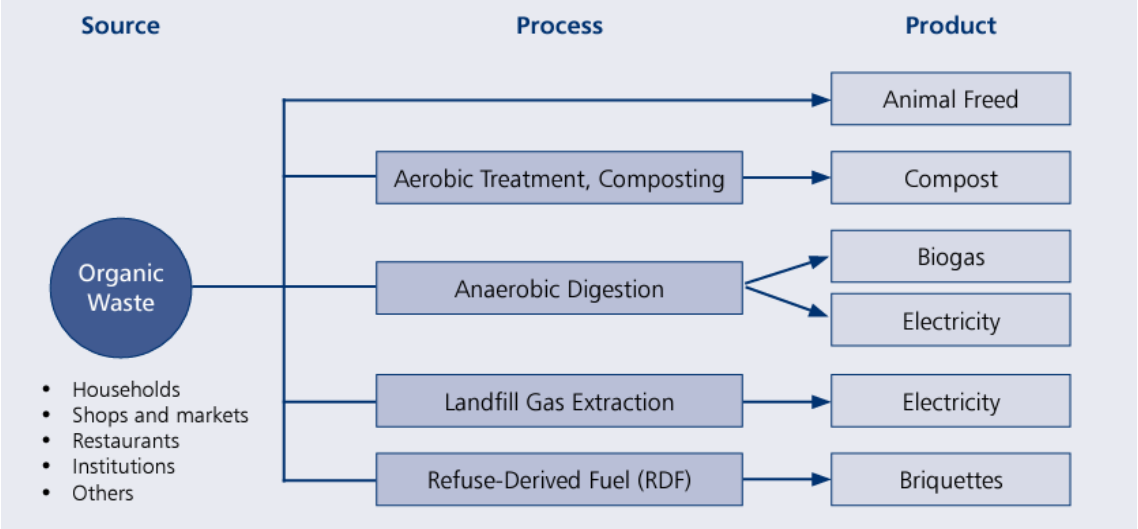

Figure 4 Mechanical biological organic waste treatment (ADB 2011, 15)

Aerobic Composting, which is a process of microbial degradation of organic products, such as food, vegetables, fruits, leaves, grasses, and crop residues. As it was mentioned before, composting is a traditional waste management option for agricultural waste, however it can also be applied to municipal waste, including individual households and commercial waste from large facilities. The process demands from two to four months to get a final product – compost, and aims to improve overall soil quality. Often the end product (compost) is sold to other business, since it is a marketable, value-added commodity (ADB 2011, 16).

Anaerobic Digestion (AD), is the biological process of breakdown of organic material by micro-organisms in the absence of oxygen, with the purpose to produce biogas (a mixture of methane and carbon dioxide). After proceeding, biogas can be used as a renewable energy source for generating electricity and heat to power on-site equipment (WRAP 2016a). Evidently this option is suitable only for biodegradables, so the process of AD starts with a careful pre-treatment, including separation of biodegradables from its plastic packaging and other non-bio elements. AD is a slow mixing process. After AD is completed, it is possible to collect digestate, which can be used as biofertiliser; or biogas, which can be used to produce electricity and heat (WRAP 2016b).

Landfill Gas Extraction, land gas is produced from organic waste, which converts to methane gas under anaerobic conditions (ADB 2011, 27). The process of anaerobic digestion is happening on landfills, where non-sorted waste was disposed. The process highly depends on weather conditions, moisture conditions, landfill management, and

the composition of the waste. According to ADB report (2011, 27), in order to extract this gas from landfills, the amount of waste should generally be greater than 1 million tons in a site with a depth of more than 10 meters. The gas is extracted with gas-collection pipes.

Refuse-Derived Fuel (RDF), is fuel made of dehydrated combustible waste converted into fluff, and then into pellets, briquettes, or logs (ADB 2011, 27). Unlike anaerobic digestion, not only biodegradable waste, but also plastics rubber and other high-caloric organic materials, however not glass or metals, can be used for this method. RDF can be used to generate electricity in combination with traditional fuels, such as coal or wood.

4.2 Selecting criteria

Each of the above mentioned technology organic waste management options is competitive, that is why a question ”which option to choose?” derives. A company, aiming to implement one or several of biological treatment methods, must consider several facts, such as for e.g. waste composition, quality of waste, investment costs, etc. Eventhough all of those indicators are important, first of all it is necessary to identify, if the amount of waste is sufficient for any type of biological treatment. The following table describes suitability of waste treatment options, depending on the amount of waste generated (ADB 2011, 30).

Table 1 Suitabiliity of waste treatment options, based on the amount of waste (*tpd, tons per day)

Technology	Small-Scale Waste Generation (less than 5 tpd*)	Medium-Scale Waste Generation (less than 50 tpd*)	Large-Scale Waste Generation (more than 50 tpd*)
Composting	Suitable	Suitable	Suitable
AD (biogas)	Suitable	Suitable	Suitable
RDF	Not suitable	Suitable	Suitable

Waste volume (quantity of waste) is the main indicator which identifies the scale of organic waste treatment facilities. From the table 1 it can be concluded that RDF (refuse-derived fuel) is not suitable for Small-Scale waste generators, because of insufficient amount of raw material; while composting and AD (anaerobic digestion) are suitable. What is more, AD facility can be placed along with a small composting facilities to utilize biodegradables (ADB 2011, 30).

When a company realizes that it has a sufficient amount of waste, the other indicators of selection can be taken into consideration. The main aspects of different treatment types were analysed by ADB (2011, 31-32). In the following table the analysis of ADB research is presented.

Table 2 Technology selecting criteria

	Indicator	Composting	AD (Biogas)	RDF
1	Organic waste suitability	Highly suitable	Highly suitable	Not economically attractive
2	Quality of waste	Medium	Medium	Low
3	Land requirement	150-200 m^2/ton	400-500 m^2/ton	125 m^2/ton
4	Investment costs	$100-30.000/ton	$350-500/ton	$75.000-100.000/ton
5	Operation cost	Low to medium	High	High
6	Skilled workers	Required	Required	Required
7	Technology	Simple	Comparatively simple	Simple
8	Capacity of facility	Household to large scale	Household to large scale	Medium to large scale

As it can be seen from the table 2, first of all a company has to identify waste composition (quality of waste), its physical and chemical characteristics; such as sortation of organic and non-organic waste, hazardous waste and e-waste. As it was mentioned before, this research focuses on biodegradable waste. From the table 2 it can be concluded, that if the biggest part of waste is biodegradable, it will be wise to use anaerobic digestion (AD) option or composting, and not RDF option, because it is not economically attractive to use biodegradable waste for RDF, but also dry soiled plastic, wood, fabrics, etc. (ADB 2011, 31).

Secondly, the quality of waste matters, since for composting and AD options, one has to use medium quality waste, with a low heavy metal composition. It means that waste for AD and composting requires source separation, while for RDF a low quality waste is acceptable. Thirdly, a company has to consider the availability of land. The thing is that (as it can be seen from the table 2) AD requires a bigger area of land, comparing with composting and RDF. However, the investment costs are higher for RDF, and potentially higher for composting (see table 2, point 4). Speaking about operation costs, they are

described as high for AD and RFD, and from low to medium for composting (see table 2, point 5).

The sixth point of the selection indicator claims that each of those methods require trained workers. Indeed, the availability of skilled workers is an important fact to be considered by a company. A company willing to implement one of those waste treatment method will need either to hire new skilled workers, or educate and qualificate those who are already employed in the company. Another important issue, - considering occupational safety of workers, and providing protective equipment. At the seventh point, the table 2 compares the technology to degree of its complexity. The AD is described as more complex than composting and RDF, however still comparatively simple. And finally, speaking about capacity of a project, composting and AD can be used both in households and large scale degree, while RDF is not recommended to be used in households (see table 2, point 8).

Additionally, any company, willing to implement one of those methods, has to consider a legislative aspects of a country, where the method is to be implemented (ADB 2011, 30). For example, there can be policies, prohibiting to place a composting, AD or RDF plant in a certaint distance to public places.

In the analytical part of this thesis the amount and the structure of perishable waste, produced by the case company is to be analyzed, and the most suitable option is to be advised.

5 CASE COMPANY

First of all it is necessary to mention that supermarket as a concept was firstly invented in France after the Second World War. This concept includes self-service and large general distribution. Nowadays in France there are seven independent distribution groups, including Groupe Casino, Groupe Louis Delhaize, Groupe Carrefour, Groupe Les Mousquetaires, Groupe E.Leclerc, Groupe Auchan, and Système U (di Rosa 2012).

Intermarché belongs to “Groupe Les Mousquetaires”, which is the third biggest distribution group in France with an estimated turnover of €25.970 million in 2015 (Retail-Index 2016). Intermarché positions itself “against high prices” (“Contre la vie chère”), which is also a slogan of the company, though it is not a discount supermarket group. The group has a number of its own brands, including Bouton d'or, Canaillou, Capitaine Cook, Monique Ranou, Pâturages, etc.

The prices of Intermarché are higher than offered by “E.Leclerc”, the best price supermarket within a non-discounters supermarket group. Nowadays shops of this group can be devided into the following types: Intermarché Hyper (more than 3200 m^2), Super (1500 m^2 - 3200 m^2), Express (placed in the city centers, less than 700 m^2) and Contact (less than 1500 m^2) (Bourja, [6.May.2016]).

5.1 Sustainable development approach

Since its creation in 1969, the group establishes relations with small and medium size local suppliers, thus negotiating best prices and the highest quality (Intermarche.com 2016a). What is more the group positions itself as a corporate social responsible company (CSR), and committed to sustainable development since 2003. The approach of sustainable development is base on four steps (Intermarche.com 2016b):

1. Sustainable products, including:
    a. transparent nutritional facts on products;
    b. products of French origin;
    c. commitment to BSCI (Business Social Compliance Initiative) for social practices in risk;
    d. 2315 product types refer to organic/bio/eco products;

e. Note the region of origin on each product;

2. Environmental protection, including:

    a. usage of energy saving equipment, including light, heating, conditioning and refrigerating;

    b. optimization of energy efficiency of buildings;

    c. limiting gas emissions through improving logistics and through offering charging stations for electric vehicles;

    d. separation and recycling of cartons and plastic;

    e. recycling of light bulbs, batteries, textile and electronic equipment;

    f. consuming less paper and carton;

3. Social activities, including:

    a. the commitment against food wastage "Pacte National contre le gaspillage alimentaire" (“National Pact against food waste”) signed in 2013 and aiming to reduce waste by 50% by 2025, and commitment to food donation with an expired due-to date;

    b. solidarity acts, by donating money to human associations;

    c. commitment to associations educating eco-citizens of tomorrow;

4. Best business practices, including:

    a. high customer service level;

    b. regular education of employees in quality, safety and environment;

    c. high level monitoring of product quality.

5.2 Campaign: fruits et légumes moches

As it was mentioned before, Intermarché positions itself as a company engaged to sustainable development, that is why the company has many initiatives towards sustainability. One of them is an initiative of 2014 in frames of “European Year Against Food Waste” campaign initiated by European Union. Intermarché has launched a

program named “inglorious fruits and vegetables” (“fruits et légumes moches”), aiming to rehabilitate uncolibrated and unperfect fruits and vegetables. This campaign can be seen as a benchmarking practice of “Feeding the 5000” flagship of the UK in 2009, which was described in the chapter 2, section 2.4 (social benefits).

In terms of this campaign, Intermarché bought the fruits and vegetables that farmers usually throw away, because of their unaesthetic look, and sold them in stores with 30% discount. Those fruits and vegetables were placed in their own shelf, with their own labeling, and their own spot in a sales receipt. What is more, the company has designed “inglorious vegetable soups and fruit juices”, so that people can ensure that those fruits and vegetables are as good as the others. The campaign reached immediate success: 1,2 tons average sales per store during the first two days; and 24% of overall store traffic increase (Intermarche.com 2015), thus benefiting economically (see section 2.4, economic benefits). Additionally, this campaign increased awareness of food waste (social benefits, see section 2.4) and had a huge impact in mass media, and all supermarkets in France were recommended to do the same.

As it was mentioned in the section 2.4, sustainable waste management can have a number of benefits. In this case, it can be said that the company has benefited from both economic and social benefits. By the virtue of this campaign, the CSR level of the company has increased, as a consequence the overall store traffic increased by 24%. It is possible to assume, that the traffic increase is caused by attraction of environmental-sensitive customers. As a result, - an economic benefit, - the company has sold more fruits and vegetables, increasing thus its gross margin.

5.3 Case study: Intermarché, Aubenas

For the case study there was an opportunity to analyze operations in the hypermarket Intermarché, located in Aubenas, France. This hypermarket has an area of 4.500 m^2, employes 150 people, and offers aroung 100.000 different types of product, and has an average of 2.000 – 3.000 customers per day for a non-holiday season; and has a turnover of average €100.000 per day. The case company differentiates its food products in three categories: national brands (for e.g. Danone, Coca-Cola), own brands (for e.g. Bouton d'or, Pâturages), and local suppliers’ products (for e.g. fresh meat, cheese from the region) (Bourja, [6.May.2016]).

Based on the literature review part, the purchasing and waste management activities of this hypermarket are to be audited and analyzed. The research is going to find out to which degree the hypermarket in Aubenas, France, operates sufficiently and sustainably in purchaising and waste management; and to offer possible improvements.

6 RESEARCH METHODOLOGY

The following chapter will describe how the case study research was held, including the research approach, data collection and the analysis of data validity, reliability and generalization.

6.1 Research approach

The case study research was built on deductive approach principles, which is based on developing a theoretical or conceptual framework, which is than being tested using data (Kuada 2012, 118). In the theoretical part of this thesis the theoretical framework of this research was defined and limited by time and capacity of a Bachelor thesis. The described theory is to be fully applied in the analytical part of the thesis. By the virtue of the analytical part of the research the third research question “What is the current situation in the case company, and what can be improved?” will be answered. In the section 7.2 the improvement suggestions will be given.

6.2 Data collection

In this thesis a method of case study research was used, in order to identify and analyze the current status of sustainability and efficiency of purchasing and waste management activities of the case company. The method of case study was chosen in order to test to which degree the practicality of the literature review is sufficient. What is more, a case study as a research method helps to study contemporary phenomena within real-life context (Yin 2003, 13).

The way of the data collection applied for this research is qualitative method, implemented by interviews in the case company (see Appendix 1); and secondary data such as company’s reports, websites and articles in newspapers or magazines. The style of the interview can be described as semi-structured, since a list of questions was written before the interview, however some additional questions derived during the interview, creating thus flexibility.

6.3 Reliability, validity and generalization

The reliability of this research can be confirmed by the fact that the answers for the research questions were based on the precise facts and experience of the company. Similar observations would be reached by any other observer.

The interview was held with two case company representatives, including Director General and Purchasing Manager, who are fully involved in decision making process, and dealing with company purchasing and waste management activities. That is why it can be concluded that the research is totally valid for the case company. What is more, supportive data sources such as company's website, articles, and company's reports were used.

Speaking about generalization, eventhough the research is based on the case company, the findings of the research, as well as best practices of the case company, can be fully or partly applied to other companies in retail sector in France and worldwide.

7 RESEARCH ANALYSIS

7.1 Current situation in the company

The case company evaluates its own sustainability as a thing to be greatly improved. The company already does many steps towards sustainability, like total recycling of packages and electronics, however there are opportunities for improvements. For example, the company claims that its employees need to have more education and possibly money insensitive in order to act responsibly towards environment. The company admits that it wastes a lot, since the waste represents almost 8% (which equals to €250.000) of the estimated annual turnover (€32.000.000) in 2016. The company believes that this amount can be reduced by 4% by the virtue of better organization and software tools, such as better demand forecasting; as well as a better organization and awareness of environmental issues of managerial staff (Bourja, [6.May.2016]).

What is more, the company claims that they do not have precise performance metrics or standards in the organization, and the one that exists, helps only to “constate” that there is a problem; however offers no clues to solve it. The company is lacking time to investigate more complex tools of control (Bourja, [6.May.2016]).

7.1.1 Waste audit systems

The company has its waste audit system, since it is an important part of gross margin calculation. The higher the waste is, the lower is the percentage of gross margin. The case company uses MSI device (Motorola) in order to discard waste. This device is able to record the reasons of discard, when did the wastage occur, as well as a ratio: which perishables are wasted (spoiled) or lost (for e.g. broken in the warehouse). However, even though the device is able to record everything, the personnel neglect that option in 95% cases of discard. The managerial staff of the company says that it happens, because personnel is lacking education, thus does not see the reason to spend time on it (Bourja, [6.May.2016]). The other reason of neglecting the rule is that personnel wants to hide mistakes (if the wastage occurred because of them), that is why they do not note the reason of discard. Because of that the case company does not basically have any statistical data about wastage.

7.1.2 Forecasting demand of perishables

Actually the company uses different systems (ASO, CAO and totally manual ordering) for different types of perishables. For example, the company claims that it uses ASO system almost for the entire assortment of the shop, - as soon as some products are out of stock, there are automatically ordered by ASO system. However, for the products, which demand relies heavily on seasons, the company uses CAO systems supported by manager, to boost or to reduce some orders. For the third group of products, like products from local farmers, the company makes orders manually (Bourgeat, [13.May.2016]).

The case company states that the ASO system is powerful, but it needs a human follow-up. Here appears another problem: a human element (Bourgeat, [13.May.2016]). If a manager makes a mistake at that point, it leads to enormous waste and breaks the whole process. For example, once because of the manager's mistake, there were booked 22 pallets of fresh products instead of 2. By the virtue of a simple error and mistype, the company has to throw 18 pallets, causing thus enormous waste and financial loses.

According to the company the system can be improved by following better process management. If for example two or more people could be responsible for manual follow up, the mistakes caused by human element, could be avoided (Bourja, [6.May.2016]).

7.1.3 Waste management practices

The case company categorizes its waste in three groups and for each group there is a subcontractor (Bourja, [6.May.2016]). Those groups include: (1) perishables that exceeded its due-date but still eatable, (2) perishables that are out of due-date and cannot be used anymore, and (3) non-perishables, including packaging, and electronics used in the shop.

1. For perishables that exceeded their due-dates but still eatable, the company uses the "Reuse" strategy of reducing waste. First of all, products which are close to expire, are given a discount of 50% and placed to a special section of the shop, where all the discounted products can be seen. If those products were not sold, the next option is applied. Following the French law (that was mentioned in the chapter 2.3.2), the shop donates these products to Association for poor people (resto du Coeur), and to animals care services (SPA, la société protectrice des animaux). It is important to notice that these practices are applied only for industrially manufactured perishables, packed and marked for the due-date by

producer. It is overall accepted by producers to mark due dates with a “safety time”, meaning that the expired products are totally safe to consume within a few days after the official expiry date; though a supermarket does not have the right to sell those products.

2. For the second group of perishables the current situation is more dramatic. The company claims that there is a daily wastage of foods of approximately 142 kg, including fresh meat and fish, fruits and vegetables, cheese and processed meat (sausages, etc.) produced by local non-industrial companies (farms). This kind of products were neither packed nor marked for the expiry date by producers, because they are fresh farmer products; the only information that these products contain is when they were produced. The due dates of these kinds of products are regulated by French Ministère de la santé (Minestry of health). Let’s say that a product “Y” has a Shelf Life of 10 days since it was produced. From the economic perspective it is absolutely clear that the company tries to sell the product “Y” to the very last moment possible (for 10 days), possibly with discounts on 8^{th}-10^{th} days, in order to cover costs. That is why the donation of these products is not desired by the company during 10 days; and the donation on the 11^{th} day is forbidden, because the product is not safe to consume. Afterwards the waste is collected by the state company and landfilled without any further treatment. Thus this type of waste has no adding value for the company and a huge negative environmental impact.

3. Among the non-perishables wastage of the company are packaging, including plastics, palettes, carton boxes; iron and metals, paper. Additionally, the shop is obliged to collect plastic cork, batteries, light bulb and ink cartridges. For each type of this waste the case company has a subcontractor, specializing in recycling of this waste. This type of waste is fully recycled by the case company’s subcontractors.

7.1.4 Current ASO system

As it was described in the section 3.2.2, a sustainable ASO system should include a number of options. In the following it is analyzed, if those options exist in the ASO system of the case company:

- An ability of differentiate between perishables and non-perishables;

➔ The case company's ASO is able to differentiate between perishables and non-perishables; by the virtue of setting a different RPP (Reoder point planning, see section 3.2.1) for perishables and non-perishables. According to the purchasing manager of the company, it was a long process to set the reoder level for each type of perishables, however thus the system works more efficient in regards to perishables (Bourgeat, [13.May.2016]).

- A usage of weekly-pattern analysis when ordering (for e.g. that the peak demand occurs on Friday and Saturday);

➔ The company does not use weekly-pattern analysis, since deliveries are fixed, and implemented every Tuesday, Thursday and Friday (Bourgeat, [13.May.2016]).

- Checking of the aggregate order level for a group of substitutable items; and

- To register the exact time of a stock-out for a substitutable item, to be able to define the statistics;

➔ The case company does not consider "substitution effect" as an option to reduce waste, based on the consumer behavior of customers, - customers want to have a wide variety of products (Bourgeat, [13.May.2016]).

- To register the daily amount of waste caused by perishable items;

➔ The company registers daily amount of waste of perishables via a special tool MSI (see the section 7.1.1), which is connected with ASO system. However, often due to neglecting the rules of discard, employees throw away products without registering it via MSI; than the system considers that there is still some stock, while no stock is available (Bourgeat, [13.May.2016]).

- Possibly other aspects like: price elasticity, weather forecasts and seasonality.

➔ The current ASO system of the case company considers such factors as seasonality and weather forecast via internal forecasting tool, which uses back propagation forecast method.

7.1.5 Current distribution

The case company Intermarché uses a unique destribution system in France, which differs from any other competitive retail company. For transportation and distribution of goods, the company, unlike any other retailer in France, uses its own vehicles (Bourja,

[6.May.2016]). Also for the distribution, the products of the company can be grouped in 3 categories (see section 5.3): national brands, own brands and local suppliers' products.

For the group of products ”own brands” the “Groupe Les Mousquetaires” has large regional warehauses, which are to replenish the shops of the chain in the region. The principle of distribution in this case is ”milk run”, since a track is loaded in one warehause and then circulates to replenish several shops in the region. Intermarché is very sensible towards the issue of sustainable transportation, and it never allows LTL (less than trackload) tracks to distribure. What is more, Intermarché tries to optimize its distribution processes as sufficient as possible, and was rewarded for efficient transportation. Another example of its sufficient transportation is ”national brands” group of products. It is interesting to mention, that those products are delivered to the same warehouses, where ”own brands” are stored, and than transported to a shop with the same track (Bourja, [6.May.2016]). In this case it is possible to speak about ”cross-docking” (see section 3.4) as an option of sustainable distribution, when products from different suppliers are loaded in the same track TL (track load) and than distributed to shops.

Evidently, direct deliveries combined with JIT delivery method (see section 3.4 point 3) are the option to be implemented towards the third group of products ”from local suppliers”. As it was mentioned in the section 3.4, JIT delivery method is based on close and stable relations with suppliers, which Intermarché is establishing since the beginning. In addition, the local supplieres of the case company deliver the products JIT themself, so Intermarché does not have to organise transportation of those. Based on well established relations, the company has an agreement with some of their suppliers to return unsold goods back to supplier without paying any fees.

Based on the description of the current situation, it can be concluded, that the case company operates quite efficiently in terms of transportation and distribution. All the recommendations described in the theoretical part of this research are being currently implemented in the case company. That is why the following section 7.2 ”analysis and suggestions for improvemets” is not going to cover distribution as a point for optimization.

7.2 Analysis and suggestions for improvements

The case company is a large retail store, that is why, in accordance with the section 2.2, it produces commercial waste. According to the interviews with the company's representatives, it can be concluded that this waste includes e-waste, agricultural waste

(from biodegradable products), hazardous (like cleaning chemicals for households) and packaging. At the moment the company deals quite well with e-waste and packages, since it is being collected and totally recycled by the company's subcontractors, thus using "Recycle" as waste management option, which we have seen in the section 2.3.3 of this research.

However the company's waste management activities connected with perishables, especially generated by non-industrial perishables with a short Shelf Life, are to be greatly improved. From the one hand, the company uses "Reuse" waste management option, by donating expired products to charity associations, which is a good practice, because, as it was mentioned in the section 2.3.2 of this research, it is the second desirable option of waste management for the environment. However, from the economical perspective it does not increase the gross margin of the company, since products are given for free. It would be wiser to optimize the amount ordered by better demand forecasting, thus implementing "Reduce" waste management option (see section 2.3.1). On the other hand, the company offers a lot of fresh food, that cannot be donated to associations, because of the reasons mentioned above (see 7.1.3 point "2"). Currently the company has to "Landfill" this waste, thus using the least sustainable waste management option, referring the pyramid of waste management sustainability options mentioned in the section 2.3.4.

Here the improvements are only possible through better demand forecasting, so "Reduce" waste management option, or through sustainable "Recycling" of perishables.

7.2.1 Reduce: sustainable purchasing optimization

As it was described in the chapter 3, "Reduce" is the most sustainable waste management option, which aims to avoid wastage at every step of product lifecycle. There are three main options described in the chapter 3, which aim to reduce waste through sustainable purchasing and inventory of perishables. In the following those options will be analyzed based on the current situation of the case company.

1. Increasing the level of differentiation

As we have seen in the section 3.1, ABC Classification can be used for increasing the level of differentiation for effective inventory management. It is crucial to understand which products are critical to control. Since the case company does not have this classification yet, it is recommended for the case company to differentiate its products,

possibly different product brands within a product category, using the ABC Classification of goods. For classification the company will need to use statistics recorded by POS. By the virtue of that, the company will be able to categorize its products, according to its contribution to the gross margin. Like that when purchasing A-product types, additional efforts are needed to be spent for demand forecasting.

2. Increasing the level of sophistication in Reoder system

Referring the section 3.2 of the literature review of this thesis, the level of sophistication of reoder systems may vary due to automation of the system, the quality of input data, correct settings of logistics options in reordering systems, and the ability of personnel to deal correctly with the systems and make decisions.

The case company claimed that it uses different levels of automization of reordering systems, including ASO, CAO and totally manuall for different types of products. That is a good practice, since it helps to reduce waste significantly, because different types of products can require different replenishment systems. Additionally, totally manuall system requires a skilled employee with considerable experience in product cathegory, for e.g. it may require judgements on quality of inventory. For these reasons Intermarché tends to employ professionals, for e.g. a butcher for a meat department. However the company also claimed that sometimes purchasing staff lacks skills and experience to effectively forecast demand; or sometimes an error can occur due to the human element.

For improving the level of sophistication, it is necessary to increase the education of personnel in regards of purchasing activities. Another idea for improvement can be assigning 2-3 employees with different backgroungs instead of 1, so that more than one person is involved in decision making process. In the following, the POS and ASO optimization opportunities are to be described.

3. Optimization of POS and Forecasting

As it was described in the section 3.2.1, POS system is a vital element for inventory management and warehousing, since it alerts the retailer to reorder and avoid stock-outs. Correct POS data is crucial for the company, however often this data is inaccurate, also for the case company. That is why the first and the most important step to increase the accuracy of data is to know where the inaccuracy comes from. The most common mistake while collecting POS data is a human element and willingness to process faster.

In case of Intermarché Aubenas, it would be a good idea to educate cashier staff acting more responsibly when using POS. POS is an important system, which is connected with ASO. However POS can transfer to ASO incorrect data, for e.g. when a customer buys two packs of yoghurt one strawberry taste and one banana taste; because both of them cost the same, a cashier often scans one yoghurt twice, instead of scanning each one separately. Then the system gets incorrect data, purchases based on this data; and as a consequence there is for e.g. oversupply of strawberry yoghurt and lack of banana yoghurt. This can cause wastage.

Speaking about demand forecast strategy, in the section 3.2.1 it was mentioned that there are basically three types of demand forecasting: simple moving average, linear regression, back propagation; named from the least to the most sustainable ones. During the interview with the case company, it was found out, that the company uses the most sustainable strategy of demand forecast, - back propagation. In order to forecast demand, the case company uses an internal tool of Intermarché, which is used by the whole group. This tool takes into consideration the demand of previous 2 years, considering quarters, sales and seasonal effect. The case company claims that the main difficulty in demand forecasting are the external factors, which are hard to control, for e.g. “horsemeat scandal” in France in 2013, or outbreak of bird flu, which effects sales of chicken.

4. Optimization of ASO

The theoretical part of this research (see section 3.2.2), have described ASO/ CAO as systems to improve the efficiency of inventory management in retailing sector. It was also emphasized that ASO/CAO systems must be differently designed for perishables and non-perishables, since an ordinary ASO/CAO system (designed for non-perishbales) does not consider a number of factors, such as aging of products in stock and outdating of products, thus causing unnecessary high inventory levels or stock-outs (see section 3.2.2).

In the section 7.1.4, the current ASO system used by the case company was described. From this description, the main features of ASO system, mentioned in the section 3.2.2, are to be analyzed. First of all, the current system of the company can differentiate between perishables and non-perishables, by additional settings of the system. As it was mentioned in the section 3.2.1 different products can require different reorder levels

(RPP). That is why the ASO system for perishables was smoothed by manual setting of RPP for different product categories.

Secondly, the current system does not use weekly-pattern analysis when ordering, since the company uses internal means of transport and has fixed delivery days. According to the purchasing manager of the company, they are totally satisfied by this method, because it does not cause any inconvenience in inventory management. That is why it can be concluded that using weekly-pattern analysis is not relevant for the case company at the moment. However, this method can be considered, if the company faces inventory management issues, caused for e.g. by enlargement of number of customers, at some point in the future.

Thirdly, the case company does not consider ”substitution effect” for products with a high substitution rate, because, according to the director general of the company, it contradicts the main idea of supermarket: if there are 10 brands that can be presented, all 10 brands are to be presented. According to the opinion of the supermarket's representatives, French customers are reluctant to substitute and would not tolerate if their preferable brand is missing, even if it is a product with high substitution rate. However, this phenomenon is not proved by any practical research. It would be suggested to conduct a study on this topic, - whether or not French customers are tolerant towards substitution while purchasing.

And finally, speaking about registering the daily amount of waste caused by perishables, it is done by the personnel of the case company every day. However often the personnel does not do it properly, by just throwing waste without registering it. Such actions cause mistakes in ASO system. That is why the first thing to be done is to educate personnel of the company, and to set this principle as a compulsory rule.

5. Options to reduce waste of perishables

As we have seen in the theoretical part in chapter 3.2.3 there are three oprions to reduce waste of perishables: reduction of lead time, demand substitution and limited assortiment, and implementing of FIFO/LIFO pinciple as inventory management basics. Since it was found out that the ”reduction of lead time” is functioning well in the case company (see the section 7.1.5) and ”the demand substitution” option was already described above (see point 4 ”Optimization of ASO”), this section will offer optimization opportunities only for the ”limited assortiment” option.

The option of waste reduction of perishables “limited assortment”, which was described in the theoretical part of this thesis (see section 2.3.2) as hardly acceptable option, since the customers expect a wide variety of products in the shop. Surprisingly, the general director of the shop considering this option as a future trend of development. However it is necessary to mention that this option requires “time” to educate customers towards sustainable consumption. At that moment, this option is not applicable, however has a large potential in the future, thanks to the French government’s “waste reduction program” (see section 2.3.1), which is going to introduce an education program about sustainable consumption and food waste as a compulsory school program and for businesses (Chrisafis 2015).

The last but not the least option of waste reduction of perishables is inventory management approach FIFO (first-in-first-out) principle, as time-based criterion for inventory management of perishables (see section 3.2.3). Based on the analysis of inventory management of the case company, it is highly recommended for the company to implement this approach to its warehouse management, since it will help to ensure that perishables do not end up with the older stock standing and spoiling on the back sides of shelves or fridges. Currently, the company claims that some wastage occurs because employees tend to follow LIFO (last-in-first-out) approach, by placing products to the back shelves of the fridges, and when a product is needed, they take the first one from the fridge; as a consequence, the older products stay spoiled in the fridge. The rule “the products which arrived earlier should be displayed as first in the shop” must become a compulsory rule of the company, in order to reduce waste caused by LIFO.

6. Optimization of waste audit systems

As it was already mentioned in the section 7.1.1 the company already has a special tool which is able to audit waste. However, the personel of the company does not use this tool to its full extent. The first and the most vital optimization suggestion for the case company is to educate its personnel and set a compulsory internal roule to frankly note the reasons of discard. That must become a basic rules of discard in the case company. As it was mentioned in the section 3.3, consistent waste audit systems are the best way to analyse wastage and find solutions to reduce food wastage, and as a consequence increase the gross margin of the case company. The good waste audit systems must record types and amounts of food waste (already done in the company), as well as reasons to discard and a place where the wastage occured. This should become the first compulsory step, in order to reduce food wastage.

7.2.2 Recycle: mechanical biological treatment implementation

As it was written in the chapter 4 of this thesis, the waste should be reduced to the possible minimum; however “zero waste” is hardly achievable for a large retailer, since it has to offer a variety of products to its customers, including fresh non-industrial (farm) products. As it was found out from the interview, the company has daily waste of fresh perishables with a short Shelf Life (see section 7.1.3). Those cannot be donated to charity organizations after the expiry date, due to safety reasons. This waste is than collected by the state contractor and landfilled without any further treatment. The lifecycle of a product is thus not closed; as a result each product disposed to a landfill is contributing to methane emissions and green house effect development (see section 2.3.4). From the economic perspective, this waste does not add any value to gross margin of the company.

According to the company’s representatives, based on the company’s internal report of 2015, the company throws daily approximately 142 kg of perishable waste, which equals to around 52 tons of waste per year, thus, according to the section 4.2, it can be considered as small-scale waste generation. Having analyzed the first criteria of waste (waste quantity), it can be concluded that the case company can implement either composting, or anaerobic digestion (AD) waste recycling options. RDF is not suitable for the case company, because of insufficient amount of waste, and due to the fact that fresh biowaste is not economically attractive option for RDF (see section 4.2).

Considering mechanical biological treatment as a “Recycling” method of waste management, the case company has to remember that this method still has a negative influence on the environment, however it is a way better than “Landfills” method. It is necessary to mention again, that the main idea of this research is to find the ways how to reduce waste to the possible minimum; and recycle those wastes that are impossible to avoid (see chapter 4), as it was also described in the benchmarking example of the UK supermarket chain “Sainsbury” (see chapter 4). What is more, currently, the case company does not profit from its waste. The mechanical biological treatment method will have additional value to the company, – renewable source of energy; or sales of products of biological treatment (e.g. bioferilizers). In the following, the advantages and drawbacks of each method are to be analyzed.

1. Composting

The case company can consider composting as a suitable method of mechnical biological treatment. The advantages of this method over AD method, is that it requires less land area and has lower operation costs (see section 4.2). What is more, the investment costs can be lower than for AD method, and the technology of this method is less complex, so it possible to assume that personell training can be less demanding. Speaking about the drawbacks of this method comparing to AD method, it can be also so that the investments costs are higher, since they vary from $100-30.000/ton (see table 2, section 4.2). The main disadvantage of this method, is that there is only one final product of anaerobic composting,- compost, which can be used only as biofertilizer (see figure 4, section 4.1). This biocompost can be sold, however, the company has to consider that a proper marketing strategy is required to sell it (ADB 2011, 32).

According to the ”Supermarket Composting Handbook” (WasteCap 2003), thanks to composting, a supermarket can save its waste disposal costs with a ”tipping” of around $50 per tonne, and improve its CSR and ”green” image. Additionally, the company can have revenues from selling the end product of compost – biofertilizer. When implementing composting as waste treatment option, the following expences are to be considered:

- Employees training (for onsite separation of waste);
- Marketing costs to sell compost;
- Location of composting facility and a hauler;
- Purchase of composting facilities and equipment.

Due to the time limitation and capability of a Bachelor thesis, this thesis won’t analyze costs, expences and revenues of composting as a waste treatment option for the case company, eventhough this method worths attention and must be considered by the case company. After cosultation with the case company, it was agreed, that this research will focuse more on AD as a waste treatment option, because it potentially has more financial benefits for the case company, and composting, as a side effect of AD, can be used.

2. Anaerobic digestion (AD)

The second waste treatment option, which is suitable for the case company, is anaerobic digestion (AD). The features of the AD method, were already compared with the composting method, and can be described as more demanding than composting, inluding: more land requirements, possibly higher investment costs, higher operational costs, and more complex technology, which can require more training of personnel (see table 2, section 4.2). However, the main advantage of AD over composting is that thanks to AD it is possible to receive both: biogas which can be used as a renewable energy source (see figure 4, section 4.1), and digestate which is left after the AD can be used as an organic fertilizer (de Dobbelaere et al. 2015, 4). Produced biogas can be used for company's internal use, such as electricity, heating, fridging or conditioning, thus reducing external costs of those. AD can be integrated with composting (Kraemer and Gamble 2014, 32), thus a company can profit from both renewable source of energy and composting. Kraemer and Gamble state that two methods (AD and composting) work best when integrated in one facility (2014, 32).

However, it is necessary to mention that eventhough AD technology is developed quite widely in a large-scale concept, it is not completely suitable for smaller-scale agro-food companies (Claros 2014, 3). The main reason of insuitability is that the capacity of large-scale plants and feedstocks, produced by smaller-scale companies, are not interrelating. Large-scale concept is not adjusted of smaller amount of waste produced by this sector.

During the interview with the company's representatives, it was found out that the case company throws away approximately 142 kg of perishable goods per day, including mainly fresh meat, fish, and diary products. This amount of waste equals to around 52 tons of biowaste per year. Considering the technological barrier described above and the amount of waste generated by the case company, the relevant anaerobic digestion (AD) plant options were analyzed for the case company.

- A business collaboration model (BCM)

Because the amount of waste of the case company is not sufficient for a small scale AD plant alone; it can be wise to collaborate with other organizations and companies to create a business collaboration model (BCM) to share technological, commercial or financial resources. BCM can include such structures as clusters, coopetition, synergy, collective action, and cooperative (Claros 2014, 4). As a consequence, the total amount of waste will become suitable for a small scale plant.

An innovative approach in small-scale, or so-called ”packaged” or compact, AD plant facilities are offered by the UK company ”SEaB”, specializing in renewable (green) energy. The company has a product type, which can be potentially interesting for the case company and its potential partners, so-called Flexibuster™. This equipment is designed to process food and organic waste to produce biogas, which is after burned to generate electricity or heat; and what is more, is a source of organic fertilizer, which can be sold (Seabenergy 2014). This compact AD plant is of the size of a standard shipping container of 6.1 or 12.2 meters long (see Attachment 2), and suitable for the companies generating waste streams of more than 100 tons of biowaste per year.

To analyze the possibilty, let’s consider the Flexibuster™ as an AD plant for the case company and its potential partners. According to ”SEaB” official web site, the Flexibuster™ requires 180 tons of organic waste per year. Considering that each member of a business collaboration model (BCM) generates the same amount of waste as the case company Intermarchè, 180 tons of waste will be produced by approximately 4 companies (180 tons needed / 52 tons generated by each).

Unfortunately, the case company could not provide precise data on transportation costs, electricity and heat usage (in kWh) per year, as well as the costs of its waste disposal. That is why the applied calculation is based on the best practices of some other companies, as well as information from the web. The following preliminary calculations may be applied (the calculations are based on the benchmarking experience of Best Western Hotel, in the UK; ADBA 2016):

	Total	**Per company**
Feedstocks	180 tons/year (≈500 kg/day)	52 tons/year (≈142 kg/day)
Investment costs	€155.107*	€38.777
Land costs (80m^2 required)	€6.720**	€1.680
Transportation costs	€***	
Operating costs / year	€12.170*	€870
Revenues		
Electricity generated / year	53.100 kWh*	13.275 kWh
Heat generated / year	54.850 kWh*	13.712,5 kWh
Income / year	€37.484*	€9.462
Waste disposal savings / year	€9.436*	€2.359
Payback period	5 years*	

*based on the best practices of ”Best Western Chilworth Manor Hotel”

**based on the fact that 1m^2 in Ardeche region of France costs €84

***based on remoteness and taking into consideration that the company has internal transport vehicles

From these calculations it can be analyzed, that using this AD plant, Intermarchè can cover its electricity annual costs up to 6,02% (the annual demand for electricity in the case company 220.500 kWh). With the investment costs of €38.777 for each member of collaborators, the payback is to be achieved after 5 years. Revenues are to be generated from coverage of electricity, reduction of waste disposal costs, and sales of digestate (compost as biofertilizer). However, it is necessary to remember, that each company will have transportation costs, since the AD plant is to serve 4 companies. What is more, the table above does not consider possible sales of biofertilizers received from digestate, and marketing costs to sell those.

- Outsourcing of mechanical biological treatment

As it is suggested before, received energy can be divided and distributed equally to each collaborator. The other suggestion is to transfer the whole amount of energy to only 1 partner (speaking about cooperation of the same group), implementing thus a benchmarking example of the UK supermarket ”Sainsbury”, which was described in the chapter 4.

As it was mentioned in the example of ”Sainsbury”, it has a partnership with the UK one of the largest waste management company ”Biffa”, which is processing biowaste produced by ”Sainsbury”, converts it into biogas, which is than burned to generate energy and covers total energy needs of one supermarket of the chain, in the city of Cannock. The energy runs directly from the biogas plant via 1.5 km electricity cable to this supermarket. That means that ”Sainsbury” has outsourced biological treatment of its biowaste to the other party. The advantages of above mentioned suggestion are clear: ”Sainsbury” does not have any investment and operational costs, or any costs associated with personnel training.

A local solution for Intermarchè can be a French waste management company SITA (www.sita.fr), which is offering such services as recovering of biowaste of service sector. Unfortunately there is no public data, including prices, available to analyze. The case company is highly recommended to contact and carry out a practical research on possible business development and partnership with SITA, or any other company in this sector.

7.2.3 Creative approach

The case company can consider a creative entrepreneurial approach for waste management of fruits and vegetables. The best practise example of such approach was designed by Finnish young start-up professionals in cooperation with one of the largest supermarket group in Finland, named ”Smooth it” (Smoothit 2015). Fruits and vegetables, which have minor insignificant defects, but still very safe to consume, are, as a rule, avoided by consumers. The idea of the project is to ”reuse” (see section 2.3.2) these fruits and vegetables, by processing them into a fresh ready to drink product ”smoothy”. Those smoothies are sold straight in the area of the supermarket.

The case company can consider this example as benchmarking, for managing waste of its fruits and vegetables. This activity can significantly decrease waste; what is more, the investments involved in this project are not high (price of a blanding machine), especially comparing to other methods of waste management, described in the section 7.2.2. Additionally, the case company already has an experience of opening a selling spot inside the shopping area (there are sushi and pizza spots right in the shopping area of the hypermarket), so it can be considered, that the managerial staff of the company has necessary skills.

8 CONCLUSION

8.1 Research findings

The objective of this research was to find out the level of sustainability of the case company in frames of waste management, comparing its waste management options with the current best practices, and make suggestions for improvements. The research has covered three research questions.

The first question “How to reduce waste of perishables in a large retail?” examined which methods of waste reduction already exist and which best practices are implemented by some companies of the same field. In order to answer this question, the theoretical part of this thesis has covered different steps of product lifecycle, including purchasing, distribution, and inventory. For example such concepts as ASO/CAO systems, demand forecasting methods, and ABC classification of perishables were analysed and evaluated to the degree of their sustainability. All theoretical approached described in the literature review part were fully applied and analysed for the case company.

The second question “How to profit from waste in a large retail?” aimed to find out if there are ways to have add value from waste, and thus improve a gross-margin of a company. This research question was analysed in the 4th chapter on the thesis, where it was found out that mechanical biological treatment options, including AD, composting, and RDF can be potentially highly benificial for any company. Each option was analyzed in details. Waste requirements (for e.g. waste amount, composition, quality, etc.) and selection criteria of each option were described, in order to figure out the best option of mechanical biological treatment for the case company. This analysis has partly answered the third research question, - “what can be improved?”.

The third research question measured the current situation of the case company in order to find improvement suggestions. This research has found out that the case company Intermarchè and the group “Les Mousquetaires” in general are already making some efforts towards sustainability and wants to position itself as a company, committed to sustainable development since 2003. The examples of such efforts are total recycling of packaging (carton, plastics), light bulbs and batteries; usage of energy saving lighting equipment, environmentally-friendly transportation. Worth paying attention, that the

company has initiated the environmental campaign “Inglorious fruits and vegetables”, striving to increase customers’ and media’s awareness of food wastage; and has succeeded to do it.

The research was held on one shop of the chain “Les Mousquetaires”, hypermarket Intermarchè, located in Aubenas, France. The research was hold through interviewing of company representatives (director general and purchasing manager), as well as on the company’s reports, magazine articles, and the company’s web-site. Having analyzed the research results, the strong and the weak points of the case company were found. Speaking about strength of the case company, it has sustainable transport chains and uses the most sustainable option of demand forecasting “back propagation”.

Speaking about the weaknesses of the case company, the company itself considers its sustainability as a thing to be greatly improved. Having analysed the current practices of the case company, and having compared them to the theoretical chapter 3 of the research, it was recommended to increase the level of education of its personnel in terms of sustainability, efficiency, and correct usage of company’s waste audit tool (MSI). What is more, the case company is advised to increase the level of differentiation (by implementing ABC classification) and to increase the level of sophistication in Reoder system; optimize its ASO system; and use FIFO principle while inventory management.

Another main finding of the research is that the case company does not implement “Recycle” mechanical biological waste treatment option, described in the chapter 4 of the literature review, while facing quite big food wastage of 142 kg per day. In this term the worldwide current practices were analyzed, and the company was advised to adopt some of those best practices. The most suitable methods of biological waste treatment for the case company are composting and anaerobic digestion (AD), due to the amount of waste generated. The company is recommended to a consider collaboration business model with other shops of the chain in order to install a small scale AD plant; or to outsource waste treatment of perishables to a specialized company, following thus a benchmarking example of British supermarket chain “Sainsbury”. What is more, the case company is recommended to consider some spin-off approaches, one of which (“Smooth it” projects) was represented in the section 7.2.3 of this thesis.

8.2 Suggestions for further research

Due to the time limitations and a Bachelor's thesis capacity, the problematic of this thesis was narrowed to perishables. Therefore, there are some suggestions for further research.

First of all, this thesis was focused on perishables only. It would be interesting to analyze the current situation of the company within waste management of non-perishables. Secondly, the research has studied sustainable purchasing activities and sustainable waste management treatment options. As it was mentioned in the section 2.2.2, wastage can occur on any step of product lifecycle, that is why another steps of product (for e.g. sustainable warehousing) can be analysed.

It is suggested to carry out a research about "substitution effect", which was described in the section 3.2.3, and based on this research it will be easy to analyzed if customers of the shop are really reluctant to substitute a missing product with another one. What is more, it can help to analyse which products have high/ low substitution rates.

Finally, the applicability of composting as waste management treatment option for the case company is to be researched in more details, including the current situation in this sector in France, investment and operational costs, legislations, etc. Speaking about anaerobic digestion (AD) and its options, it is recommended to carry out a practical research about possible partnership with French waste processing company SITA.

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Appendix 1: Interview questions

1. How would you evaluate sustainability of your company?
    a. If the employees and managerial staff are aware of sustainability issues?
    b. In your organization considering that there is a lot of waste and why it's considered to be a lot?
    c. What are the costs of that waste?
    d. What is the benchmarking in the organization? For example do you have performance metrics, or standards?
2. Do you have any waste audit system, which is able to record:
    a. ration of perishables and non-perishables wastage;
    b. reasons to discard;
    c. when in supply chain did the wastage occur;
    d. if not, do you have any other metric and control instruments?
3. How do you forecast demand of perishables?
    a. Do you use POS (point of sales) data for demand forecast?
    b. If you use ASO/CAO system, how does it work? Does it consider non ordinary demand, such as seasonal demand, promotions?
    c. Do you use totally automated ASO system, or is it assisted by a purchasing manager (CAO); or is it totally manual for some product categories?
    d. How precise are the forecasts? Are you satisfied with the performance of actual system?
4. Which method of forecasting do you use?
    a. simple moving average (considers demand as constant = every month the same demand - which is often not true)

   b. linear regression (doesn't consider demand as constant, but refers to the seasonal index)

   c. back propagation (an algorithm, which takes into consideration quarters, sales and seasonal effect of the last two years to predict the demand).

5. Do you analyze occurred wastage, and try to improve the demand forecast? How?

6. How do you manage waste?

   a. Yourself; how?

   b. Through waste collection constructer (is it public or private)

      b.i. if it’s done through a constructer, what is the price?

      b.ii. Do you know what happens with this waste after?

7. What is done with the products close to expire?

8. What are the distribution ways of fresh products at the moment? What are the most ways options for the company? Does a track drive empty/half-full?

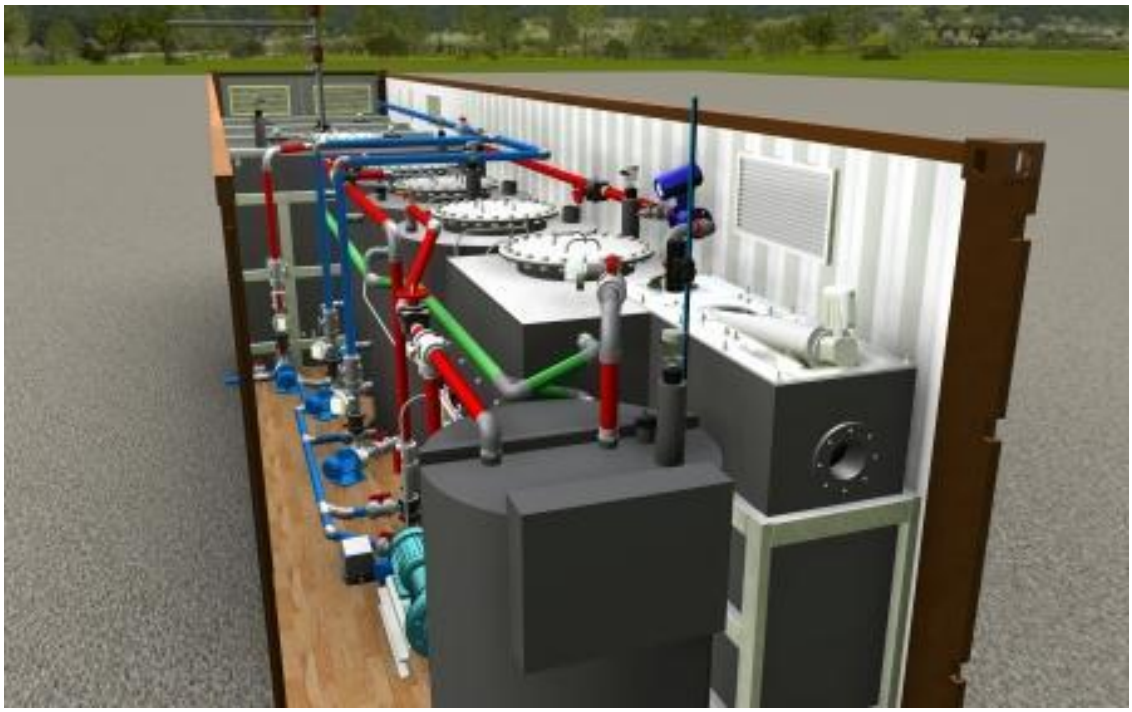
9. How many kilos of perishables are produced daily (monthly)?

10. Do you consider some improvements for the current situation?

11. Would you like to promote your company as a “green supermarket”?

Appendix 2: Small scale AD plant

Picture 1 Small scale AD plant SEaB Flexibuster (source: SEaB Energy)



Picture 2 Small scale AD plant SEaB Flexibuster (source: SEaB Energy)