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What is the impact of Circular Economy on the Food Industry in Brussels?

Mémoire présenté par :

Louise VAN MOLLE

Pour l'obtention du diplôme de :

Master's degree in Management Science

Année académique 2019-2020

Promoteur :

Ruba SALEH

Boulevard Brand Whitlock 6 - 1150 Bruxelles

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As part of this online filing, the signature consists of the introduction of the thesis via the ICHEC-Student platform.

In order to finish this thesis properly, I have to thank several people for their support, engagement, help and enthusiasm. In this section I would like to take the time to show gratitude to them for their contribution to this project.

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Introduction

1. Thesis topic

According to the UN Environment approximately 1.3 billion tonnes, which is equal to almost one third of the entire food production, is being wasted or gets lost worldwide. In Europe, consumers waste around 280 kg a year per capita. Almost 200 kg occurs during production and 90 kg of the waste happens during consumption (Sawe, 2018). The food loss and waste contributes to the lavish of resources such as water, land, energy, labor and capital. All those resources could be used for other things. Furthermore, it produces unnecessary greenhouse emission gasses which contributes to climate change. (UN Environment, 2019). The food waste can happen at any moment of the food supply chain. In the Flemish region of Belgium, food waste amounts to an average of 907 000 tonnes annually (Food Waste Awards, 2019). With analyzing the circular economy in Belgium for the master thesis, I tend to find a solution. Last year, on April 2, FoodWIN awarded four companies with The Food Waste Awards. The award goes to companies which reduce food waste in the most creative, innovative and efficient way possible. The winners were Too Good To Go, W13, Bio Bakkerij De Trog and Het Facilitair Bedrijf. (Food Waste Awards, 2019).

In Brussels more and more businesses arise that are embracing a new way of handling. The circular economy is slowly, but surely making its way to the new normal. Can it mean something for the way customers consume food? Can it mean something for the food industry in general? Can it mean something for all the actors in de food supply chain in Brussels? Let's find out!

2. Motivations for the topic

I really wanted to dig deeper into the idea of how a company can be successful in today's economy, which is very much focused on sustainability. In my opinion, no business can keep growing or even existing if they don't look for new solutions or strategies in order to tackle the issues of climate change. Every company, big or small, needs to change and work together to find new sustainable plans and strategies. The topic is not past, but future related. If there is no change to come, our future in business and our economy as we know today will not exist much longer. My career will be in the businesses of tomorrow. Being successful in the present economy is finding solutions and implementing new strategies. Sustainability is key in the strategy of a business that wants to keep growing. Sustainability also stands for no or definitely less waste.

The interest in the food industry comes from a huge crush on food. I love to explore new cultures and especially the food. But, while going to restaurants in Belgium and all over the world, I was and still am wondering what happens with the leftovers? In my last year at the Odisee Hogeschool Brussel, we had to come up with a new idea and business plan as a final group project. With our team, we came up with the idea of picking up the leftovers from restaurants and sell them via an app at a lower price to students. We called it Food For Thought. A few months later, Too Good To Go was introduced in Belgium. Sadly, we weren't the ones launching the app. However, it is an excellent invention and I'm glad someone had the same idea as we did and turned it into an actual app. By analyzing the circular economy in Belgium, I tend to find a solution to the food waste.

3. Objectives of the thesis and its hypotheses

The research tends to find an answer on the impact of the circular economy on the food industry in Brussels. Therefore, in order to understand the impact, the following hypotheses were formulated:

- Circular economy has an economic impact on the food industry in Brussels, such as cost reduction.
- Circular economy will create new jobs in the food industry in Brussels.
- Circular economy has a social impact on the food industry in Brussels.
- Circular economy has a societal and behavioral impact on the consumers in the food industry in Brussels.
- Circular economy has an environmental impact on the food industry in Brussels.
- Circular economy has an environmental impact on the global health of citizens through the food industry in Brussels

4. Methodology

Secondary data

The master thesis will be an applied research paper. Therefore, the base of the following dissertation is a literature study. At the end of 2019, a book written by Hughes Belin and Cédric Hananel was published. The book focusses on the circular economy in the city of Brussels. Of course, several other sources are used, which can all be found in the bibliography at the end. To end the first part, two business cases are included with a view to compare two cities which have implemented the circular economy approach.

Primary data

I also attended two workshops and a salon organized at Tour & Taxis by Brussels Environment. The first one was called Rabad Day and was organized in October 2019 and the second one was the Zero Waste Salon in November 2019. There I met with people working in the sector. So, I got to know businesses and people that I could interview for the dissertation. During the workshops, I learned a lot about the circular economy system that is already in place in Brussels.

At the Zero Waste Salon, I was also a guest at a debate between several people who launched a circular business in order to reduce food waste in Brussels.

Furthermore, in order to collect more data and to better understand the concepts, there will be additional business cases in the form of interviews. Those interviews give more insight on how certain enterprises are already tackling the problem on the field in Brussels. In the appendix, all the interviews can be found. However, the questions in the actual interviews can be altered or can be asked in a different order. The companies who were interviewed for the master thesis are all small or medium Belgian businesses, Belgian nonprofit organizations or enterprises active in Belgium. Those different organizations have an impact on the food industry in Brussels. The purpose of those interviews was to collect data in the field of research. For my thesis, the focus lays more on the qualitative research and data. It means that the number of interviews is less important than what has been said by the interviewees.

On top of that, regarding my background in Marketing and regarding the share of the customer on the food waste problem, it was interesting to set up an online survey. The intention of the survey is to see if the customer knows how big his or her share is on the problem and to try to come up with a solution. That part covers the quantitative view point of the research. The analysis of the representative sample with 100 respondents can be found in the last part of the research. For the exact methodology of the online survey and the interview, I kindly invite you to go read the second and third chapter as it is more detailed.

Table 1: Research methods

Research steps	**Data collection method**	**Data analysis method**
Step 1: Research and literature	Scientific papers and reports about circular economy and the food industry	Classic content analysis.
Step 2: Case studies	Qualitative research: interviews	Transcribing all the interviews and report answers by grouping them per category.
Step 3: Online customer survey	Quantitative research: an online survey with 18 questions. Two were open questions, the rest of them were multiple response questions with both one or multiple answers possible.	Collecting respondents through website SoGoSurvey. Once the data was collected, it was transferred to SPSS, a statistics data editor.

The impact of COVID-19 on master thesis

Suddenly, life as we knew stopped. “Stay home, safe lives” will be engraved in everyone’s mind and the quarantine will be forever embedded in history. People couldn’t come outside of their homes, only for essential groceries. Shops, companies big and small, schools and so much more were or are still closed. It is safe to say that the COVID19-pandamec affected us all. Therefore, it was indispensable for companies to reinvent themselves if they wanted to survive. Restaurants had to rearrange their concept in order to keep on existing. Some shops and companies could not continue their daily business. The future is still uncertain for a lot of them.

For some writing a thesis in those circumstances could be seen as very fortunate. No distractions coming from friends and families, parties, going out for a drink on sunny terraces and so on. Although it means you have to focus 100% on your thesis, it is still very hard. One has to be careful not to drawn oneself in it. Take the time to go outside and enjoy walks. Take the time to spend time with the people closest to your heart. But most of all: to relax. Everything will come together in the end.

Personally, the quarantine did me well. Fortunately, I was already in contact with a lot of people for my interviews. Some of them were already done. I had gathered most of my resources for my literature. And last but not least, I had already posted my online survey. However, as time went by, I still encountered some difficulties.

First of all, my promotor told me in the beginning of the process that I had to have ten interviews. At the beginning of the pandemic, I had four. I was in contact with several people who stopped responding to my emails. After a while, some of them told me they didn’t have the time. They were too busy turning their businesses around in order to keep on existing. Some of them did respond later on and scheduled a date in order to do the interview over the phone. Others asked if they could answer my questions via mail.

Secondly, although I had found several resources online, my literature part missed some depth. I send my first draft version to my promotor and she told me the same thing. Luckily, my promotor is very helpful and she sent me a lot of additional scientific papers for me to add to my research.

In the end, my research and literature part came together well and I was able to interview seven companies all together for my case studies. These weird times definitely taught me to be more creative and to enjoy the little things.

Chapter 1. Frame the problem in its theoretical context

1.1 Circular economy

1.1.1. Definition: What is circular economy?

A lot of publications and articles have appeared on the concept of circular economy. For example, some of the well-known "Big Five" consultancy companies such as Deloitte, EY and McKinsey Company have published reports about the topic as from 2015. (Hekkert et al., 2017). As any economic system, the circular economy has several definitions, defined by official public and private organizations (Belin and Hananel, 2019). Hekkert, Kirchherr and Reike (2017) confirmed the affirmation in their article named "Conceptualizing the circular economy: An analysis of 114 definitions".

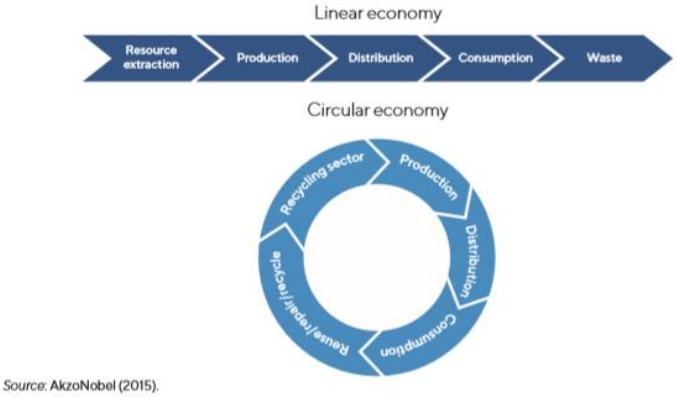
A first definition treated for the thesis purpose is the following: circular economy is an economic system for exchange and production that wants "to enhance the efficiency at every stage of the product life cycle, for both products and services, for the use of resources and to diminish its impact on the environment while developing the well-being of individuals" (Belin and Hananel, (2019), p.29). The definition is being used by the Agence française de l'Environnement et de la Maîtrise de l'Énergie (ADEME).

In fact, during the production process, it's about reusing the renewable and non-toxic resources (Belin and Hananel, 2019). In the classic linear model, it is being assumed that natural resources will be forever available, abundant and easy to source. In addition, the assumption of them being very cheap to dispose of. (Reichel et al., 2016). On the other hand, for the consumption, it implies to share and optimize products or services that have already been used. After the consumption, it is important to reuse, repair, renovate and recycle those products for as long as possible in order to reduce the use of new raw materials and cut down the production of waste. (Belin and Hananel, 2019). Regarding the reuse, it is useful to state that the product is reused efficiently (Reichel et al., 2016). It will give the products a longer life while creating, recreating and keeping their value (Parlement européen, 2018). In case some of those resources cannot be reintroduced in the cycle, it is necessary to replace them with renewable ones (Reichel et al., 2016).

Looking at a second definition, treated by the European Parliament, the circular economic system aims at (Belin and Hananel, 2019):

- Reducing the waste of resources;
- Slowing down the environmental and climate impacts through clean material cycles (Reichel et al., 2016);
- Developing a local economy, while creating a value chain that is closer to home;
- Increasing the well-being of the individuals and participating in an inclusive economy;
- Stimulating the competitiveness, while first of all boosting the resilience of the companies and secondly by protecting them against rarity of resources and price volatility;

- Encouraging the collaboration between different kinds of sectors;
- Replacing activities with a lot of resources with activities with less resources, while delivering more value (Reichel et al., 2016).



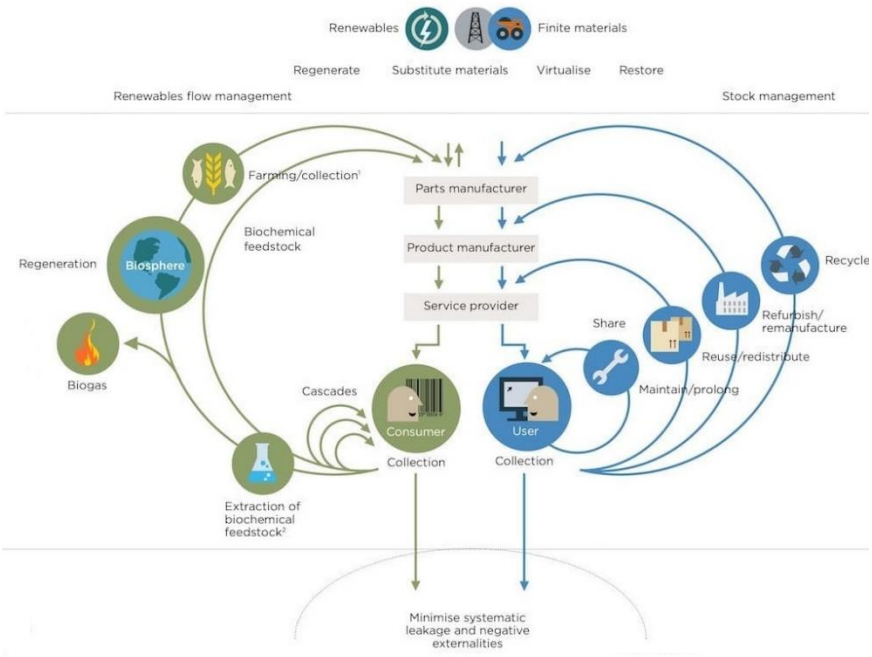
Source 1: Akzo Nobel. (2016). The Circular Economy.

Figure 1: Linear vs circular economy

As figure 1 shows, the system stands against the objectives of a linear or traditional economy, which is a take-make-waste extractive industrial model. We take resources, make products and services and when they are not wanted anymore, they are thrown away. The circular economy instead recognizes that the economic system needs more efficiency at all stages. It doesn't only mean that it targets fighting the negative impacts of the linear economy, but rather that it represents a shift in the system in order to build long-term resilience, generates business and economic opportunities and provides environmental and social benefits. We have to transform the take-make-waste model by reviewing how to manage our resources, how to make and (re)use products and what to do with the materials afterwards. (Ellen MacArthur Foundation, 2017). If there is no value left, the circular economy tends to create new value, but it is also important to ensure that the value of those renewable resources stay in the cycle through high-quality recycling (Reichel et al., 2016). That is the only way to obtain a successful economy that can benefit everyone within the limits of our planet. (Ellen MacArthur Foundation, 2017). It can be seen as a local economy that is based on the knowledge of the customers and the collaboration of the different economic players (Belin and Hananel, 2019).

According to the Ellen MacArthur Foundation (2017), introducing the circular economy will first of all illustrate the end of waste. Products will no longer be used once, but will be deconstructed and reused both for the same purpose and for another. Secondly, it will enhance collaborations. It will force us to rethink the society we know today. The Circular Economy System Diagram illustrates the flow of the materials through the "value circle".

Figure 2 represents a diagram that is divided into three sections. Those three sections all together represent the outline of a circular economy. The first section focusses on the principle of preserving and enhancing the natural capital by controlling the finite stocks of resources and balancing renewable resource flows (Ellen MacArthur Foundation, 2017). It is about designing out of waste and pollution. If we can change the way we look at waste as a negative effect of our production and by applying new technologies, we can make sure that waste and pollution will not be created in the first place. (Ellen MacArthur Foundation, 2017).



Source 2: Ellen MacArthur Foundation. (2017). Concept: Infographic of Circular Economy System Diagram.

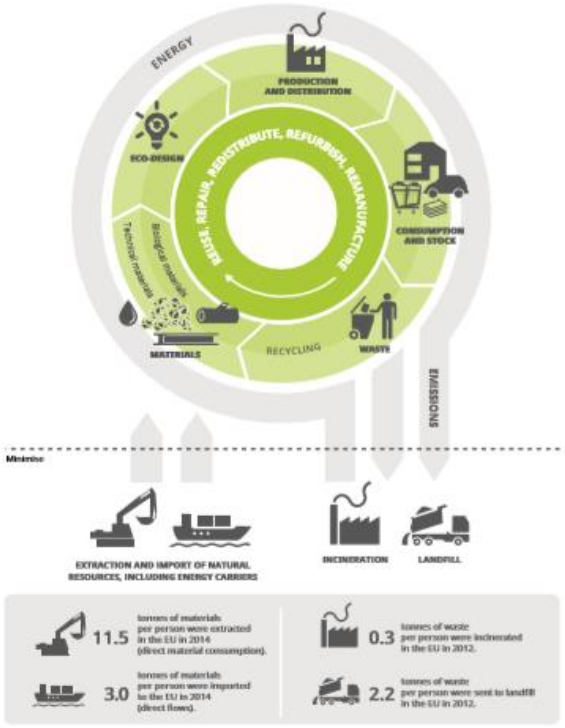
Figure 2: The circular economy system diagram from the Ellen MacArthur Foundation.

The second principle stands for optimizing the resources by circulating products, components and materials at the highest utility at all times so that we keep them in use (Ellen MacArthur Foundation, 2017). We can maintain them in the economy, but unfortunately, that is not the only solution. For food and packaging, materials should be recycled (Ellen MacArthur Foundation, 2017).

Thirdly, the diagram shows how to foster system effectiveness by revealing and designing out negative externalities in order to generate natural systems (Ellen MacArthur Foundation, 2017). Externalities can be defined as a positive or negative effect coming from the production or consumption of a good or a service. It's referring to a cost or a benefit received by a third party, which has no control over the creation of that cost or benefit. An example of a negative externality is pollution. It affects the whole society. (Kenton, 2019). In nature, there is no such thing as waste. So we shouldn't be focusing on doing less, but on doing good. (Ellen MacArthur Foundation, 2017).

For a company, it only represents a goal to achieve. There is a long way to go in order to implement it correctly. The first steps can be several actions promoting an efficient use of the resources and raw materials. However, those changes in supply chain have to be profitable for the company. The next step will be when the organization adopts a circular economy model. That is achieved by linking the creation of economic value to the creation of a positive environmental impact. According to the ADEME (2014), there are three main categories. The first one is applied to the sustainable production and the demand of the products and services. The second one comprises the consumption, the demand and the behavior. Lastly, it can be about the waste management. That brings us to the six economic models of the circular economy:

1. Eco conception: the model follows the principles of durable design, reversibility and disassembly by taking the entirety of the life cycle into account with little impact on the environment.
2. Industrial and territorial ecology: also known as “industrial symbiosis”. It focusses on the exchange of flows or a mutual supply.
3. Economy of functionality or “product as service”: here, the access to a product is put forward instead of the possession of the product. Clients use the products linked to a contract with additional services such as the maintenance. Products can be toys, clothes, bikes, home appliances and much more.
4. Exchange platform: the model is one of the most common models of the circular economy since the beginning of the smartphone. The objective is to optimize the use of a product or service thanks to a virtual platform. The platform gives the opportunity to book the item for an agreed time. Examples of the model are the many rental cars, bikes, steps and scooters.
5. Expansion of the duration of use: by fixing, ameliorating and reusing the product or service.
6. Recycling: it is based on innovation and advanced technologies and techniques in order to revalorize and repair products that have reached the end of their lifecycle.



Source 3: European Environment Agency. (2019). A simplified model of the circular economy for materials and energy.

Figure 3: A simplified model of the circular economy for materials and energy

On the left, a simplified model of the circular economy for materials and energy can be found. The outer circle represents the overall energy flows. It takes into account the total energy efficiency and the share of renewables. Furthermore, the middle circle shows the material flow in the recycling loop. There is a difference between abiotic technical materials, which are metals and minerals, and biological materials. The last mentioned are easily renewable, in contradiction to the technical materials that are not. Lastly, the inner circle stands for the reuse, redistribution, repair, remanufacture and refurbishment. Everything the circular economy focusses on. (Reichel et al., 2016).

When mentioning a circular economy approach, it is also important to mention the following concept, namely cultural heritage. A definition of cultural heritage can be “the amount of resources such as cultural capital that provides over time a range of cultural, social, economic, and environmental output” (Gravagnuolo et al., 2018, p.1). It is a sustainable form of conservation by which the life of the cherished heritage is extended and cultural values are preserved for the future generations. It is sustainable because it enables the reduction of exhaustion of raw materials. It also decreases transport, energy consumption and dispersion, while contributing to lower waste and landfill environmental costs and to scaling down the production of carbon emissions. (Gravagnuolo et al., 2017). Those positive consequences are very similar to the ones from circular economy. By adapting and reusing the abandoned and underused cultural heritage and landscapes, economic growth social wellbeing and environmental preservation can be achieved. It will also contribute to a sustainable development of cities and regions. It considers different dimensions such as economic, social, environmental, and finally the cultural dimension. (Gravagnuolo et al., 2017).

1.1.2. Critics and challenges

The new system faces a lot of judgement. Firstly, a lot of experts say that the analysis of the impact and the consequences are not reliable. That is because the scientific literature is not yet exhaustive due to methodological and data limitations (Belin and Hananel, 2019; Reichel et al., 2016). Also, the system comprises so many different areas of expertise and many aspects that need to be taken into account are so diverse. So, of course, some sectors would benefit more from it than others (Reichel et al., 2016). Some will lose, some will gain (Reichel et al., 2016). (Belin and Hananel, 2019).

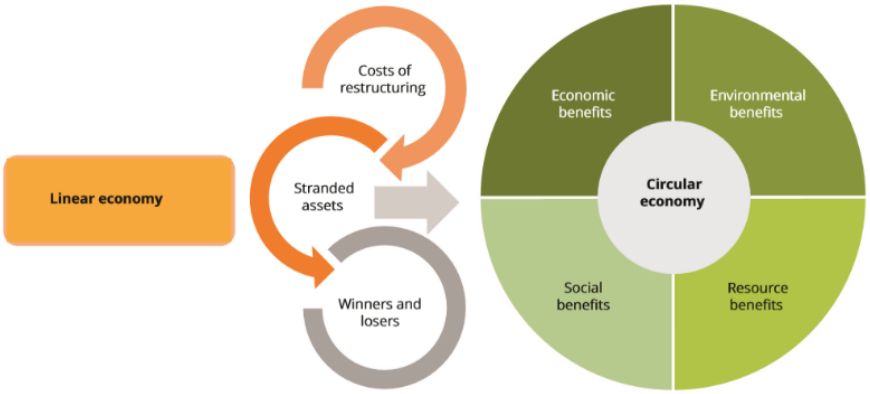
Secondly, it can be seen as a system that is not up to the transformation needed of the actual economic model. Furthermore, it can be recognized as an utopia. A concept invented to perpetuate the economic model we have today. Another critic can be greenwashing. It can be the case for companies applying a little recycling or reducing a little bit their amount of waste. Greenwashing occurs when an organization spends a lot of time and money on marketing the environmental friendly activities they do instead of really minimizing their environmental impact (Corcione, 2020). However, if you want to apply circular economy to your business, it must be founded by profound changes and a real shift in management. (Belin and Hananel, 2019).

The Ellen MacArthur Foundation states that it is important to find a balance. On one hand, an efficient financial system and on the other hand, a very resilient system that develops interconnections and synergies with a view to defy shocks. (Ellen Mc Arthur Foundation, 2017). In addition, circular economy is only beginning to bloom and some answers can only be found in the long run thanks to a lot of experimentation. (Belin & Hananel, 2019).

A big challenge for the circular economy is for the company embracing the system to stay profitable. Innovation is key in this case. If a company wants to succeed, it will have to acknowledge the customers' needs while maximizing indirectly the environmental and social benefits by taking the externalities into account. (Belin and Hananel, 2019).

1.1.3. What is the impact of a circular economy in general?

A circular economy system has different benefits such as economic, social and environmental benefits, which is stated by the Ellen MacArthur Foundation in the section above. Several hypotheses are considered as an answer for the question. Those hypotheses can be divided into three main subjects. The first one is the economic impact, the second one talks about the social impact of circular economy and lastly, the environmental impact is also mentioned.



Source 4: Reichel, A., Schoenmakere, M., Gillabel, J., Grossi, F., Brueggemann, N., Wilts, H., Zoboli, R. and Arnold, M. (2016). Circular economy in Europe. Developing the knowledge base. 10.2800/51444.

Figure 4: Transition from a linear to a circular economy

A case study of the Chair for Circular Economy and Urban Metabolism showed a positive outcome in Brussels, more specifically in Schaarbeek. In that municipality three horses and carriage have been put to use in order to collect organic waste. The way of collecting waste raised a lot of curiosity and thus more people were encouraged to participate. On top of that, it proved that the horses reduced infrastructure costs. Thus, the collected organic waste found its way back to the agricultural system. (Hill et al., 2018, p.29).

1. Economic impact

First of all, the circular economy can be seen as a strategic answer. Many strategies are used in the type of economy in order to continue to use materials and products in a high-quality way for a longer life (Reichel et al., 2016; Circular Flanders, 2018). Products or goods can be repaired and sold with a high second-hand value. It is called an “eco-design” (Reichel et al., 2016). They can also be upgradeable and can be taken apart and turned into new products. Nothing is lost and down-cycling is avoided in the circular economy (Circular Flanders, 2018; Reichel et al., 2016). With down-cycling is meant that waste materials or products are transformed into new products of less quality (Reichel et al., 2016). It requires a lot of workforce. For dismantling, sorting, selective deconstructing and reconditioning of the materials in order to reinject products and services back into the cycle. So, it motivates to create and boost local economic activities. (Belin and Hananel, 2019).

Creating waste can also be seen as wealth (Belin and Hananel, 2019; Reichel et al., 2016). It can be seen as a gigantic new pool of reusable resources. A lot of countries and metropolitan cities import (raw) materials and resources. That puts a limit on their production. Brussels is one of them. It doesn't extract a lot of raw materials from its territory. Therefore, Brussels needs to find it elsewhere. However, the imported goods and services bring a negative impact on the environment, because a huge amount of pollutant emissions is involved. On top of that, one cannot forget the extensive supply of garbage that is sent out of the country. Remember those articles in 2019 stating Asian countries, such as China and India, refused our containers? They no longer wanted to serve as a dumpster for the Western countries. That could be the change needed in order to adopt slowly, but surely, the circular idea. (Belin and Hananel, 2019). So it creates a buffer to external shock in order to be more resilient (Hill et al., 2018).

Thirdly, importing large quantities of manufactured goods or raw materials can make the region dependent of the price of those resources or raw materials. For Brussels, the imports climb up to 98%. That is a big disadvantage for Brussels. A lot of the economic actors of the capital area are sensible to the dependency, the everchanging prices and shocks or lack of foresight. (Belin and Hananel, 2019). The reducing amount of resources and also the increasing demand from a growing global population is an inevitable trend nowadays. Cities are objected to rising prices and increased global competition for importing resources (Hill et al., 2018). On the contrary, focusing on a decrease in global needs, the circular economy absorbs those global economy shocks. Along with insecurities regarding the pricing, there is also the insecurity of getting the right amount of raw materials and resources. Indeed, some raw materials could disappear in the following years. If one is dependent on other countries for those disappearing materials, it is in bad luck. (Belin and Hananel, 2019).

Furthermore, in a linear system, the price of a product or service is determined by the market. However, there are also externalities that have an effect on the price. (Belin and Hananel, 2019). In a circular economy, though, the externalities are included in the price of the product of service. That means everything is taken into account. For example, the price of the local workforce. Even if that is not equal in every part of the world. On the one hand, the circular economic system does not remove the negative externalities. It considers the emissions and/or the pollution. On the other hand, the externalities with a positive effect on society, such as better health and the creation of new jobs, are not being included. Per contra, while transitioning from the linear to the circular system, it can be seen as a huge economic advantage for the linear system. The price is only considering the market and consumers are sensible to the aspect of value for money. (Belin and Hananel, 2019). So in that case, it is a big disadvantage for the circular economy. However, if you can make your consumers conscious enough to understand it, they are maybe willing to pay the extra money for that extra value. (Belin and Hananel, 2019).

For companies embracing the circular model can be seen as an advantage, because they can differentiate themselves from their competitors or expand their offer by proposing a new way of customer relationship management. (Belin and Hananel, 2019). They can provide a product-service system instead of a product-ownership (Reichel et al., 2016). Not to mention, they can also improve their image, because by offering new services they can extend their product lifecycle. It may result in a serious competitive advantage for the businesses in Europe (Reichel et al., 2016). According to Eveline Lambert (2019) it will also increase customer loyalty. Furthermore, the costs will decrease thanks to the small price they have to pay for materials that will nevertheless be thrown away. (Belin and Hananel, 2019). On top of that, when companies reuse or resell their unsold goods and products, they are avoiding taxes on their waste. If the amount of waste decreases, the amount of taxes is decreased together with them. (Watteyn et al., 2019).

Another advantage is that all those new, innovative and creative projects and companies can attract other cultural and creative industries. Which can result in new residents and even more new businesses (Gravagnuolo et al., 2018). With all the innovation and new views on how to use (renewable) resources, there is also a gain in technological innovation. That technological innovation for resource reuse and reduction can be shared with and exported to other countries. As such, economies of scale are realized and thus, the country's competitiveness can even grow further. (World Health Organization, 2018).

However, it will require several changes in order to implement all those different steps in order to achieve circular economy. A company will have to reinvent itself. It will have to change its lifestyle and priorities. Not only for its business approach, but also for the customers and its consumption patterns and behavior. A lot of education on governance and skills will be necessary. Also, the way stakeholders participate and interact will change. So, the switch between the two systems will have to be monitored closely through Key Performance Indicators and data. (Reichel et al., 2016).

An example in Brussels of a company embracing the circular economy and using available resources is Rotor. It is a cooperative design practice that researches the organization of the material environment. (Rotor vzw-asbl, n.d.). In 2016, a spin-off of their practice was launched. The project offers the reuse of construction materials in the field of salvaged building components. The materials come from the Antwerp City Hall prior to the renovations and the North Station in Brussels for example. (Rotor Deconstruction, 2020)

2. Social impact

A circular economy is also social. It founds platforms, exchanges and sharing. An example of the sharing economy is the disposal of rental bikes and steps in cities. It provides a link in society. It can bring entrepreneurs from different sectors together. Both from the "classic" economy as well as from the social economy, where solidarity plays a big role, through bottom-up and top-down projects. It also stimulates the participation of the employee in the company. The social impact is strengthened in metropolitan areas, because the social aspect is much more present there. It is an opportunity to harmonize the citizens with the world they live in. (Belin and Hananel, 2019). The cooperation in that type of economy can take several sorts of forms.

It can refer to the sharing of information, as well as the existence of platforms for exchange, an atmosphere of collaboration and the actual participation process itself. (Hill et al., 2018). In addition to a circular economy creating a sharing economy and collaborations, it also introduces the use of new financing models. Models such as crowdfunding, investment of local banks, ethical banks, NGO's, foundations and so on make their entrance. (Gravagnuolo et al., 2018).

Of course, sharing and cooperating can be challenging, because it is neither natural nor evident in the economy as of today. With a view to success, time and energy need to be put into relationships to have healthy collaborations flourish. (Hill et al., 2018). A good relationship consists of giving and taking, as we say. Also, big companies are not eager to share their knowledge and know-how, because of their intellectual property (Hill et al., 2018).

Nevertheless, the circular economy could be an answer to problems such as unemployment, exclusion, identity withdrawal and so on. (Belin and Hananel, 2019). Les Petits Riens could be mentioned as a good example for circularity and its social impacts on society. It all began in the 1930's with a young assistant priest. He decided to establish playgrounds in Brussels for underprivileged children. In the meantime, he also started to collect clothes and furniture. In 1937, the young priest introduced a new way of social living for people who didn't have any money nor shelter. That type of living is now known as living in solidarity. Those people lived and ate together. In order to provide employment they collected, sorted and sold the clothes and furniture as second hand products. As of today, their goal is still to fight against poverty by tackling economic and social challenges. (Spullenhulp, 2018).

Nowadays, they have several social activities going on. The first one is providing shelter to the homeless. The shelter is one of the biggest ones in Belgium. By doing so they want to help the underprivileged people and in the same time give them the opportunity to become independent again and give them more self-confidence. (Spullenhulp, 2018). During their time in the shelter, people have to set up their own project. After their stay, the objective is that they continue with their personal project with some help of the Spullenhulp team.

They also have a shelter for youngsters, which is subsidized by the Commission Communautaire française (COCOF) (Spullenhulp, 2018). Since 2011, they also offer follow-ups for people with an addiction (Spullenhulp, 2018). A social shelter is also one of their ways to help people and to listen to them by providing debt mediation, legal assistance, entertainment for children and food assistance (Spullenhulp, 2018).

3. Environmental impact

As mentioned before, switching from a linear to a circular economic system can have several environmental impacts. The first one being to reduce the greenhouse gas emissions. Production processes we know and use today are harmful for nature, especially for our fauna and flora, the microorganisms, and our natural eco system. Sharing resources, reusing materials and finished products and revalorizing old inventions can all contribute to decrease the pollution.

In addition to that, importing all those resources and raw materials counts for 83% of the greenhouse gas emissions in Brussels. Which is absurd since those materials are not even produced in the metropolitan area. (Belin and Hananel, 2019). It can also kill two birds with one stone: thanks to using the scarce resources better, it can avoid high amounts of CO2 emissions and pollutants (Reichel et al., 2016). It will help reduce global warming. (Circular Flanders, 2018).

Furthermore, it also contributes to the health of people. There is obviously a link between better air quality in the city and the health of its inhabitants. It has been proven that in an urban area, such as Brussels city, a high quantity of pollution can reduce the life expectancy of a European inhabitant by 2,2 years. It is also known that bad air quality takes the life of many people, whose deaths have come too soon and could be avoided. Circular economy can help in the field by motivating people to exercise more by opting for soft transport, for example transport by bike. It can also advocate for healthier food. And of course for better air quality. (Belin and Hananel, 2019).

Lastly, the circular economy will not only help to better the air quality, but also to purify the water and decrease soil degradation. It will also have an impact on the biodiversity loss, the climate change and general waste. So, it will definitely help reduce environmental pressures linked to extraction, emissions and waste. (Reichel et al., 2016).

1.1.4. What is the current situation?

The news at the end of 2019 was filled with strikes organized by different parties. Anuna De Wever, Youth for Climate, Greta Thunberg and many more came together once a month. The students even gathered every Thursday for several weeks. Also the extreme heat waves in Brussels during the summer were never experienced before. A clear sign to take concrete measures and to change our current economic system. (Belin and Hananel, 2019). Unfortunately, the climate is not only getting worse in Belgium. It affects the whole world. That can be seen by the increasing amount of natural disasters.

Not so long ago, Australia, parts of the United States and even large parts of Europe were overpowered by (bush) fires. Now is the time to act, together (Belin and Hananel, 2019). To listen to each other so that we, as a community, can meet the challenges. To make people aware of innovative ideas and businesses.

In the economy we know today, resources are being used in products which are then destroyed once their effectiveness wears off. It is called the linear model. (Circular Flanders, 2018). It results in a lot of raw materials, much more pollution, a distressed climate and consumers who keep buying new stuff. We forget that the basis of those resources is not unlimited. It is focusing on short term instead of long term. (Belin and Hananel, 2019). The current system is no longer working for businesses, people or the environment (Ellen MacArthur Foundation, 2017). Therefore, in the circular economy the focus is on the maximum reuse of products and resources with a minimal loss of value. (Circular Flanders, 2018). The value of products and materials is maintained for as long as possible (European Commission, 2019). It becomes more and more clear that in the things we throw away, real gems can be found (Belin and Hananel, 2019).

Also, the population is still evolving worldwide. China and India are still expanding enormously for example. An expansion of the population also means that we will need more resources in order to keep the same quality of life. However, that will become more and more difficult. In the long term, resources will become more scarce and expensive. There will also be a huge impact on the environment. The traditional linear lifestyle is thus becoming unsustainable. (Circular Flanders, 2018).

It is also important to mention that by trying to implement circular economy, one must take the current cultural heritage into account. It is the identity of the city. Hence, implementing a circular economy is about protecting and preserving the cultural heritage, while also adapting the existent resources to the ever changing needs and uses of the local communities. (Gravagnuolo et al., 2018).

1. In Europe

Since the last decade, a lot of cities in Europe have therefore welcomed the circular economy. It has recently become more interesting for the European policymaking because of its solution-based perspective and the increasing environmental constraints (Reichel et al., 2016). For the cities it's on the one hand about avoiding waste and reusing materials and about creating value and new sorts of jobs on the other hand. Governments and regions have a serious role to play in the implementing. They began implementing the following type of economy by supporting local entrepreneurship. Once they find a great way in doing that, they can see positive outcomes such as dealing with their own waste, creating technology, knowledge and social innovations. (Hill et al., 2018, p.29).

The European Commission contributes to implementing the circular economy and to reduce the general food waste of the citizens. The different regions and cities get a voice through the European Committee of the Regions (CoR). It represents the local and regional authorities across the European Union (EU). Its main principles is to bring the EU citizens closer to the union by involving them in the decision-making process. Thus encouraging the citizens to greater participation. (European Committee of the Regions, n.d.).

The EU is not obliged to follow the advice given by the Committee, however, in practice, it does. (European Committee of the Regions, n.d.). It negotiates at several stages of the EU law-making process and builds alliances with other Institutions in order to commit to the future of the EU citizens. (European Committee of the Regions, 2019).

Thanks to the CoR being recognized as a valuable partner, it has coordinated several projects. A special commission was set up for its competence of waste policy and circular economy. It is called the Commission for the Environment, Climate Change and Energy (ENVE) (Euopees Comité van de Regio's, 2019). In 2018, the Commission worked on seven matters regarding to the environmental policy and circular economy, such as air quality, the drink water policy and waste packages (European Committee of the Regions, 2019).

The European Union also set up a real action plan in order to implement the circular economy more broadly. It introduces initiatives along the entire life cycle of products (European Commission, 2020). One of its missions is to make sure that the resources are kept in the EU economy for as long as possible. It is seen as going beyond waste and environmental policy while encouraging innovation in terms of consumption. It will slowly eliminate exclusive ownerships and will introduce sharing or leasing products, infrastructure or services. (World Health Organization, 2018). In 2015 the EU introduced a new circular economy package which includes the following actions (World Health Organization, 2018):

- Ecodesign production and guidance for industrial sectors
- Efficient consumption
- Waste management
- Market for secondary raw materials
- Innovation
- Several actions against food waste, plastics and in favor of bio-based materials
- Investments and monitoring

It also includes targets to achieve by 2030 such as for recycling 65% of municipal waste, which are mandatory and 75% of packaging waste. On top of that, a study shows that most of the leading countries in the field of circular economy are mainly EU member states and more particularly countries in the western and northern part of Europe. (World Health Organization, 2018).

Furthermore, the EU has established a lot of organizations, businesses and NGO networks in order to promote, research and share their intakes and experiences on the circular economy. Examples of those information sharing businesses are, among others, the EMF in the United Kingdom, Circle Economy from the Netherlands and the Circular Economy Institute in France. (World Health Organization, 2018).

2. *In Brussels*

Before considering the current situation, it's important to cite that Brussels has always been a city which adapted quickly to the current economic conditions of the day. In the Middle Ages, the city was already well-known for its luxury goods and crafts. Later on, it grew into an important production hub and achieved its peak in the 19th century when it was responsible for about 2/3 of all jobs in the region. Needless to say that Brussels reinvented itself again after. Nowadays, the economy is focused on services. The capital of Belgium is one of the richest cities in Europe thanks to that. Over the last decade, several questions have been asked, namely "What is the value of the industrial land and should industry remain in the city?", "What is the future of urban manufacturing?" and "How can it support the region's circular economy ambitions?". That is why over the recent years, several plans and projects have emerged. (Hill et al., 2018). In addition, as we all know, the political situation in Brussels is quite complicated due to different political parties and governments. That is why all the different parties need to share the same vision for the city (Hill et al., 2018).

Since 2016, the capital of Brussels is encouraging people to start new businesses while implementing the circular lifestyle. From an economic point of view, there are a lot of advantages. For Brussels, it signifies a shift towards a low carbon economy, new local employment and respect for the inhabitants' way of life and environment (Belin and Hananel, 2019). It was also the year in which the Programme Regional en Economie Circulaire (PREC) was launched. In English it is called the Brussels Regional Programme for a Circular Economy (BRCPE) (Ellen MacArthur Foundation, 2019). With that initiative, Brussels wants to position itself as one of the most innovative European region and as a precursor of adapting the circular economy. All other circular economy activities come from the program (Ellen MacArthur Foundation, 2019).

There are three main objectives. The first one is to transform the environmental objectives into economic opportunities. Secondly, implementing the circular economy in Brussels in order to produce locally when possible, is reducing transport, optimizing the use of the area and creating added value for its inhabitants. Lastly, it wants to contribute to creating employment. (Bruxelles.environment, n.d.). The initiative focuses on five key economic sectors: retail, logistics, waste and resources, food, construction, and the building environment (Ellen MacArthur Foundation, 2019). Those sectors were chosen because they offer a great potential for job creation. They have as well an impact on emissions and it addresses different challenges for the region of Brussels (Hill et al., 2018). It was set up for a period of four years. In 2018, a midterm evaluation took place.

By that time, 60% of their goals were already met. Together with Be Circular, economic support is being offered with a view to help companies to innovate, promote and provide trainings (Hill et al., 2018, p.37). They had collaborated with 319 entrepreneurs and financed 194 projects. In 2019, 76 new projects were registered to join Be Circular. (circulareconomy.brussels, 2018). Some of the interviewees also mentioned the organization, but that will be discussed later on in chapter 3.

The case study of Gravagnuolo, Saleh, Ost and Girard (2018) shows an example of the cultural heritage mentioned above in line with circular economy, namely the Tour à Plomb in Brussels. In 2017, the project was the winner of Be Circular and the PREC. The materials used for the renovation came from the site itself and workers were trained by in-situ workshops. The Tour à Plomb or otherwise known as the Brussels shot tower, was built in 1832. It served as a gun powder factory. Over the years it switched from several owners and had multiple different functions. Since the 2000s it hasn't been in use, but it became a distinct element of the landscape in the city. The new value is related to a lot of neighborhood events multifunctional space and a symbol for local identities. It's an old place where new community relationships can be built. In fact, it is a sustainable neighborhood contract situated in a popular neighborhood of Jardin des Fleurs in the heart of the city. The project was called "Contrat de Quartier" and ran from 2011 until 2015. It was an action plan to improve the living environment of a precarious area. After several renovation works, the new site was inaugurated in June 2018. It is now a socio-cultural and educational center completely dedicated to the neighborhood activities with an integrated gymnasium and theater hall. There are also five classrooms and a teacher's room to be used by the high school situated next to the Tower. (Gravagnuolo et al., 2018, p.2-3).

Furthermore, in October 2019, the private sector in Brussels started with the City Climate Challenge. That challenge consisted of 30 new projects with the purpose of lessening the CO2 with 30% by 2030.It is said that by achieving that goal, the economy will benefit from it. It will create jobs and even strengthen the competitiveness. (Callens, 2019). For the capital of Brussels, 58 000 jobs are circular. That is equal to 8,1% of the total employment. 4000 jobs are in the waste management. 3500 people work in the recycling and maintenance sector. Most of the people, which is equal to 22 000 employees, are active in the digital sector. Indirectly, the same amount of 22 000 jobs were created. Those people are operating in the trade sector, administration and construction. (Dufourmont et al., 2019).

1.1.5. What can it really mean for Europe?

The Circular Economy Action Plan demands a partnership from all economic actors, consumers, citizens and civil society organizations (European Commission, 2020). It is also important to mention that all the principles of circular economy need to be enclosed in all the functions of the city, if the city wants to be circular. That means establishing a regenerative and restorative urban system by design. The idea of waste is also eliminated. Furthermore, the assets are used at the highest level of utility. Digital technologies are vital and it generates prosperity and economic resilience for itself and its citizens. (Hodkinson et al., 2018).

As in every other part of the world, Europe has to and will still have to deal with global and interdependent social, economic, environmental and technological trends. Additionally, with the expansion of the population mentioned above, there is already a struggle on the planet to have enough food and other natural resources, demands for land and the absorption of waste. (Reichel et al., 2016). Nevertheless, what will it really mean for Europe to implement the circular approach?

First of all, the economic impact regarding the resources. It would reduce the demand for primary (raw) materials and thus weaken the interdependency. By recycling, introducing eco-design and preventing waste, the region of Europe has already avoided an estimated amount of six to 12% of all material consumption. However, by using innovative technologies and improving the resource efficiency, the material imports could be scaled down to up to 24% by 2030. For the food, mobility and construction sector, the annual savings of primary resources can even be around 600 million euros by 2030. Although, that would require a lot of changes in the sectors previously mentioned. By implementing the circular economy practices of reusing, redesigning and preventing (unnecessary) waste, it could recover an average of three to eight percent of the annual turnover or 245 to 604 billion euros. (Reichel et al., 2016). By efficiently using resources and reusing them for the creation of new products, the EU's GDP can grow by an additional 0,5% by 2030 (European Commission, 2020) and the European business could save 630 billion euros per year. (Circular Flanders, 2018).

Secondly, the social impact considers more sustainable consumers and job opportunities. In fact, social innovation linked with the sharing economy, reuse and recycling can result in a more sustainable consumer behavior. Also, the European Commission says that up to 178 000 new direct jobs can flow out the implementation by 2030. A recent study even states a creation of 700 000 jobs in total (European Commission, 2020). Different type of jobs could be created such as the preparation and sorting of products and materials for reuse, medium-skilled jobs are expected for closed-loop recycling and remanufacturing and lastly, high-skilled job for bio-refining. Jobs for all levels of education could be created by replacing products by services. (Reichel et al., 2016). For businesses in general, it could mean new opportunities inside and outside the EU (European Commission, 2020).

Last but not least, the environmental impacts are the main objectives of the EU for introducing the resource-efficient approach. By organizing more ambitious targets regarding recycling and packaging waste, a decrease of around 424 up to 617 million tonnes carbon dioxide in the greenhouse emissions can occur. (Reichel et al., 2016). It can even result in climate neutrality by 2050. By transitioning to the circular model, it will reduce its consumption footprint and double the material use by 2030. For the inhabitants of the EU, a whole new range of high-quality, sustainable and safe products will be provided. Those products will be affordable and efficient. (European Commission, 2020).

1.2. The Food Industry

As mentioned in the first section of the chapter, a European Action Plan has been put in place in order to implement the circular economy in the European Union. Of course, that new circular system can be applied in any industry. For the specific thesis topic, the focus lays on the food industry.

The next chapter will consider the negative aspect of food waste during the entire food supply process. First, a definition of food waste and losses will be given. Secondly, the current situation worldwide, in Europe and finally in Brussels will be explained. Furthermore, the key actors of each step in the production process will be presented. Lastly, some tips and tricks on how to fight food waste will be suggested.

1.2.1. Definition: what is food waste?

According to the UN Environment food loss and waste is the decrease in mass or nutritional value of food throughout the supply chain (UN Environment, n.d.). In the first case the quantitative aspect is evoked, in the second case the qualitative aspect. The loss or waste is applicable to the production intended for the human consumption even if it is afterwards redirected to a non-food use (UN Environment, n.d.). In countries with a medium to high income, food is wasted to a high extend. It is thrown away, even if the food is still suitable for consumption. Of course, unpredictable things will always happen such as bad weather conditions and sudden change in demand. (Gustavsson et al., 2011).

There is a slight difference between the two concepts. When speaking of food loss, one means the food that is spilled, spoilt, lost or decreased in quality and value during its process. Normally, that takes place at production, post-harvest, processing and distribution stages (UN Environment, n.d.). In short, it happens in the early stages of the chain. The Food and Agriculture Organization of the United Nations (FAO) adds that it is the result of decisions and actions from the food suppliers (United Nations, 2020).

Food waste, on the other hand, refers to the food that has reached the final stages of the process and has become a fit and qualitative final product, but still doesn't get consumed. It typically occurs, but not always, at retail and consumption stages (UN Environment, n.d.). Again, the FAO adds that it is the result of decisions and actions taken by the retailers, food service providers and consumers. In short, food waste happens at the end of the chain. In addition to the actual food loss and waste, the energy and resources that go into it also have to be taken into account (United Nations, 2020).

There are five types of food losses/waste which each apply to the categories of food supply chain, namely the vegetable and the animal commodities and products. The types are the agriculture production, post-harvest handling and storage, processing, distribution and consumption (Gustavsson et al., 2011).

The FAO has introduced the Food Loss Index (FLI) and the Food Waste Index (FWI). The FLI focusses on the food loss at every stage of the supply chain measured by the changes in percentage losses for a basket of 10 main commodities by country in comparison to a base period. A proposal for measuring the FWI is still under development. (United Nations, 2020).

Roels and Van Gijseghem (2011) also make a distinction between inevitable and avoidable food loss and wastage. The inevitable food loss happens mostly for non-edible food products, while avoidable food loss occurs for edible food products. (Roels and Van Gijseghem, 2011).

1.2.2. What is the current situation?

1. Worldwide

According to the UN Environment approximately 1.6 billion tonnes, which is equal to almost one third of the entire food production, is being wasted or gets lost worldwide. In Europe, consumers waste around 280 kg a year per capita. Almost 200 kg occurs during production and 90 kg of the waste happens during consumption (Sawe, 2018). The food loss and waste contributes to the lavish of resources such as water, land, energy, labor and capital. All those resources could be used for other things. Furthermore, it produces unnecessary greenhouse emission gasses which contribute to climate change. (UN Environment, 2019). The food waste can happen at any moment of the food supply chain.

Now, different projects have been set up worldwide in order to fight the food loss and waste. The first and most known project is the 2030 Agenda for Sustainable Development. It was adopted in 2015 by the General Assembly of the United Nations. It is a universal framework reuniting all the different global challenges. Those challenges cannot be fought individually. (Gravagnuolo et al., 2017).

The United Nations state that "this Agenda is a plan of action for people, planet and prosperity. (…) We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind" (UN 2015, p.5). From that Agenda, 17 Sustainable Development Goals (SDGs) came forward. (Gravagnuolo et al., 2017).

Source 5: United Nations. (n.d.). 17 Sustainable Development Goals.

Figure 5: 17 Sustainable Development Goals (SDGs) by the United Nations

The 11th SDG consists of sustainable cities and communities. It highlights the fact that good urbanization and development are interdependent. Good urbanization and development can be linked with job creation, livelihood opportunities and improved quality of life. However, in order to achieve all those positive consequences, the natural system, the newly built environment, the communities and the private and public institutions should work together closely. (Gravagnuolo et al., 2017). The 12th SDG lies on the responsible consumption and production. That is the focus of the thesis. Responsible consumption and production will result in less waste and in reusing some of the surplus.

Another report called "*Reducing Food Loss and Waste: Setting a Global Action Agenda*" (2019) gathers new information and research in order to address the huge food loss and waste worldwide. It offers a global action agenda with a view to lowering the amount by half, which is in fact the United Nation's Sustainable Development Goals (SDG's) for 2030. (World Resources Institute, 2019). The report invites everyone to participate: from governments, businesses, farmers to consumers and has three views on how to fight food waste (Flanagan et al., 2019):

1. Target-Measure-Act: recalls to firstly set targets on how to achieve the goal. Secondly, measuring the hotspots of food loss and waste, while keeping an eye on the progress. And lastly, take action.
2. Make a to-do list for every (key) player in the food waste chain.
3. Come up with "10 scaling interventions" in order to put in place the Target-Measure-Act model and the to-do lists.

2. In Europe

The concept of circular economy is no longer unimaginable in the European policy for agriculture (Van Buggenhout et al., 2016). Every year, around 173 kg of food waste is produced per European citizen. For Europe as a whole it means an amount of 88 million tonnes. (FoodWIN, 2020). As mentioned before, a European Action Plan regarding the circular economy has been implemented since 2015. The plan also affects the food industry, as any other industry active in Europe. Concerning food, water and nutrients the European Commission aims at providing sustainable and renewable bio-based materials. (European Commission, 2020).

An estimated 20% of the total food production is lost or wasted in Europe. Therefore, the Commission targets a reduction in food waste as a key action. The target comes from the EU Farm-to-Fork Strategy and is in line with the SDG's mentioned previously. (European Union, 2020). For example, implementing the circular model in the food industry would mean more resource-efficient farming practices, organic farming and reducing food waste. Regarding the costs for some consumer goods such as food, beverages and textile, potentially 700 billion USD could be saved per year. That is equal to about 20% of the input costs. (Circular Flanders, 2018).

The Commission will also introduce specific measures in order to achieve a more sustainable food distribution and consumption. In addition, a legislative initiative will be launched to substitute single-use packaging, tableware and cutlery in food services. In agriculture, the Water Reuse Regulation will be introduced. Regarding reusing water, it will review the wastewater treatment and sewage sludge. It will also establish an Integrated Nutrient Management Plan in order to ensure sustainable application of nutrients. (European Commission, 2020).

3. *In Belgium*

The Food Industry is one of the most important industries in Belgium. In 2018 it was the biggest industrial sector with 18,3% of the total Belgian profit. The specific turnover goes up to almost 52 billion euros and has created more than 90.000 direct jobs and over 170.000 indirect jobs. (Fevia, 2018).

The industry didn't grow in one day. Our country needed years of expertise in order to brew thousand different brands of beer, the best chocolates and the original Belgian fries. It endured several changes that resulted in a lot of innovation. Nevertheless, there are a lot of standards and regulations that need to be taken into account. In addition to those standards and regulations, stakeholders tend to put pressure on the Food Industry. (Avermaete and Viaene, 2002).

That is the reason why Fevia, the federation of the Belgian Food Industry, represents 26 sectors and 700 enterprises and their environment. They strive for a durable growth for the sake of having and continuing to have a strong and competitive industry. They are convinced of the quality, diversity and innovation of the Belgian Food Industry. The foundation consists of three main subdivisions, which are similar to our political system; Fevia Brussels, Fevia Flanders and Fevia Wallonia. Their expertise covers six domains: competition, safety, environment and energy, jobs and talent, food and health and last but not least durability. (Fevia, 2018). They launched their own brand "Food.be" which symbolizes the strengths mentioned before. The slogan says it all: "Small country, great food". (Food.be, 2020).

Unfortunately, with great success in an industrial sector comes a lot of pollution. The challenge regarding decreasing the total amount of food waste is seen as a global issue. It concerns the public through the government and politics, but also private sectors such as producers, private companies and individuals as customers. When talking about food waste, it is also important to mention that it goes beyond the actual food being wasted or getting lost. It contains also the energy, the land, the water and the animals used for the production of those elements. (Lusk and Ellison, 2017).

Let's have a look at the current situation of Brussels and put it into numbers. More than one million people are living in Brussels nowadays. In contradiction to the food industry in Belgium, the food production industry in Brussels is relatively small. It only represents less than 1% of the annual revenue and accounts for around 300 businesses and 4,000 jobs, including in bread/patisserie/biscuits (69%), chocolate and confection (12%), and meat processing (8%). Moreover, 12% of the average household income is spent on food with Brussels' citizens producing an estimated 800,000 tonnes of waste every year. (Ellen MacArthur Foundation, 2019). The yearly food waste in Brussels accounts for 134 000 tonnes (Lambert, 2019). An average of 350 kilograms of waste is created per inhabitant on a yearly basis. Thanks to Bruxelles-Propreté, 34% can be revalorized. (Belin and Hananel, 2019). In November 2019, the Zero Waste Salon took place at Tour and Taxis. During a debate about "Comment solutionner le gaspillage alimentaire à grande échelle? ". A question was asked about why the amount is that big. The answer given by the three participants of the debate consisted out of three arguments. First of all, we are given more and more choices regarding food in canteens, supermarkets, restaurants and so on. Secondly, consumers don't want "ugly" fruits and vegetables. So they are automatically thrown away. And lastly, there will always be unplanned waste. We cannot control and foresee everything. (Watteyn et al., 2019).

Several initiatives have been launched over the years in the field of circular economy. The GoodFood label is one of them. Brussels Environment launched the label. The idea came in 2015 when a collaboration was set up between Brussels Environment, the Agriculture Department and hundreds of representatives of the Food Industry in Brussels and Belgium as a whole. The label represents restaurants in Brussels which prepare their meals with fresh, local and seasonal ingredients. Those restaurants also take the environment into consideration with an eye on reducing food waste. In fact, one of the targets is to reduce 30% of the food waste by this year. (Ronsmans et al., 2019).

Obtaining the label is based on different criteria for sustainable food. The criteria are established by Brussels Environment, but an independent institution is responsible for control. The goal of the GoodFood label is to support the sustainable approach of the restaurants and canteens and to offer them coaching. Of course, combatting the general food waste is also part of the job. Once one gets one of the three different degrees of the label, it stays valid for three years. If one is interested in the several restaurants and canteens participating, one can check them out on their website or one can recognize them by the label hanging in the restaurants themselves. (Ronsmans et al., 2019). In order to get the label, the restaurant should meet up to different criteria. There are five main and 14 optional criteria. If 30% of those are met, the restaurant will get one chef's hat. 50% will give them two chef's hats and 70% three hats. (leefmilieu brussel.brussels, 2019). The main criteria are the following (leefmilieu brussel.brussels, 2019):

1. Abide the law: it speaks for itself that the restaurant must respect the sector's policies.
2. Communicate sustainable approach: it should be done before receiving the label. After obtaining the GoodFood label they should continue and use the offered tools.
3. Do not use products of the fifth range: those are pre-cooked, packaged, pasteurized or sterilized agriculture products that need to be stored fresh or are ready to use. The control is made on the spot.
4. Offer at least some vegetarian options depending on how many dishes the restaurant serves à la carte.
5. Use only bio eggs (code 0) or eggs from a free-range farm (code 1). Inspection is on the spot.

Another example is Brussel LUST. The initiative was launched in 2017 and promotes the adoption of a shorter food supply chain. Its job is to inform food producers about the potential market for local and organic products in Brussels. Therefore, company visits are organized and even inspirational tours with producers who have already shown interest . (Ellen MacArthur Foundation, 2019).

In addition to above initiatives, a lot of innovative platforms and business models are arising. For example the crowdfunding platform MiiiMOSA which is dedicated to collecting funds for bettering the ways of agriculture and food production. A second example is a network of citizens called Groupes d'Achat Solidaires avec l'Agriculture Paysanne (GASAP). They group themselves with organic producers to ensure a direct supply and they offer a guaranteed demand. Also a lot of supermarkets with new business models are launched nowadays. (Ellen MacArthur Foundation, 2019).

Furthermore, a lot of organizations join forces with other companies in order to resell their unsold products. Dominique Watteyn explained during the « Zero Waste Salon » at Tour & Taxis in November 2019 the concept behind Frigos Solidaires Ixelles. They collect the unsold food related articles in supermarkets in order to redistribute them to families in need. Those articles and products are not retransformed. She stated that thanks to that initiative a waste valorized at 500€ a month per family is avoided. More than that, GoodFood has created a new law that all the unsold food related products in supermarkets have to be redistributed to those kind of initiatives. That is a huge benefit for the supermarkets also, because they don't have to pay the 6% of VAT on the unsold products and in addition they dodge the trash taxes. It has both a social impact and an environmental one. Also Hélène Demanet from Happy Hours Market affirms to work together with supermarkets, restaurants and cafés. They resell the unsold meals and food related products to individuals. In case they still have unsold products, they hand them out to associations such as Frigos Solidaires.

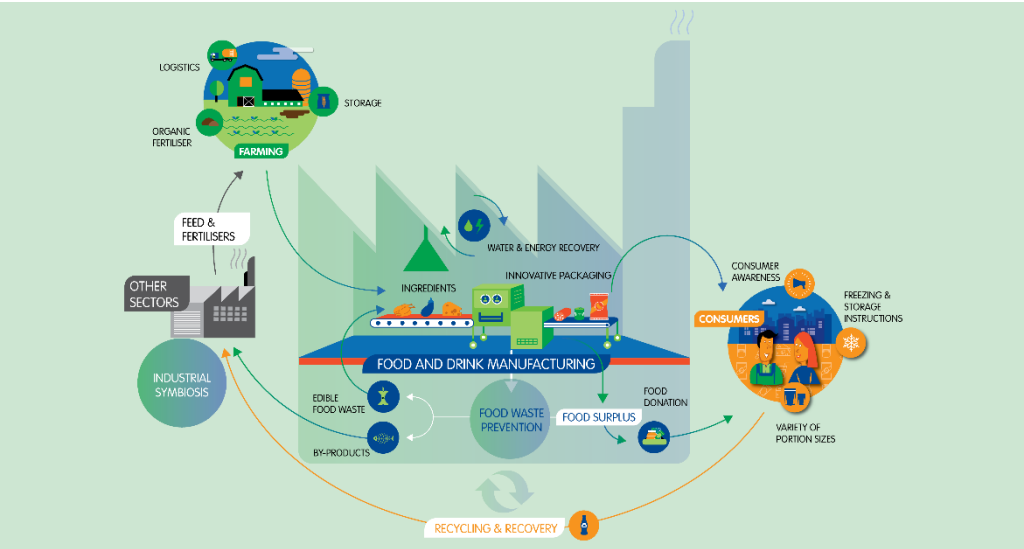
Sometimes the unsold products are remade into new products. In the case of Rob Renaerts from Coduco; soups, ice creams and much more are made out of those unsold items. (Watteyn et al., 2019)

Be aware that there will always be a huge amount of invisible food waste. It is a fact that there are not enough consumers in Belgium for the entire production. On top of that, the logistics are not efficient enough in order to distribute the whole produced quantity. (Watteyn et al., 2019).

1.2.3. Who are the key actors in the food waste chain?

A production chain doesn't consist of only one actor. In order to get a finished product, several actors contribute to the process. That is also the case for the food industry. Farmers and producers, restaurants, cafés, hotels, supermarkets and customers are all part of the food chain process. Unfortunately, with processes, there also comes waste production. In this chapter, the different actors are being analyzed for their part in the food waste chain. Food in our supermarkets in Belgium comes from all over the world. For example, meat eaten in Brussels may come from a farm in the Netherlands, fed by soya from Brazil, which is grown on African-mined phosphorus (Hill et all., 2018, p.29).

As mentioned before, food loss and wastage can happen at any moment of the food supply chain. It can also occur in every place in the world. Thus, in developed countries as well as in developing countries. There is one big difference between them. In developed countries the biggest part of wastage takes place at the end of the chain, while in developing countries it develops rather at the start. (Roels and Van Gijseghem, 2011).



Source 6: FoodDrinkEurope. (2018). Ingredients for a circular economy.

Figure 6: Circular economy in the food and drink industry in Brussels

1. Farmers and producers

In developed countries, 12% of the total food waste happens during the farming process or immediately after harvesting. Several products go to waste during the processing and packaging stage. 10% of all grain products, 5% of all fish products and 4% of the meat. (Gustavsson et al., 2011). For example, fruits that got bruised during the pickings or the threshing. It could also be crops that did not meet the quality standards and supermarket restrictions or crops left behind because of a drop in pricing or due to poor mechanical harvesting tools. (Bagherzadeh et al., 2014). Due to those quality requirements, the products can be down-graded to a lower category. It does not automatically count as loss or waste. The products can also be outgraded. When harvesting happens too early it can also result in food losses and wastage. In the fishing industry wastage can occur when other species are caught, which is called bycatch, or fish that doesn't meet the requirements. In the meat industry, it occurs when some of the animals die or accidents happen. Some animals can also get diseases. Sometimes treatments with antibiotics determine that the animal cannot be used anymore for the meat industry. (Roels and Van Gijseghem, 2011).

Some of the food losses or waste can also occur due to economic factors. Mostly it is because of a mismatch in supply and demand. The farmers can get in trouble due to market crises. (Roels and Van Gijseghem, 2011).

2. Transportation and processing

During the next stage of the food supply chain, the waste and losses appear after the products leave the farm for handling, storage and transport. It includes food eaten by pests and insects. Sometimes, the edible products degrade by fungus or diseases.

The losses regarding the processing of primary food products can be seen as process losses. In this case, it is about non edible and thus inevitable food losses and waste. They are fix elements of the cultivation process. Examples of those non-edible food products are potato skins in the potato industry and bones, carcasses and some organs in the meat industry. Of course, there are also evitable and thus edible food losses and waste. Examples are damaged products due to technical shortcomings, overproduction, damaged packaging or because of loss of quality. (Roels and Van Gijseghem, 2011).

3. Distribution and supermarkets

For the distribution, the biggest problems are the inventory of the supply and the demand forecasting. A miscalculation in one of those two subjects can cause a surplus, which will then lead to waste. It is important to make the right choices between having a big stock or the risk of going out of stock and having empty shelves. (Roels and Van Gijseghem, 2011).

Supermarkets also work with a big inventory and stockage. It is also important to mention that there is a big difference between the “use by”-date for very perishable food products and the “best before” for less perishable food products. The “best before” products cannot be sold anymore, but they are still edible and consumable. So, the supermarkets have to take them out of the shelves. (OVAM, n.d.; Roels and Van Gijseghem, 2011).

4. Customers

Last but not least, the customers. On the contrary of what people may think, most of the food waste occurs at consumption. Unfortunately, the consumers are the biggest polluters. 53% of the food that consumers buy is being wasted afterwards (Heymans, 2019). It also includes food losses and waste at restaurants or cafés. The food waste in the last part of the food supply chain consists of food that was bought, but not consumed. Secondly, it could be food that was cooked, but not eaten. It could be any sort of edible product sorted out due to quality. (Bagherzadeh et al., 2014). A part of the problem here is that in industrialized and developed countries, people can afford to waste food (Gustavsson et al., 2011). The amount of food available in restaurants, supermarkets and hotels is large enough. It encourages people to fill their shopping cart or plate with way more than what they actually can eat. (Gustavsson et al., 2011). Another problem can be the marketing strategies used in developed countries. For example the “buy one, get one free” or “two for the price of one”. (Roels and Van Gijseghem, 2011). In Belgium, for example, during the COVID19-pandemic, promotions were even forbidden in order to prevent people from buying too much at once.

It is also important to mention that food loss at present stage in the supply chain is different per country and nation. The differences are related to culture, climate and socio-economic factors. (Roels and Van Gijseghem, 2011).

5. Horeca

Horeca can also be part of the consumers group. They actually act like two actors. Firstly, they are also consumers, because they buy food and transform them into meals. Secondly, those meals are sold to the end-consumers, namely, the clients. So, there is both wastage in the kitchen, where the food is transformed and at the end of the meal that the consumer bought and ate partially. In the kitchen there is avoidable and inevitable food waste. However, the consumer wastage is evitable. (Roels and Van Gijseghem, 2011). More information about tips and tricks can be found in the section below.

1.2.4. How to fight food waste: some tips and tricks

1. How to fight food waste?

Now, by putting the two main aspects of the thesis together, the impact of the circular economy on the food industry in Brussels can be analyzed. The first and easiest solution that comes to mind is prevention. Several tips and tricks for prevention can be found in literature. In the book "Global food Losses and Food Waste - Extent, Causes and Prevention"(2011) the writers suggest several prevention methods which will be discussed in the following paragraphs (Gustavsson et al., 2011).

The first solution advocating for fighting food waste is a better communication and cooperation between farmers. It could reduce the risk of overproduction and surpluses. Also, in developed countries, premature harvesting can produce food losses. Poor farmers harvest their crops too early for several reasons. One of them is the need for cash. Hereby, the crops lose their nutritional and economic value. (Gustavsson et al., 2011).

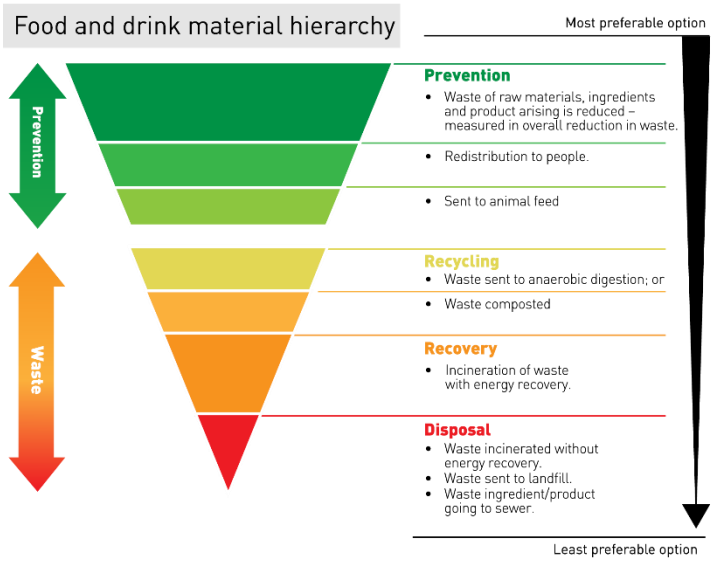
A second prevention method concerns the supermarkets. It is about organizing small resource-poor farmers and diversifying and upscaling their production and marketing. In that way, financial institutions can give them credit or advance payments can be given from buyers. It can also help reducing food losses and waste by supermarkets. Some of the products are refused by supermarkets at the farms gate. A solution can be to redirect the human consumption to animal feeding, but that is only for a small part of those refused crops. Furthermore, supermarkets can hand out surveys in order to see if customers are willing to buy food with "wrong" weights, sizes and appearances. As long as the taste is not affected. Of course, there is always the option of selling without the interference of supermarkets. It will avoid the application of their strict quality standards. (Gustavsson et al., 2011). Another problem was mentioned in the section above. Marketing strategies can push customers to buy way more than they need to. (Roels and Van Gijseghem, 2011).

For supermarkets and horeca, there is one big problem that can be avoided. They offer a "one size fits all" packaging or portion (Roels and Van Gijseghem, 2011). However, that does not fit our society at all. Some people eat more or less than others at a restaurant. It also depends on the environment and the atmosphere. At the supermarkets a lot of different types of households shop their groceries. Some households are very big and need to buy a lot of stuff. Therefore, the family pack or maxi pack is very useful. On the other hand, nowadays, more and more people choose to stay single or live alone. They are forced to buy package sizes that are way too big for them. Nowadays, we see more and more unpackaged stores offering food products in bulk, such as Färm and Brüt by Färm. That can be a suitable solution.

Concerning the government, they should invest in infrastructure. In general, it will improve the infrastructure for roads, energy and markets. Private investors could improve transportation, storage and cold chain facilities. It is important, because failure to comply with the food safety standards can lead to food losses. (Gustavsson et al., 2011).

Lastly, education can be prevention. Education in schools and through initiatives such as workshops are possible starting points to change people's attitudes towards the current massive food waste. (Gustavsson et al., 2011). In addition to education in school, customers should also be educated. In a survey from Sonecom that took place in 2003, 73% of the citizens of Brussels state that they don't throw away much or nothing at all. Another research from the Université Libre de Bruxelles states that the citizens of Brussels are not aware of their food waste. (Roels and Van Gijseghem, 2011).

Food Win and the Food Waste Alliance propose a roadmap to fight food waste for companies or households. It starts with the diagnosis. They help estimate the personal amount of waste calculated with their food waste calculator. Generally, the consumer is the problem. They are indeed accounted for 53% of the food waste. After that, a strategy is set up based on the waste hierarchy. (Heymans, 2019). The waste hierarchy is a guidance for minimal food waste in the circular economy. It shows actions to reduce and manage the waste in an order of preference. (World Health Organization, 2018). The upside-down pyramid has two main parts. The green part focusses on prevention, while the red part focuses on how to treat waste. It means that the last section reveals what can be done about the existing food waste in households and the food supply chain. Some of the suggested actions are not as beneficial for the environment. However, it is better to look at the green part of the figure, because that broadcasts ways of prevention. And finally, it's time for impact and a strategy is implemented through concrete actions (Heymans, 2019).



Source 7: European Former Foodstuff Processors Association. (2019). Food and drink material hierarchy WRAP.

Figure 7: Food waste hierarchy

2. *In daily life*

When delving into the topic of food waste, a lot of tips and tricks in daily life can be found. For example, in the magazine from Delhaize, tips are given to avoid food waste. In every magazine they promote the seasonal fruits and vegetables and they provide the customers with recipes. After the recipe section, there is a section about how to properly use the fruit or vegetable's waste in order to reduce food waste in the household. For example: use the skins, roots or stem in soups or for homemade broths.

In the brochure of Brussels Environment one can also read about several "tips with a big impact". The first tip is to make a shopping list. Decide beforehand what will be cooked and make a list with all the ingredients needed. Take the things one has already in the pantry into account. Secondly, prepare the amount needed for the household. That way too much leftovers will be avoided having. Thirdly, use reusable recipients in order to preserve well food and leftovers. In case one has leftovers, keep them well-stored and process them again if possible. They can also be divided into smaller portions and go in the freezer for later. When one is not at home, one can also try to avoid food being wasted. For example, when a plate can't be finished at the restaurant, ask for a doggy bag. (Leefmilieu Brussel, 2018).

Furthermore, some famous chefs and restaurants share tips and recipes where they reuse food waste. It shows that even in restaurants they are trying to fight the problem. They can set a good example to prove that it is okay to innovate in the kitchen at home or in restaurants. The pictures show recipes shared by Helene Darroze, a two star French chef. Those recipes were shared on her personal Instagram page.

Figure 8: Recipes of chef Helene Darroze

1.3. What is the impact of circular economy on the food industry?

The impact of circular economy can be economic, social and environmental as explained in the first chapter. In the next section, the focus lays on the impact on the food industry in order to find an answer for the thesis question. Of course, a lot of the impacts mentioned in the first chapter can be applied to the food industry, but some of the impacts can be very specific to the sector. Real examples can be found in the last chapter of the thesis in the analysis of real business cases in the food industry in Brussels. Also, the case studies at the end of the chapter will enlighten those concepts and ideas.

1.3.1. Economic impact

The main objective of the circular economy is of course reusing, redistributing and revalorizing products and goods. It applies also to the food industry. The goods can be resold or redistributed. Sometimes, one does not even need to pay for products, thus reduicing the purchasing costs. Afterwards the product can be upgraded and turned into something new. So down-cycling is avoided. In the food sector, creating waste can certainly be seen as wealth. The produced waste literally is the base for new business ideas and concepts. In that way, the local economy is boosted. In order to collect, redistribute, recycle, reuse and so on all those products, employment is created.

That new way of thinking already appeals to a lot of small companies in the food industry. As shown in the last chapter, several SME, non-profit organizations and even big companies have started implementing the circular economy system. Although it requires a lot of changes and reinventing, the food industry is slowly, but surely finding its way towards a more circular way of doing business.

A big advantage of those new business ideas and concepts is that the price of the goods is more fair, because the externalities of the sector are taken into account. There is no distinction between negative and positive externalities. It considers the pollution and the local work force. As mentioned earlier, the price of those goods can be higher than the goods created in a linear system. To that extent, it is very important for those new businesses to motivate people into paying a little extra for the added value. The added value can be seen as a unique selling proposition. It can differentiate the business concept from other companies practicing the linear economy and offer them serious competitive advantages.

1.3.2. Social impact

The circular economy also has an impact on the social and societal aspect of the food industry. It intoduces a platform where products and ideas can be exchanged and shared. Through several initiatives from the government, knowledge and business concepts can be experienced by others. A lot of information regarding new business concepts and ideas, initiatives, organizations and so on can be found online. Because of those sharing aspects, it can bring several entrepreneurs together. For example, Brussels Beer Project and Maison Dandoy found their way to each other and collaborated. More information about that collaboration is explained in the last chapter of the thesis.

Solidarity plays a big role. A lot of volunteers offer their free labor force to small enterprises or initiatives in order to help them around. The employees working for those companies are also very involved in the mission and vision of the company they work for. Those small enterprises can use every bit of help. The sharing does not only happen through solidarity and platforms, but it applies also to the working space.

A lot of entrepreneurs with innovative ideas start small and need to be creative in order to find working space. There are more and more co-working spaces who offer help, advice and offices. There are also public kitchens that can be reserved for several days a week.

Enterprises starting in the food industry have more than one goal. Of course, part of their motivation is growing a successful company. However, their biggest objective is to bring awareness and sensibilization about food waste and loss in the food industry.

1.3.3. Environmental impact

A big incentive for people starting a concept while implementing a circular economic system, is the environmental impact. The circular economy will reduce the greenhouse gas emissions, the soil depletion and water dissipation too in the food industry. The concept of sharing resources and reusing food waste can contribute to a decrease in pollution. The circular economy will not only help to better the air quality, but also purify the water and decrease soil degradation. It will also have an impact on the biodiversity loss, the climate change and general waste. So, it will definitely help to reduce environmental pressures linked to extraction, emissions and waste. It will also make sure that the process for the food being wasted, from farm till fork, was not useless. The energy, labor force, soil and water used for creating one food product, will be revalorized and put back into the cycle. Thus having an impact on the amount of food waste and losses throughout the whole food supply chain.

Another environmental impact of the circular economy on the food industry is global health. A study put together by the World Health Organization (2018) lists several health and welfare implications due to the implementation of the circular economy. Recycling can affect the health of citizens directly by redistributing edible food waste. It will reduce mal nutrition, poor diets and obesity. Thanks to the circular economy, a shift will happen towards a healthier food production.

Furthermore, people tend to have less cardiovascular and respiratory problems, because of the reduced emissions in the soil and in the water. In addition, by recycling, less waste needs to go through waste management. Therefore, incineration, landfill and more emissions are reduced. That leads to decreasing cases of cancer, negative birth outcomes and respiratory risks. On top of that, the resource-efficient agricultural processes ensure that less fertilizers and pesticides are used, which also affects the health of their consumers positively. The sharing economy mentioned previously, also affects the health indirectly via reduced manufacturing emissions. (World Health Organization, 2018).

However, if food waste is not recycled properly, it can have negative effects on people's health. First of all, composting can cause asthma or extrinsic allergic alveolitis, which is a lung disorder caused by organic dust. Composting is not the best solution for food waste as seen in the food waste hierarchy. Secondly, food poisoning can happen if the food safety is compromised. Some food can still be consumed after its expiration date, but one should always be cautious.

And lastly, if the recycling process is not done right, people, the soil, the water and food can get exposed to several toxic chemicals. Those negative impacts are unintentional consequences. That is why they have to be managed during the transition from linear to circular. (World Health Organization, 2018).

1.4. Case Studies

1.4.1. Cities and Circular Economy for Food - Brussels, Belgium

For present part, the case study about Brussels from the Ellen MacArthur Foundation (2019) was used. The case study is called "The Cities and Circular Economy for Food report" and it was published in 2019. It explores the role that cities together with their businesses and governments can have in creating a circular economy for food. It advocates the circular economy only as one of the many approaches that can develop a healthier and regenerative food system. (Ellen MacArthur Foundation, 2019).

Implementing a circular economy in the food industry here would see peri-urban farmland supply regeneratively produced food, the prevention of food waste and the valorization of organic waste. Thanks to the transition, it would benefit from millions of economic savings, improve health, farmlands, and the environment with less greenhouse gas emissions and a lot of fresh water saved. The redesign could be possible with an investment of more than 130 million USD. (Ellen MacArthur Foundation, 2019).

The Ellen MacArthur Foundation has listed five advantages for Brussels. First of all, the city is the political capital of Europe. Brussels is the home of many multicultural and European institutions. Secondly, it has a growing adoption for healthier food and better production practices. Furthermore, the city is surrounded by agricultural land with high productivity potential for growing. And last but not least, it has a highly developed logistics and transportation infrastructure.

Therefore, Brussels is a perfect candidate to test the new circular approach for food policies and practices. The advantages will be developed in detail below. (Ellen MacArthur Foundation, 2019).

1. Brussels' unique assets

Brussels is a high-income and well-connected city at the heart of Europe. The small and stable city is a city of diplomacy and lobbying, and the home of many European institutions. It is an economically attractive region and one of the richest in Europe. The food production industry is relatively small, representing less than 1% of annual revenue. It accounts for around 300 businesses and 4,000 jobs, including bread/patisserie/biscuits (69%), chocolate and confection (12%), and meat processing (8%).

2. Urban and peri-urban food production

Almost half of Brussels' peri-urban land is dedicated to agriculture. The main products are crops, dairy and animal products. In the peri-urban area, a lot of fertilizers are used. However, organic farming is slowly developing in Brussels.

Furthermore, food policies are getting stricter in terms of innovation and shortening the supply chain and new initiatives are setting in such as the ones mentioned in the chapter above.

3. Urban food consumption

A trend towards higher fruit and vegetable consumption is growing. In fact, in Belgium, people spend less of their consumption budget on meat than on fruits and vegetables. Belgians are actually one of the biggest fruit and vegetable consumers in Europe. Research shows that the flow of production from Belgium into Brussels is relatively small. It makes Brussels well-positioned to achieve the ambitions of a circular economy for food.

With the GoodFood Strategy already in place and an increasing demand and a growing awareness for food products that are local, healthy and respectful, the city is in a good position to pull the lever "source food grown regeneratively and more locally".

4. Organic waste and food by-products

Today, most of the organic waste created in Brussels ends up being incinerated (97%). It was only in 2015 that organic waste was collected. Now, the other 3% that is being collected is composted in gardens and community composts every year. There is thus an opportunity to start minimizing that waste and developing a circular approach in the industry. A study of the Université Libre de Bruxelles (ULB) presented potential scenarios for an organic waste infrastructure. Together with those proposals, such as organic waste collection and centralized treatment, food waste initiatives are growing and targets set by the GoodFood Strategy are expected to amplify that trend. The last chapter of the case study focusing on Brussels consists of several scenarios or proposals if the circular economy was introduced:

Proposal 1: What if 30% of the food available to the citizens of Brussels was produced in the peri-urban area using regenerative practices?

The area could, according to a study from Wageningen University, provide the food needs of 90% of Brussels citizens. It could be interesting because the demand for organically grown and local produce is increasing. Thus resulting in healthier citizens. 31 million USD could be saved each year in health costs due to cleaner water and lower pesticide exposure. Another benefit is that the soil health could be enhanced by introducing organic alternatives to fertilizers, leading to a decrease in soil degradation.

Figure 9: Regenerative food production supports natural systems

Besides, 42 000 tonnes of greenhouse gas emissions could be avoided each year, having a huge impact on the current problems regarding climate change. The last benefit is that half of the city's residential consumption of drinking water could be saved every year.

Proposal 2: What if Brussels reduced its avoidable food waste by half?

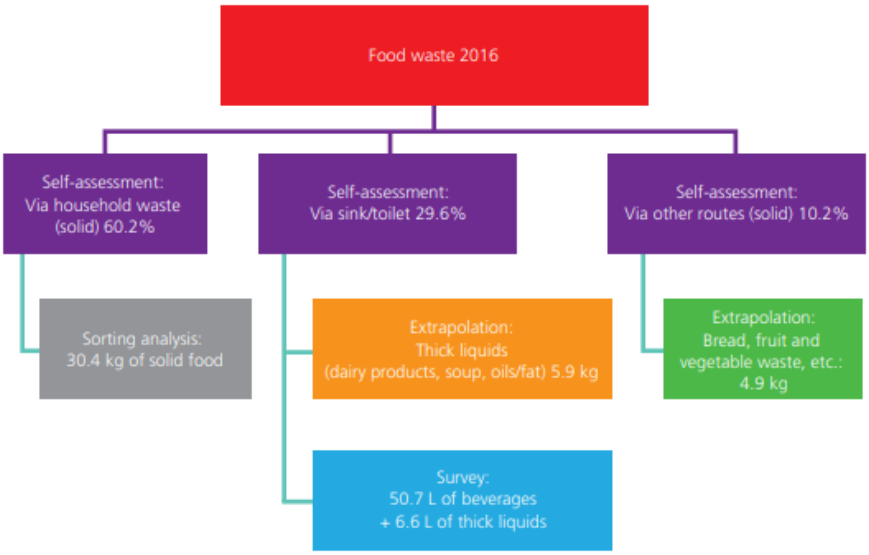
If half of the food waste was prevented, namely 12,500 tonnes, USD 91 million could be saved each year based on the local market value of food. The second proposal is an excellent example of the impact of circular economy on the Food Industry in Brussels. First of all, it will have a big economic impact. Namely, 91 million USD worth of food spend could be avoided based on the market value of food. Secondly, 2,8 million USD worth of health savings will come out of the scenario, which means healthier citizens. The next benefit has an impact on the environmental aspect. 18,750 tonnes of CO2 emissions could be prevented. That amount is equivalent to the carbon confined by 23 million trees per year. It will also save 2.4 million m^3 of freshwater.

Proposal 3: What if Brussels collected and processed half of all remaining organic waste into high-quality compost?

The last scenario proposes to divert an additional 72,000 tonnes of food waste, food by-products, and garden clippings from incineration and landfill to valorize them into compost and biogas. It will save 4.4 million USD worth of avoided synthetic fertilizers. It will also contribute to healthier soils by recapturing nitrogen, phosphorous and carbon which could be fed to the soil to rebuild its health and fertility.

1.4.2. Samen Tegen Voedselverspilling – The Netherlands

In the Netherlands, the government and the food industry have been working together since 2009. It resulted in lots of individual actions such as campaigns and research, but nothing really changed the situation. In fact in 2010, the average food waste in solid food was around 48 kilograms. In 2016, the average declined to 41 kilograms of food waste per capita per year. That is when the Ministry of Infrastructure and Environment decided to conduct a study on solid food waste in households. The result of the study is shown in the figure below (van Dooren, 2017):



Source 8: van Dooren. (2017). Supplementary memorandum on Food waste in Dutch households in 2016.

Figure 10: Result of consumer survey: "Food waste in the Netherlands based on self-assessment"

Their objective was to reduce 20% of the food waste by 2015. Now, with the SDG's plan to decrease half the food waste per capita by 2030 at the retail and consumer level, the Netherlands have joined the bandwagon. That is why they relaunched another customer survey in 2016. (van Dooren, 2017).

Samen tegen Voedselverspilling, a foundation launched in 2017, regroups several organizations, the government and experienced institutions. They want to prevent, reduce and revalorize food waste across the entire food chain. Thanks to the collaboration and foundation, the Netherlands are the first country wanting to trim by half the food waste amount by 2030 using the "Target-Measure-Act" model and the Food Waste Hierarchy (Stroosnijder et al., 2019). Their mascot is called Becky and she gives several tips to reduce food waste at home, such as:

1. Check and plan: check the fridge and pantry and plan groceries by making a grocery list.
2. Think in leftovers: sometimes only a piece or part of a vegetable, meat package or something else is needed. Think in advance what can be made with the other pieces or parts of the food product.
3. Buy fresh vegetables and fruit instead of a lot at once.
4. Opt for frozen food.
5. Don't be afraid of weird-looking fruits and vegetables. They taste just as good.
6. Save the leftovers. One can eat the leftovers as they are or make another meal with them such as soup, omelets, salads or wok them.
7. When the food product almost reaches its expiration date, cook or freeze it. It will extend the expiration date by two days.
8. Choose one day a week where one make a meal out of everything one has at home.

They also provide educational material and initiatives where companies can become stakeholders. (Stichting Samen Tegen Voedselverspilling, 2020). Thanks to the foundation, fighting food waste was put in the spotlight. Several other initiatives in different cities were launched. An example of such initiative was mentioned in Steden tegen Voedselverspilling (2020). It consists of a partnership of several commercial and non-commercial organizations that work with leftovers. They have two priorities: sustainability and poverty reduction. Therefore, they deliver leftover food to people in need in Almere, the Netherlands. So, two times a week food waste from three to four supermarkets is collected. In 2018, they started cooking workshops with a view to teach people how to deal with food wastage, additionally showing people how to cook healthy with a restricted budget. (FoodWIN, 2020).

Chapter 2. Research question(s) and hypotheses

2.1. Research questions

As the introduction and the theoretical context already suggest, implementing a circular economical system can have several benefits. However, some difficulties have to be met regarding the implementation. In order to find adequate answers to the research question for the master thesis, different sub questions need to be answered through interviews.

The first question tackles the subject of how and why people are interested in launching a business based on circular economy. The next question focusses on the difficulties that the SME, nonprofit organizations or enterprises encountered following the setup of their business or initiative. The majority of the interviewees started laughing when the question was asked. A lot of difficulties surfaced, but fortunately, there were some people and organizations ready to help them. Those organizations will be discussed in the next section.The third question is about the price of the raw materials. Furthermore, the financial aspect of the setup will be discussed. The sub question zooms in on the investment the business owners had to make and where they could find financial support. Finally, the most important question is the one about the expected impact of their business. The impact can be economical, social, environmental or all of them combined. At the end, all those sub questions will together offer an adequate answer to the research question: “What is the impact of Circular Economy in the Food Industry in Belgium?”.

In addition a customer survey was included in order to see what the behavior of customers is regarding to food waste. That survey will give an answer on how customers think about the way food waste is created at home and how it can be prevented, avoided or reduced.

2.2. Hypotheses: what is the impact?

Several hypotheses were made up for the master thesis. There are six different ways the circular economy can have an impact on the food industry in Brussels:

- Circular economy has an economic impact in the food industry in Brussels, such as cost reduction.
- Circular economy will create new jobs in the food industry in Brussels.
- Circular economy has a social impact on the food industry in Brussels.
- Circular economy has a societal and behavioral impact on the consumers in the food industry in Brussels.
- Circular economy has an environmental impact on the food industry in Brussels.
- Circular economy has an environmental impact on the global health of citizens through the food industry in Brussels.

Chapter 3. Methodology and findings

3.1 Case studies: different organizations and their stories

3.1.1. Methodology

As mentioned in the introduction, interviews were gathered with seven Belgian SME or nonprofit organizations and one big supermarket channel in order to have a clear view on how the implementation of the circular economy in the food industry in Brussels works. The interview happened in person face to face, by phone or via mail. The questions asked were the following:

1. How did you come up with the business concept/idea?
2. How many employees are working in the company? (fulltime, part-time, volunteers)
3. What is the overall investment you had to make in order to start business?
4. Do you have a business plan? How did you come up with it? Is it the same for every city?
5. How big is your partnership network? Who are your main partners?
6. Did you face any difficulties during the setup of your business?
7. Where can you find help/solutions if necessary?
8. How do you decide on the price for the “raw” material?
9. What are people’s reactions and feedback? How do you collect the feedback?
10. What impact (economic, social or environmental) do you want to have on our society with your business?

Sometimes the questions were asked in French, because the interviewee preferred it that way. Sometimes the questions quoted above were asked in a different order. Sometimes a question was already answered by the interviewee before it was even asked. Below you can find a list of the enterprises used for the business cases:

- MadLab
- Fruitopia
- Maison Dandoy
- Too Good To Go
- FruitCollect
- Färm
- Carrefour

The interviews have been transcribed and can be found in the appendix at the end of the thesis. The answers were grouped into categories as explained in the second chapter, namely the different sub questions.

3.1.2. Who are the interviewees?

Seven organizations have been interviewed. They are all situated in or are active in Brussels. The goal was to have different kinds of business concepts, in order to see how the impact, the business plan and the difficulties were per type of business.

The first business that played a part in the interviews for the master thesis is MadLab. They produce organic and artisanal cookies and crackers. Their products are being sold in specialized shops and organic ones. They have been active in Brussels for over two years. (MAD LAB, 2020). The contact was made with Cyril Beneche, founder of the organization, at a workshop called Rabat Day in Tour & Taxis in Brussels. MadLab fits the type of organization needed for the master thesis because the dough of the cookies and crackers is made of spent grain from the Brussels Brewery, la Brasserie du Renard (MAD LAB, 2020).

The second person interviewed was Alexandre Helson from Maison Dandoy. Maison Dandoy is a well-known cookie brand in Belgium. It is a family business founded in 1829 in Brussels (Maison Dandoy, 2020). At the end of 2019 they announced a collaboration with Brussels Beer Project. That is what made them interesting for the dissertation. The collaboration consists of on the one hand Maison Dandoy, using the beer residue from the brewery and on the other hand Brussels Beer Project, using the broken cookies and the ones who are not qualified for sale for their beer in return (Maison Dandoy, 2019). That is the perfect example of a fully circular approach.

Then we have Fruitopia. The company was founded in 2017, as a result from students saving unsold fruits and vegetables from the “marché du Midi” in Brussels. Now, the company has two objectives. The first one, the most important one, is to sensitize the customers. They offer workshops to give people alternatives in order to reduce food waste at home. Their second objective is to collect unsold fruits and vegetables, transform them into jams, chutneys and so on in order to resell them in specified stores. (Fruitopia, n.d.).

Too Good To Go was also very kind to participate. The company is well known in a lot of cities in different countries. They are a huge competitor to Deliveroo and Uber Eats. However, there is one difference. You have to go to the supermarket, hotel, restaurant or café with your own recipient. Reducing food waste is the key driver for their business. The concept of Too Good To Go Belgium started in Ghent in 2018. Since then, their community grew up to more than 3300 partners and 1 million “Food Waste Warriors”. Together they have saved up to more than 2 million meals. (Too Good To Go, 2020).

The next partner is FruitCollect. The name says it all. They collect fruits. The difference here with Fruitopia is that the fruits are being collected from private gardens. They are not the unsold products of a supermarket, but fresh fruit from people who don't eat all the fruit produced by their own trees, which is the redistributed to other associations such as Horizons Neuf, Amarrage and more. They started in 2015 and have since saved up to 65 tonnes of fruit. (FruitCollect, 2020).

Färm was also interviewed. Färm wants to be an alternative supermarket. It is a network of cooperative bio shops where you can shop locally, organically and ethically. They mostly sell seasonal fruits and vegetables and bet on bulk products. They now have 11 Färm shops and one Brüt By Färm shop. (Färm, 2010). They were asked what is being done with the unsold products in their shops in order to fit into the essay.

Finally, Carrefour was contacted to compare their view on fighting food waste. They have set up an initiative called "Act For Food". The initiative is committed to several actions, such as fighting food waste, using less plastic and packaging and so on.

As you can see, those companies are all different. They have the same goal, but act differently. For the younger concepts amongst them, young people were confronted by an issue and wanted to offer a solution against food waste. Therefore, they decided to pick up "raw" materials and produce something new with it. The company Too Good To Go is also quite young. They differ from the other companies, because they focus on delivering unsold meals. Those products are already processed. Their business concept is to offer a platform in order to resell leftovers of a specific day. Furthermore, we have a well-established brand, Maison Dandoy, who had the opportunity to start a collaboration thanks to the circular economy system. Only few of them also try to tackle the mindset of the customers by providing workshops and tips and tricks. It was also very important for the thesis to see how a supermarket tries to help in the fight against food waste. That is why Carrefour and Färm were contacted.

In the table below, a quick overview in order to compare the different organizations.

Name of company	Business concept	Year of establish-ment	Number of employees	Environ-mental impact	Social impact	Economic impact
MAD LAB	Turning spent grain into sweet cookies and salty crackers	2018	2 associates and 2 employees		X	
Maison Dandoy	Collaboration with Brussels Beer Project: turning speculoos into beer and turning beer draft into speculoos	1829	+- 100 employees	X	X	X
Fruitopia	Collecting unsold fruits and vegetables and turning them into chutneys, jams, etc. + sensibilization through workshops	2017	3 associates, 3 part-time employees and 1 intern	X	X	
Too Good To Go	Offering a platform where restaurants, cafés, hotels and supermarkets can resell their unsold items through surprise boxes + sensibilization	2018	34 people in the office	X	X	
FruitCollect	Collecting fruit from private gardens and redistributing them to youth houses/shelters + sensibilization	2014	300 voluntary workers		X	
Färm	Network of cooperative bio shops + sensibilization	2013	+- 120 employees	X	X	
Carrefour	Big supermarket chain with a new initiative called “Act For Food”	1963	+- 10 000 employees	X	X	

3.1.3. How did they come up with their business idea?

Together with the Brussels government, a lot of initiatives and organizations have been launched in order to facilitate the transitioning from the linear system to circularity. It also provides companies with economic opportunities and non-financial benefits. Isabella Grippo, CEO of hub.brussels, states: “It’s up to the Brussels Region to make its assistance offering, which is already very complete, as clear as possible and to show entrepreneurs via role models that the Circular Economy can have a positive impact on their company, its employees and the environment.” (hub.brussels, 2019).

As seen in the summarized table above, some of the interviewed companies exist much longer than others. Companies being active since longer had to reinvent themselves or come up with another business idea in order to keep up with the circular economy system, such as Maison Dandoy and Carrefour. Alexandre Helson from Maison Dandoy said that they were already working together with an organization in order to get rid of their cookies surplus and waste. Although that organization got already quite a lot of waste, Maison Dandoy wanted to do more. They partnered up with another company. They already knew each other before they started to collaborate. Brussels Beer Project had its brewery next to the manufacture of Maison Dandoy’s cookies. That collaboration is a beautiful example of a full circle system. The broken speculoos cookies are transformed into beer and the draft from the beer is transformed into another type of speculoos cookies.

For Carrefour it is another story. As a big supermarket they have to keep up with the challenges nowadays. That’s why they started “Act for Food”. It is a worldwide action program to motivate people to eat better. They want to become the leader in offering good and affordable food for everyone. The idea of launching the program came from higher up, but every country has the right to choose which actions they want to introduce. Vera Vermeeren elaborated that those actions embrace the problems and challenges of each country specifically. So, those companies felt the need to change something about their daily operations in order to give something back to the environment they’re active in.

The more recent business concepts do have different motivations for starting a circular concept. Let’s start with the story of MadLab. They began their journey by producing savory crackers from spent grain that was given to Cyril Benche, the founder of MadLab, by a small brewery in Brussels called Beerstorming . They asked him if he could do something with it. Although, he was already producing sweet biscuits, he had no clue where to begin. That is why he went to Moeder Lambik, because they served savory chips as appetizers to their customers. He liked the taste of malt and wanted to create something similar. Now, a couple of years later, the spent grain comes from the Brasserie du Renard in Wavre and MadLab produces several kinds of sweet and savory crackers. The day I met with Cyril, he was meeting with a potential new partner later in the evening.

For Fruitopia, the beginning of their business concept takes us to the morning market, at Bruxelles Midi. The founder, Simon, was shocked that a very large amount of fruits and vegetables was thrown away after opening hours. Therefore, he decided to do something about it. From time to time, he took some of the fruits and vegetables and started cooking them in a cooperative kitchen/supermarket called Bees Coop. After a while, he decided to launch his own business with the help of CoopCity, which is an incubator near Bruxelles Midi. The incubator is a form of social entrepreneurship that wants to have an impact on the behavior of consumers. That is why Fruitopia focusses above all on sensibilization. The money-making part of the business comes after that.

Sam Ampoorter tells the story of Too Good To Go, which began during a world trip in India. There, Jonas, the Belgian founder, met with the original founder of the app, which was launched in Denmark in 2016. Jonas came back to Belgium in March 2018 and launched the Belgian version of the platform. The mission of the company is all about fighting food waste on an international level. That is why the app has been launched in many other cities and countries in Europe. Together with the mission of fighting food waste there also comes a social business aspect. Therefore, Too Good To Go provides educational information in order to sensitize customers. Of course, the service they're most known for is their restaurant service. Restaurants, cafés, supermarkets and hotels can become partners and offer meals or food products in surprise packages at the end of their opening hours. Customers can retain a package by connecting through the app. They pay via the app and receive a pick up time. The different factor is that customers have to bring their own recipients in order to collect their surprise box.

FruitCollect was established in 2014 by Maxime Niego. His parents had a garden with a lot of fruit trees in it. Every year, a lot of the fruit that grew in their garden rotted. Until, one day, he decided to collect the fruit and bring it to the youth shelter in front of their house. The kids and youngsters who came there had no access to healthy food. So, he brought the healthy fruit to the shelter. Today, the company collects fruit in more than 300 gardens and they also work together with organic supermarkets in Brussels and farmers. They have expanded their business a lot actually. In the beginning they collected around one ton of fruit. Whilst last year, they accumulated 30 tons and this year they are aming for 50 tons.

The organic supermarket Färm originated from several people. It started with two people who had a shop in Etterbeek, Brussels. They met with other people who wanted to create a business concept around food and had the money and means to start. Together, they decided to launch Färm. The first organic shop opened its doors in Brussels, at St-Catherine. The idea was to realize a one-shop shopping experience. A place where one can buy every sustainable product one needs, in a responsible way. Now, they have opened 11 more shops, scattered around Belgium.

3.1.4. How is the price calculated for the “raw” material?

Let’s be reminded that the “raw” material here is recycled from somewhere else. That is why the word raw is between quotation marks. Most of the companies active in the sector don’t have to pay for the products they recycle. They have an understanding relationship with their partners. Sometimes the partners just ask for a little badge of the tasty products in return. Consider it as a mutual benefit.

“We do have like a pretty good relationship. We don’t pay for it. It’s in exchange for some biscuits.” – Cyril Beneche, MadLab

Same goes for FruitCollect. They work together with individuals.

“No, It’s for free ! Yes. Let’s say, the majority of the people decide to work with us for ecological reasons rather than financial reasons.” – Maxime Niego, FruitCollect

Only one of the companies interviewed for those case studies said they had to pay for the raw material.

“We buy our draft from Brussels Beer Project and it’s relatively expensive. We pay 7€ per kilo. We have to pay for it, because it costs them a lot to produce.” – Alexandre Helson, Maison Dandoy

3.1.5. What difficulties did they face?

There are a lot of challenges entrepreneurs encounter during the process of building a business from scratch. Five out of the seven companies interviewed faced difficulties. First of all, a vision has to be developed of the company. Hereby taking into account envisioning the business idea. Where others see problems, you must see opportunities. In that case, the problem is the big amount of food waste produced every year in Brussels. Your business idea becomes a solution. The next challenge is to transform the solution and opportunity into a value, one’s unique selling proposition. The next step is to find financial support. Your idea has to be sold to potential investors. For some of the companies that were interviewed finding funds and financial aid was very difficult.

Another challenge to face, is finding a location to start the business. For small beginning enterprises and sole proprietorships it is very hard to find a suitable location with their hard savings. Luckily, nowadays, several solutions can be found for the problem such as incubators and shared kitchens.

In the circular economy system, the food waste collected as raw material is transformed in order to make new food products. To be able to collect those raw materials, companies such as Fruitopia need transportation and logistics. Unfortunately, relying on a small budget and a sustainable vision finding the right transportation method can be a big challenge.

Sometimes implementing innovative ideas can cost more than what it actually gives back to the company. As such, it is not very wise to keep the project going. Sometimes difficult decisions have to be made about which projects one wants to keep supporting if they prove to be not profitable enough. Opposed to that, two persons being interviewed didn't face any challenges while starting their new business concept. For Maison Dandoy, the collaboration went very smoothly. No difficulties were faced during the transition from the linear to the circular system.

"No, everything went well." – Alexandre Helson, Maison Dandoy

The app of Too Good To Go uses no difficulties and setting it up in Belgium went smoothly.

"Actually no. Actually it's a super easy app to use. Also for our partners. They have like this extension on their laptop, where they can add or delete surprise packages. And it's super easy to use. Also, we check in regularly with our partners to see how they're doing. If they're experiencing any difficulties with consumers, with the app, with how many packages they should put online and everything. So actually there is a lot of feedback and communication." – Sam Ampoorter, Too Good To Go

1. Financial support

Once one has established its vision and mission, one has to surround itself with people one can trust. Together with a team one will establish a business plan. In order to elaborate the business plan, one needs to raise capital. That points to the first challenge some of the interviewed companies faced. In fact, for some companies it is very hard to find substantial financial funds and investments. That was the case for Maxime Niego from FruitCollect. Mostly, because the amount of businesses implementing the circular economy has been rising in Brussels.

"In fact, it is really about the financials that it gets complicated. Four years ago, the circular economy was an unfamiliar concept, you know? Today, well, last week I went to a convention about circular economy and there were 500 people. Four years ago, there were 50 people. You see? So it brings a lot of files and call for tenders. So, I would say that receiving funds and financial aid is getting more complicated." – Maxime Niego, FruitCollect

So, their approach was not ordinary. The company started by testing its hypotheses by putting them into practice and demanding funds little by little instead of going for the big guns.

"First of all, we started testing hypotheses. We validated them while doing. And once we had validated them, we started asking for funds. Whereas, logically, it's the opposite. We take the hypotheses, we try to validate them theoretically with the help of market research and so on. And once we decide to validate them, we ask for funding in order to have the means to invest. We test directly on the field. But this takes way more energy, investment and human sacrifice. That's why we started with asking for smaller amounts, while we could have done the opposite and immediately go for the big guns…" – Maxime Niego, FruitCollect

2. Location

Coming up with a good business location at a good price is not easy. Especially for beginning companies. Luckily, there are several incubators that offer their space, advice and experience. For companies who need a kitchen to cook or transform food products, there are shared kitchens too. According to Cyril Beneche, while starting your own company, you encounter a lot of difficulties. Finding an suitable location is one of them.

"I started out at my own place, which was completely not legal. Then I rented… I don't know if you know Co-oking? It's a shared kitchen. I really started out over there. I was going there by bike and spend my nights working there. So yeah, it was difficult because I was not selling enough to really be profitable. And the price of the kitchen was quite expensive. I needed one because I had started something and I had some demands. Then I had the chance to go to Namur, to another workshop kitchen. I shared with only one other guy who needed it for one or two days a week. I had he time to grow over there. That really helped me." – Cyril Beneche, MadLab

3. Transportation/logistics

For companies that turn food wastage from supermarkets or other actors of the food supply chain into new food products, transportation and logistics can be a big challenge. Because of the small budgets they have, they need to be creative in finding transportation. For example, Fruitopia had and still has a lot of difficulties to overcome. Among other things, their biggest challenge is their logistics. Currently, their only means of transportation is a shared cargo-bike. Thus collecting unsold food products such as fruits from a supermarket is complicated. The personnel of the shop has to be trained too to sort the fruits that could be reused.

"It's really complicated. Certainly, the logistics of collecting the unsold fruits is a hassle. It's a hassle, because in the shop, the people have to be really sensitized, I'd like to say, and they have to want to cooperate. This means they have to sort the unsold products really well and so on. And that is already very complicated. Then the collection of the unsold fruits. What would be nice is that there is reversed logistics. Thus, delivering the finished products and collecting the unsold food at the same time. But, therefore, we need to be able to deliver two times a week in each store. Also, there is the logistical problem where we have to collect the shared cargo-bike at one place, the stores are somewhere else and the kitchen is at another place…" – Antoine, Fruitopia

On another note, the government is aware of the general problem with the actual transportation issues in Belgium. The way it works nowadays is not yet according to circular system. Cyril Beneche explains that there still is a lot that can be done.

"The Regional Minister for Environment is talking about logistics in Brussels, transportation and stuff like that. And… That is interesting and they have ideas. But they know to change any legislation, it's going to take 3 years. So there is a lot that they can do." – Cyril Beneche, MadLab

4. Profitability

Sometimes developing and implementing innovative ideas in a company can be very expensive. One has to find the right balance between innovating for the sake of the planet or doing what can be done with the means one has. If one really wants to implement a great innovative and new idea, but it costs more than it gives back, than it's not a good idea to implement it. That was the case for Färm. They experimented with some ideas to fight their food waste in store, but some of them were not profitable enough.

"The problem is that working with unsold food products, it usually requires manpower and a lot of work. And in Belgium, it's expensive. So, it's difficult to be profitable. In any case, it's a waste of money. We don't always look for profitability, but it doesn't have to cost us more than it yields… For a while, well in the beginning in fact, we had a kitchen in the shop and so there a lot of the spoiled and uglier vegetables were prepared. Once they're cooked you don't see it anymore. We also tried another project with a sheltered workshop where they collected the unsold vegetables in order to make soup. Afterwards, this soup was sold in our catering section. But, unfortunately, it wasn't profitable enough. It was too expensive to organize the collection and the transportation. We had to abandon these ideas." – Isadoora Meersseman, Färm

3.1.6. Where to go for help or solutions?

As circularity grows in Brussels and with the help of the RCEP a lot of organizations were set up to offer help, guidance, advice and solutions such as Be Circular and hub.Brussels. There are also several social incubators and entrepreneurships scattered around Brussels. Over there, people share their expertise and knowledge. One can also have a specific coach appointed to for guidance and advice. In some of those organizations one can even rent its own space for headquarters or offices. Another option is a call center, namely 1819. They answer all type of questions. Lastly, one can also contact its competitors. In that case they become frenemies.

1. Be Circular

As circularity grows in Brussels and with the help of the RCEP a lot of organizations were set up to offer help, guidance, advice and solutions. First of all, Be Circular, in collaboration with hub.Brussels and Bruxelles.environnement, is the biggest reference when it comes to businesses and circular economy. They offer support such as information, inspiration, coaching, financial support and they help find the perfect location (Bruxelles.environment, n.d.). Another member of the RCEP is Circlemade.brussels. It was launched in 2018 as the Brussels circular economy innovation network. The organization consists of innovative companies, public and private institutions. They use their expertise to inform, monitor, support and drive innovation. By joining their community, one can reinforce its image and brand and develop new skills. It is also a place where one can extend its network and partnership opportunities, which is very important. They can help penetrate new markets and speed up development. (hub.Brussels, n.d.).

One of the companies interviewed mentioned the coaching of Be Circular as their go to for help and advice, namely Fruitopia. For the profitability-side of their company, they rely on their expertise.

"Their coaching is based on profitability. They are part of the PREC and their mission is to create more employment in circular economy. It is interesting for us, because we have to integrate profitability in our business. So yeah, the coaching is interesting. It's from someone who has already launched several business and he helps us regarding entering the market. Because, we are not really at ease with the commercial side since this is not our vision nor mission. But we need it to survive." – Antoine, Fruitopia

2. Social entrepreneurship

Another option is an incubator or social entrepreneurship. It is actually one of the biggest challenges while transitioning towards a more sustainable economic model in Brussels. Its goal is to bring economic activities and social justice together. It consists of three pillars. The first one states that the ultimate goal is social and/or ecologic with limited profit. Secondly, the project must be feasible economically. It needs to have an economic activity and create jobs. Lastly, the company has a lot of autonomy and all stakeholders have a say. (hub.Brussels, n.d.). That is the case for Fruitopia. They decided to have their headquarters in a social entrepreneurship, which is called CoopCity.

"We are accompanied by a structure. A social entrepreneurship called CoopCity. That's for all things management and so on. It's a way for us to have a management, but not the classic type of management. It's a bit more horizontal. To this extent everyone has something to say. (…) So, yes, we have had management trainings at CoopCity. But also for the marketing. And also the fact that we have to achieve a level of profitability." – Antoine, Fruitopia

Cyril Beneche from MadLab opted for a social incubator as well in the early stages of his business set up. Via Village Partenaire in Saint-Gilles a coach was appointed to him. That person shares its guidance and expertise.

"An organization that is here to help new entrepreneurs by coaching them and giving them advice. So, you have to meet with them from time to time. They'll help with the business plan, the financial plan as well. I met mine in Village Partenaire in Saint-Gilles. They are specialized in the food industry and entrepreneurs. But, when I started out, I explained my business to the coach. He told me like "yeah, the business plan, don't do that right now. Start selling stuff and then you'll do the business plan". But, actually I shouldn't have listened to him, because I went in there not knowing exactly what kind of quantities I needed to live from it. There is a lot of ways to get help. But, if you can, just get an accountant. That's more interesting." – Cyril Beneche, MadLab

3. 1819

Next in line is a call center called 1819. It's a hotline you can call for any advice needed when starting a business. One can ask them about business structures, how to grow its business, subsidies, financial support, permits and regulations, insurance and taxation, marketing, sales and so much more. Their help is free of charge.

"They give you all the answers! Pretty much. You have to know they're there. But once you know, you can call them every day. And they are there, they'll answer every day for free, to help you, to help you find solutions." – Cyril Beneche, MadLab

4. Frenemies

Because a lot of business concepts are getting launched in the sector, one can also interact with some frenemies. In Dutch they have a word "concullega". It's a merge between the words "concurrent", which means competitor, and "collega", which means colleague. It's very interesting if one can find a more experienced frenemy with a degree to help them out. It is more like a big brother who gives guidance in difficult times.

"Speaking of partnerships, there are also other associations that have more experience, so you can call tell them and ask them for advice." – Antoine, Fruitopia

3.1.7. Where to go for financial support?

As previously mentioned in the section above, circularity is growing in Brussels. In order to stimulate and motivate new entrepreneurs to be part of the journey, the regional government of Brussels foresees direct financial supporting measures. Thus, they try to offer premiums, loans or a stimulating tax system. Together with Village Finance, they have launched Be Circular, which is a very important actor. The project group supports the four themes: the 3 R's, which are repair, reuse and recycle, nutrition, the construction sector and the new economic business models regarding circular economy. (be.brussels, 2018). Part of their supporting features is financial support. They offer it to companies in the early stages, start-ups and scale-ups (Bruxelles.environment, n.d.).

Since 2016, Village Finance also grants funds in the context of circular economy. Their funding matches an amount of €5000 with a view to support 20 start-ups and very small businesses. Of course, businesses regarding the four themes mentioned previously. Hub.Brussels also offers financial support.

In addition, there are several other ways to obtain funds. For example, subsidies. Crowdfunding is also very popular nowadays. For FruitCollect, crowdfunding was one of their financial aids. Lastly, Too Good To Go listed internal donations as their financial support. In fact, people who want to launch the app in their country can count on the other countries to help them financially.

1. Funds

Every year, companies that are using techniques or the whole circular system can register themselves in order to receive subsidies. In that way, a big network is created and it can be very interesting to be part of it. Madlab is a member of such a network and received subsidies this year for their project.

"We received the subsidy this year actually for our work with the spent grain. And that's a whole different network. We can meet with them. There is plenty more groups of network. (…) I know that the subsidies for Be Circular for example, come from the regional parliament. But then, there's like ideas coming from the federal government or legislations they could put in place… implement. Like, Be Circular is good." – Cyril Beneche, MadLab

Be Circular is also important for Fruitopia. Antoine said that they received a fund from them. However, their funds are quite specific. In their case they received financial aid for developing their circular conservation techniques in order to transform their food products.

However, Cyril Beneche from MadLab states that some of the requirements for receiving funds can be very complicated. At a Be Circular reunion, he started the conversation.

"We asked them a question about another subsidies, that was, in our minds, not fit to the ones they were supposed to help. Actually for circularity there is a subsidy to help a company to employ people. Like it's 15 to 20 000€. So that's quite a lot. It could really help a lot the situation of employment in a company like us. But to be able to ask for this subsidy, you have to prove that you are using 600 tonnes a year of material and that you make 5000 euro of profit on each ton. So, that will mean 3 million euro benefits in the industry. Which doesn't need a subsidy to hire people! So, that's very strange. So we asked them the question and they agreed with us that it was completely strange. They will try to change it. But, that will take at least two years. So… It might be too late for us." – Cyril Beneche, MadLab

Of course, there are also other organizations that can support a company. Through subsidies for example. Those subsidies can be for specific uses. FruitCollect received several kinds of grants in order to launch their business concept and hire new people.

"We received subsidies. In 2018-2019, we received one of €33 000 for the period between August 2018 and August 2019. These subsidies were for investments and Human Resources Management (HRM). I think €10 000 was for HRM, thus for paying the staff. (…) Also in 2018, we received three associative subsidies. It was a total amount of €22 500 plus €3500 and €3000. So more or less €30 000." – Maxime Niego, FruitCollect

2. Crowdfunding

There are different types of crowdfunding. For example, a business angel can lend money to a company, because the business concepts appeals to him. Sometimes, the investor donates the money in return for something else regarding the business. The difference with a real loan is that those investors are mostly individuals like you and me. The money one lends or gives to the company can be of any amount.

"And then, we did a crowdfunding. Where we collected €11 000." – Maxime Niego, FruitCollect

3. Internally

In the case of Too Good To Go, the social aspect reaches further than just with their partners. Each country that has already set up the app and has some experience, can help another country when it decides to join.

"We always help other countries to get started by investment of another Too Good To Go country. So every time the country is born out of another country."– Sam Ampoorter, Too Good To Go

3.1.8. What is the expected impact of their business?

As mentioned several times, business concepts embracing the circular approach can have three types of impact on the food industry in Brussels. The last question of the interview involved the expected impact of the companies on their sector. Following, the next part gives an immediate answer on the research question of the master thesis.

The overall economic impact of every company interviewed is the opportunity to create a new business concept or collaboration. Thus providing a boost in the local economy of Brussels. Furthermore, most of them do not have to pay for the "raw" materials they use, so the purchasing cost decreases. Only Maison Dandoy specifically stated that their collaboration with Brussels Beer Project will have an economic impact on their company and our society.

"All three are our expected impacts. Those are our challenges for tomorrow. Producing in a sustainable way, without suffocating our planet." – Alexandre Helson, Maison Dandoy

Some of the companies' missions is that they want to set an example. They started their business by facing a big issue in the environment of Brussels and wanting to offer a solution. They want to show people how food waste can be fought.

"An example. An example of what could be done. It's not by doing crackers that we are going to solve the problem of spent grain in urban breweries. There is a lot of other things to do with it, it's just that showing to people that there is a lot to be done. That's only one of the small things that we can do." – Cyril Beneche, MadLab

Cyril Beneche from MadLab also adds some suggestions about what could be done with all the big and small breweries in Brussels in order to reuse way more spent grain.

"There is ideas in construction, to use spent grain as isolant, maybe. It might not be easy, but it could be very interesting. It's like four to five breweries here in a radiant of 500 meters and all of them have to call Bruxelles Environment to get rid of the spent grain, to burn very wet resources. So that's a lot of transport, a lot of energy used for it. That's way too bad. That's too bad. And none of them are organic, so that's why I can't use it right now. La Source, just in front, is going to introduce a fund to get part of its production organic, so that I can reduce that. That would be great." – Cyril Beneche, MadLab

For Fruitopia, the impact is both social and environmental.

"It's social and environmental. I don't know which one comes first. It depends. Because we mostly wish to have a final impact in the mindset of people. So, a quantified impact will be complicated to have. We want to be a key actor for sustainable food products and the fight against food waste. Therefore, people need to know about us and our practices. So that they can try and do the same as we do. Ultimately, quantified impacts will be visible. But, these are very hard to measure. Expect from our quantified impact such as our amount of fruits collected from the organic supermarket, but that is peanuts. It's a couple of tonnes per year compared to what is consumed in Brussels. It's minimal.

That's why I think that the goal is to change the mindset of people. So, the quantity is not much currently. But, we want our products, the jams, that we produce to be symbolic. In order to show that currently there is a lot that is thrown away and that we can make very tasty things with it. On one hand, the production of fruits needs to stop, because there is already a big amount. Or, we need to stop making jams with fresh fruits, to the extent that we can create a logistics cycle much more interesting. We could in general produce less and have the same quantity at the end of fresh products and afterwards chutneys, jams, cookies, whatever you want, even ketchup, and so on. So, that can be seen as a symbol. Furthermore, ultimately, the other side of our business is the sensibilization and thus sensitize the households and people at home. It is much harder to sensitize the farmer or producer." – Antoine, Fruitopia

Cyril Beneche from Madlab states the same thing. Both companies are reducing the food waste, but it's minimal compared to the amount produced and consumed yearly in Brussels.

"We're going to reuse probably 1,7 tonnes of spent grain this year. That's a lot. But, that's nothing compared to what is produced. We could do a lot more about that." – Cyril Beneche, MadLab

For Too Good To Go, the impact is also both environmental and social. They have a huge environmental impact by saving unsold meals and therefore reducing the CO2. It also affects the whole production process. In addition, they also provide educational material and they want to focus also on households.

"Well, we have a huge impact on the planet actually. If you see that every saved meal is equal to 2 and a half kg of CO2 that are produced for nothing. Those numbers you can find on the website, where they come from and everything. If you see that that is the impact of CO2. But also on a social level: a lot of people who are getting aware of the problem of food waste and how everything is actually combined together. It's not only food that we save, but also it's like the whole production process that wasn't been done for nothing. So, for example, save a banana. Just giving an example… You also save all the water, all the soil, all the production process in the whole process. It's much more than food. We're also working hard on four pillars to get our movement going. So we're focusing on household and education. We have a lot of material on the website. You can just go and check it. On a political level and on an industrial level. So, we just want everyone to be aware of food waste and what kind of an effect it has. So, We give of keynotes. Not only to students like I'm doing right now, but also keynotes to university, to high schools, and so on. We're even planning on working together with summer camps. It's in the pipeline. But you can just go and check the educational material on the website. It's under movement. Just go and have a look around on the website, I'm sure you will find a lot of extra information. A lot more details over there." – Sam Ampoorter, Too Good To Go

Another example of social and environmental impact is Färm. Their most important goal is to equally sensitize people and to have a positive impact on the environment. To sensitize them to adopt more sustainable ways of consumption. They also try to have as less unsold food products as possible. Of course, there will always be some wastage. For that amount they work together with small organizations like Fruitopia to collect it.

"Well, we hope to sensitize people and to convince them to adopt more sustainable ways of consumption. So, more seasonal consumption, less packaging, vegetarian options, everything that involves sustainable food. (…) Färm's vision is in fact changing eating habits in order to change the connection between people. There is also an environmental impact, because everything that is reused, results already in less waste. So, it's good for the environment as well as the health of people." – Isadoora Meersseman, Färm

Maxime Niego from FruitCollect states that their expected impact is much more social.

"Yes, that's right. In fact, it's more social. Food waste is in fact an excuse, you see. It's an excuse in order to meet with people, to foster social friendships and so on. We also try to sensitize people directly. With the individuals, we are in their garden and generally we meet with them. And they see our action immediately. The people in need, so the shelters, are with us on the field and they have the right to attend two educational workshops and two cooking workshops per year. So, they are in direct contact also which promotes a change in behavior." – Maxime Niego, FruitCollect

Cyril Beneche from MadLab also adds some suggestions about what could be done with all the big and small breweries in Brussels in order to reuse way more spent grain.

"There is ideas in construction, to use spent grain as isolant, maybe. It might not be easy, but it could be very interesting. There are like four to five breweries here in a radiant of 500 meters and all of them have to call Bruxelles Environment to get rid of the spent grain, to burn very wet resources. So that's a lot of transport, a lot of energy used for it. That's way too bad. That's too bad. And none of them are organic, so that's why I can't use it right now. La Source, just in front, is going to introduce a fund to get part of its production organic, so that I can reduce that. That would be great." – Cyril Beneche, MadLab

3.2 Customer survey: food waste in a household

3.2.1. Methodology

For the following section, an online survey was carried out. The website SoGoSurvey was used for its template. The online survey consisted of 18 questions. The first part was about the respondent such as in which age category the respondent is situated, which gender and where he or she lived. The next part of the question were about the actual food waste in their household. The following section of the online survey covered their behavior. In particular, if they were ready to change in order to reduce the amount of food waste at home. It also tackles the willingness to join several workshops or to share their waste with others. Below, all the different questions can be found:

Q1	How old are you?	1: 18-30 2: 31-40 3: 41-50 4: 51-60 5: 60+	Multiple choice: 1 response
Q2	What is your gender?	1: Male 2: Female 3: Other	Multiple choice: 1 response
Q3	Where do you live?	1: Flanders 2: Brussels 3: Wallonia 4: EU 5: Other (Please specify)	Multiple choice: 1 response
Q4	How many people make up your household?	1: 1 person (alone) 2: 2 persons 3: 3 persons 4: 4 persons 5: 5 persons or more	Multiple choice: 1 response

Q5	Where do you usually go for your grocery shopping?	1: Big supermarkets 2: Bio supermarkets 3: Small grocery shops 4: Local markets 5: Other (Please specify)	Multiple choice: 1 response
Q6	How many times a week do you go grocery shopping?	1: 1 time 2: 2-3 times 3: 3-4 times 4: 4-5 times 5: 5 times or more	Multiple choice: 1 response
Q7	Do you plan your groceries beforehand with lists, meal plans etc. ?	1: I strongly disagree 2: I disagree 3: I agree 4: I strongly agree 5: I don't know	Multiple choice: 1 response
Q8	How much do you throw away after a week?	1: A lot (more than 1kg) 2: Average (between 400g-1kg) 3: Not much (less than 400g) 4: Nothing 5: I don't know	Multiple choice: 1 response
Q9	What do you throw away the most?	1: Fruits and vegetables 2: Meat/charcuterie 3: Dairy (milk/yogurt/ cheese) 4: Bread 5: Dry food 6: Other (Please specify)	Multiple response

Q10	What is the reason for throwing it away?	1: Out of date 2: Looked/smelled/tasted bad 3: Rotten/expired 4: Wrong package size 5: Too much leftovers 6: Other (Please specify)	Multiple response
Q11	Are you willing to do something about it?	1: Yes 2: No	Multiple choice: 1 response
Q12	Would you go to organized workshops?	1: I strongly disagree 2: I disagree 3: I neither disagree nor agree 4: I agree 5: I strongly agree	Multiple choice: 1 response
Q13	Would you go to organized workshops and pay for it?	1: I strongly disagree 2: I disagree 3: I neither disagree nor agree 4: I agree 5: I strongly agree	Multiple choice: 1 response
Q14	If you agree or strongly agree: what would you expect from it? If you disagree or strongly disagree or are being neutral: why?		Open question

Q15	Would you be willing to take some else's "waste" for free? From your neighbor for example.	1: I strongly disagree 2: I disagree 3: I neither disagree nor agree 4: I agree 5: I strongly agree	Multiple choice: 1 response
Q16	Would you be willing to take someone else's "waste" and pay for it?	1: I strongly disagree 2: I disagree 3: I neither disagree nor agree 4: I agree 5: I strongly agree	Multiple choice: 1 response
Q17	Would you be willing to buy revalued products with your food waste in a specialized shop? For example: jams out of old fruit.	1: I strongly disagree 2: I disagree 3: I neither disagree nor agree 4: I agree 5: I strongly agree	Multiple choice: 1 response
Q18	What would be your idea to reduce food waste in a household?		Open question

Due to the limited free trial service on SoGoSurvey, 100 responses were collected. However, because it is an online customer survey, 100 responses were enough for the quantitative part of the thesis. Thus providing a clear view of the current customer behavior on food waste.

As a next step, the collected data have been analyzed by the software SPSS by IBM. Thanks to mentioned data software, several kinds of tests can be carried out. Firstly, a codebook was set up in order to prepare the data for analyses. In the codebook, the type of questions are defined together with the measurement level for the variables. For that survey, multiple response questions were used. Regarding the measurement levels, some of the variables are nominal and some of them are ordinal.

The nominal measurement level occurs when the answers consists of several categories and those categories have no particular order. Ordinal variables have also answers divided in different categories, but those categories have a logical order. For example, the age of the respondents. Then, the results from the online survey had to be transformed into codes that SPSS could understand. Every choice of answer got a number. That is how the data was imported into the Statistics Data Editor software. The result is now a fully filled out codebook with all the results of the respondents. Thus being ready to be analyzed and tested.

1.	Frequency tables
2.	Multiple response with multiple response set
3.	Descriptive statistics: level of coherence with crosstabs
4.	Scaling techniques

The first analysis is the one concerning a single variable. It means that the analysis will only regard one question of the online survey at a time, without comparing them to other variables and questions. No averages nor medians were calculated with those tests, because the type (nominal or ordinal) of responses are not adequate for that kind of test. In this case frequency tables were used to report the data. The tables show how many times a response appears in the results.

The next analysis covers the questions with multiple response variables. Meaning multiple responses are accepted for one question. For the customer survey, it regards question 9 and 10. A separate variable was made in SPSS for each option. For example, question 9 was divided into six different questions with a possibility of answering yes or no to each of those separate questions. For the test, the purpose is to put all of those separate variables into one graph. With that new specific table a simple bar chart has been made.

In addition, it is interesting to analyze if some groups of answers are comparable with others. Therefore, grouping variables, which are independent variables, and test variables, which are the dependent variable, were chosen. Those kind of tests belong to the descriptive statistic tests. In order to use those tests, cross tabs of the different questions have to be made. Afterwards, the Cramer's V test is used with a view to check the level of coherence between the two variables. Clustered bars were included to represent the tables in a clearer way.

Finally, a lot of the questions in the online survey use scaling techniques in order to measure the opinion of the respondents. The respondents can choose between: I strongly disagree, I disagree, I neither disagree nor agree, I agree, I strongly agree or in some cases also I don't know.

3.2.2. Findings

1. *Respondent's background features*

Who participated to the online survey?

The customer survey had 100 participants. The first part of the customer survey concerns general questions. Those general questions can be seen as demographic questions. It is to draw a picture of the background of the participants. The following tables are **frequency tables**. The report says that the survey was answered by more women than men. 80% of the participants are female and only 20% are male.

Table 2: Gender of respondent

	Frequency	In %
Male	20	20,0%
Female	80	80,0%
Total	**100**	**100,0%**

The research group are mainly people between 18 and 30 years old (77%). The second largest group is situated between the age of 51 and 60 (11%). The rest of them is situated between the age of 31 and 50. Only one partaker is over 60 years old. With those results we can conclude that most of the participants are students, young graduates or people who are at the beginning of their career.

Table 3: Age of respondent

	Frequency	In %
18-30	77	77,0%
31-40	5	5,0%
41-50	5	5,0%
51-60	11	11,0%
60+	2	2,0%
Total	**100**	**100,0%**

Outcomes about wastage

Large retailers account for approximately 70% of food sales for households. Although supermarkets dominate the scene, more direct channels are on the rise since the last few years. (Ellen MacArthur Foundation, 2019). We can also see above trend in the retrieved findings. Most people go to big supermarkets. In the customer survey it is even 89% of the respondents compared to the 70% in the study mentioned earlier. In addition, people tend to go to small grocery stores and local markets.

Table 4: Place of grocery shopping

	Frequency	In %
Big supermarkets	89	89,0%
Bio supermarkets	6	6,0%
Small grocery shopping	2	2,0%
Local markets	2	2,0%
Other (Please specify)	1	1,0%
Total	**100**	**100,0%**

Table 5: Amount of food waste per household per week

	Frequency	In %
A lot (more than 1kg)	11	11,0%
Average (between 400g-1kg)	30	30,0%
Not much (less than 400g)	47	47,0%
Nothing	7	7,0%
I don't know	5	5,0%
Total	**100**	**100,0%**

In the customer survey, people said that they do not throw away much. The most common answer is less than 400 g per week per household. That is impressive given that on average, in Belgium, around 350 kg organic waste gets thrown away per person per year. The speculation about the mismatch can possibly be that people don't know how much they really throw away or maybe the people who participated really do know how to reduce and avoid a large amount of food waste at home. The second common answer is between 400 g and 1 kg.

A report from Roels and Van Gijseghem (2011) states that a lack of consciousness is an important feature regarding that topic. The customer often doesn't have a notion of the magnitude of food that he or she is throwing away. One also underestimates the problematic nature of the loss and waste, such as the negative impact on the environment. Together with the possible financial benefits that come with dealing better with the wastage. Therefore, it is important to sensitize and educate. As long as the consumer is not aware of that issue, prevention is not an option. (Roels and Van Gijseghem, 2011).

Outcomes about willingness to change their habit

A very positive thing about the outcome of the online customer survey, is that 99% of the respondents stated that they wanted to do something about their behavior of throwing away food. People are ready to change their habits. It could be a great opportunity for supermarkets, big or small, organic, bio or classic.

Table 6: Willingness to change habit

	Frequency	In %
yes	99	99,0%
no	1	1,0%
Total	**100**	**100,0%**

In the questionnaire, one suggestion was made in order to organize some workshops to learn more about how to fight food waste at home. 38% agreed to go to those organized workshops, but also 29% were neutral about the idea. However, 41% disagreed to pay for those kind of workshops, which is important to take into consideration from the quantitative study.

Table 8: Willingness to go to organized workshops

	Frequency	In %
I strongly disagree	6	6,0%
I disagree	24	24,0%
I neither disagree nor agree	29	29,0%
I agree	38	38,0%
I strongly agree	3	3,0%
Total	**100**	**100,0%**

Table 7: Willingness to go to paid organized workshops

	Frequency	In %
I strongly disagree	20	20,0%
I disagree	41	41,0%
I neither disagree nor agree	23	23,0%
I agree	15	15,0%
I strongly agree	1	1,0%
Total	**100**	**100,0%**

Another suggestion was to share some food waste with someone else, for example from a neighbor. That could create a sort of community between people living in the same area. It could be carried out by an application or online group in order to communicate efficiently. That could unite several ingredients being saved and used for cooking a great meal or even treats, meals, jams and so on to share again after. The opinion of the respondents was a little differed. 31% said they agreed. However, 34% said they disagreed on the idea. When asked if they are willing to pay for those goods, the majority was not on board.

Table 10: Willingness to take someone else's waste for free

	Frequency	In %
I strongly disagree	9	9,0%
I disagree	34	34,0%
I neither disagree nor agree	17	17,0%
I agree	31	31,0%
I strongly agree	9	9,0%
Total	**100**	**100,0%**

Table 9: Willingness to par for someone else's waste

	Frequency	In %
I strongly disagree	32	32,0%
I disagree	37	37,0%
I neither disagree nor agree	18	18,0%
I agree	11	11,0%
I strongly agree	2	2,0%
Total	**100**	**100,0%**

Another positive outcome of the online survey is that the respondents were interested in buying “recycled” food waste that is transformed into new products in specialized shops. So, for people who launched a business such as Fruitopia, that is great news. Even though they explicitly said they didn’t want to make money out of their idea. It is a positive outcome, because it means that the respondents realize that there is still plenty of value in their food waste.

Table 11: Willingness to buy new product from food waste from specialized shop

	Frequency	In %
I strongly disagree	2	2,0%
I disagree	16	16,0%
I neither disagree nor agree	8	8,0%
I agree	64	64,0%
I strongly agree	10	10,0%
Total	**100**	**100,0%**

Ideas on how to reduce food at home

The last section for the outcomes of the online customer survey, are the answers to the second open question (18). The question tackles what the respondents are willing to do at home to reduce their food waste. Most of the suggestions respondents gave in the online survey is already listed under chapter 1.3. The majority of them suggest to plan groceries and meals before going to the shop for food. In addition to make a list, but also checking what is already in the fridge, the freezer or the pantry at home before leaving for the supermarket. Awareness shopping could be seen as a prevention.

The majority of the respondents want to have smaller package sizes available when buying food. That can also prevent food waste at home. On the other hand, people could opt to go to smaller and specialized grocery stores in order to buy smaller amounts such as the butcher, the bakery and the smaller grocery shops.

Once one is in the process of having too much, prevention can’t be applied anymore. Then we are situated in the red zone of the food waste hierarchy. Ideas to reduce food waste in that situation are composting or giving it to animals such as goats, chickens, dogs, and so on. One could also take leftovers for lunch the next day. Another suggestion is to choose one day of the week where only leftovers are eaten. Furthermore, several people suggested to set up a sharing community with neighbors as a suggestion in the questionnaire.

2. Tests

Multiple response

The question considering the product which is thrown away the most, is a **multiple response question** in the customer survey. Meaning that the respondent can choose multiple answers. That can be seen in the totals of each type of product. If we add up all the different total amounts there is not equal to 100%. It is important to be aware that there are only 20 male respondents compared to 80 female respondents.

To be able to test the multiple response questions, a multiple response set had to be made. In that set the different yes or no questions regarding the products are put into one variable. The "super" variable can be used later for more profound testing. In the table below, an overview of the most thrown away products from the online survey is shown.

Table 12: Overview most thrown away food products

		Count	In %
Most thrown away product	Fruits and vegetables	39	39%
	Meat/charcuterie	63	63%
	Dairy (milk/yogurt/cheese)	75	75%
	Bread	57	57%
	Dry food	96	96%
	Other (Please specify)	92	92%
	Total	**100**	**100%**

As there is another multiple response question in the questionnaire, another super variable had to be made. The table represents the reasons for throwing food away.

Table 13: Overview reasons for throwing away food products

		Count	In %
Reasons for throwing away food	Out of date	61	61%
	Looked/smelled/tasted bad	53	53%
	Rotten/expired	28	28%
	Wrong package size	95	95%
	Too much leftovers	77	77%
	Other (Please specify)	95	95%
	Total	**100**	**100%**

Cross tabs

In order to test the multiple response test more profoundly, **cross tabs** have been used to show the difference between different groups. The first mapping that has been used for comparisons is the gender of the respondents. The table below gives an answer on the question: "Is there a difference between male and female respondents regarding which product is thrown away the most?".

Table 14: Difference between male and female respondents regarding which product is thrown away the most

		Male		Female		Other		**Total**	
		Count	In %	Count	In %	Count	In %	Count	In %
Which product	Fruits and vegetables	5	25,0%	34	42,5%	0	0,0%	**39**	**39,0%**
	Meat/charcuterie	16	80,0%	47	58,8%	0	0,0%	**63**	**63,0%**
	Dairy (milk/yogurt/cheese)	14	70,0%	61	76,3%	0	0,0%	**75**	**75,0%**
	Bread	8	40,0%	49	61,3%	0	0,0%	**57**	**57,0%**
	Dry food	19	95,0%	77	96,3%	0	0,0%	**96**	**96,0%**
	Other (Please specify)	20	100,0%	72	90,0%	0	0,0%	**92**	**92,0%**
	Total	**20**	**100,0%**	**80**	**100,0%**	**0**	**0,0%**	**100**	**100,0%**

Dry food is the type of product that is thrown away the most (96%). 96% of the female respondents opted for that answer and 95% of the male respondents. 92% of the respondents said they throw away among other things (other), but they only mean packaging or leftovers. So the second largest group of food that is thrown away is dairy products. 76% for female respondents and 70% for male respondents. It appears that fruits and vegetables are thrown away the least (39%). Still, 39% is a lot. It can be explained by the fact that fruits and vegetables only account for 10% of the food expenses according to Watteyn et al. (2019). People tend to think that those products don't cost much, so it's less of a deal to throw them away. (Watteyn et al., 2019).

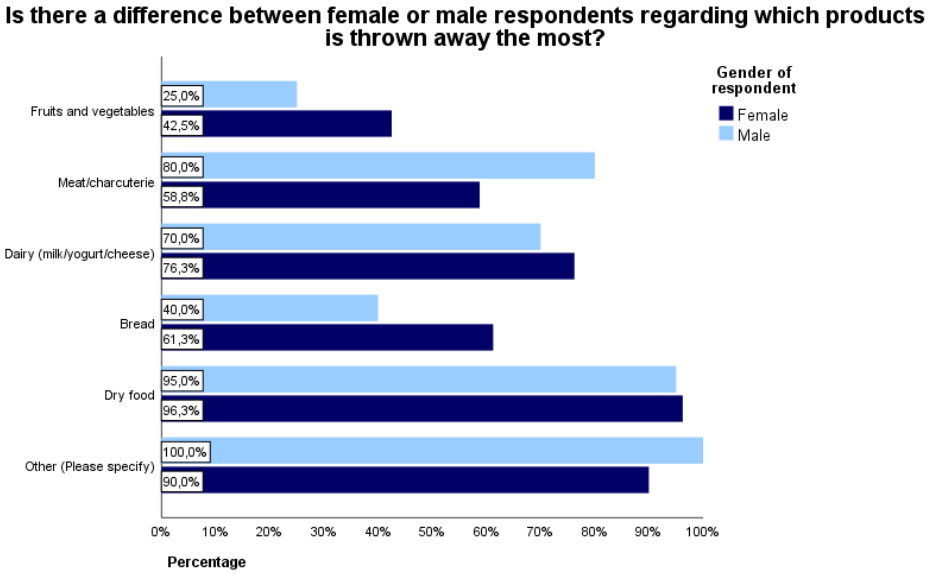


Figure 11: Difference between male and female respondents regarding which product is thrown away the most

In the graph above, a quick overview is shown of the table mentioned previously concerning the difference between male and female respondents regarding which product they throw away the most.

Table 15 and graph 12 show the difference in answers of female and male respondents regarding the reason they throw food away the most. As the table shows, 95% of the respondents gave the wrong package size as the most common reason for throwing away food. That is 19 on 20 respondents for men and 76 out of 80 for women in the sample. Also, other items such as hard and dry bread and only the cut offs of fruits and vegetables came up. The third most common reason is apparently too much leftovers.

Table 15: Difference between male and female respondents regarding the reason food is thrown away

		Male		Female		Other		**Total**	
		Count	In %	Count	In %	Count	In %	Count	In %
Which product	Fruits and vegetables	5	25,0%	34	42,5%	0	0%	**39**	**39%**
	Meat/charcuterie	16	80,0%	47	58,8%	0	0%	**63**	**63%**
	Dairy (milk/yogurt/cheese)	14	70,0%	61	76,3%	0	0%	**75**	**75%**
	Bread	8	40,0%	49	61,3%	0	0%	**57**	**57%**
	Dry food	19	95,0%	77	96,3%	0	0%	**96**	**96%**
	Other (Please specify)	20	100,0%	72	90,0%	0	0%	**92**	**92%**
	Total	**20**	**100%**	**80**	**100%**	**0**	**0%**	**100**	**100%**

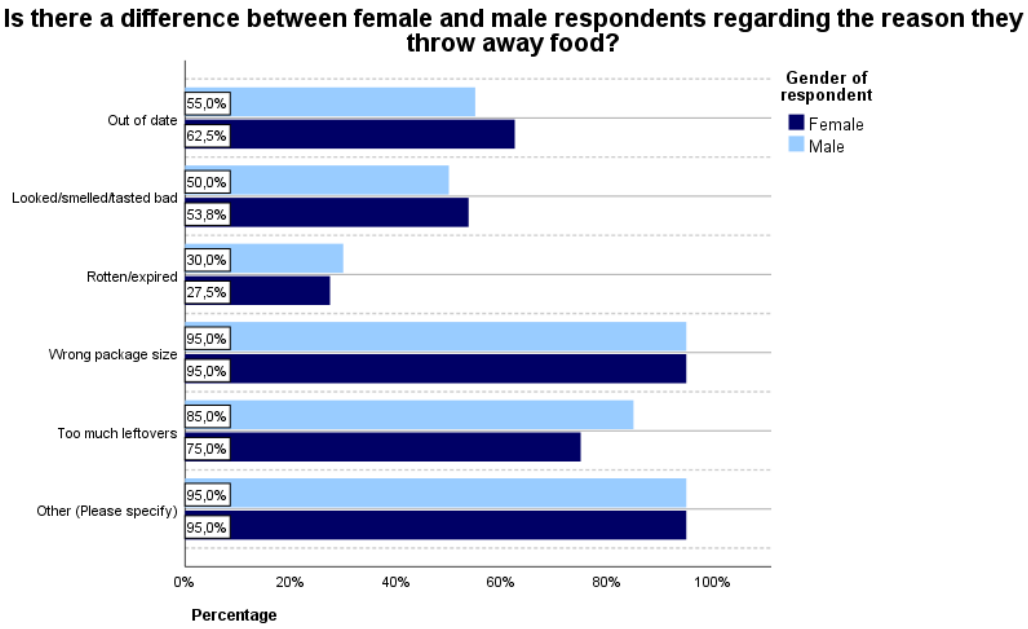


Figure 12: Difference between male and female respondents regarding the reason food is thrown away

The least common reason is because the food is rotten or expired. Only 28% of the respondents chose this reason. When looking at the differences in answers between men and women, we see that the two groups answered quite equally.

Level of coherence

With the intention to analyze more thoroughly the difference between groups, a second test has been carried out. The second test deals with **measuring the level of coherence** between two or more variables. In the test there is an independent variable. That variable classifies the groups. On the other hand, there is also a dependent variable which is the variable being compared. For that type of tests the variables have to be nominal or ordinal. Because the analysis is descriptive, the conclusion is only valid for the sample of the online survey, namely the 100 respondents.

Is there a difference in the amount of food waste between the number of people in the household (HH)?

The table (cfr. appendix: table 17, p. -47-) contains a crosstab in which the cells are in column percentages. Thus, the difference between the number of people in the household can be compared. The Cramer's V test was used to see what the link is between the number of people in the household and the amount of food waste per household. The value of Cramer's V is 0,235. It means there is a **relatively strong link** between the amount of food waste and the number of people in the household for that sample only. Meaning the number of people per household has an impact on the amount of food waste thrown away. The crosstab below can be used for further tests.

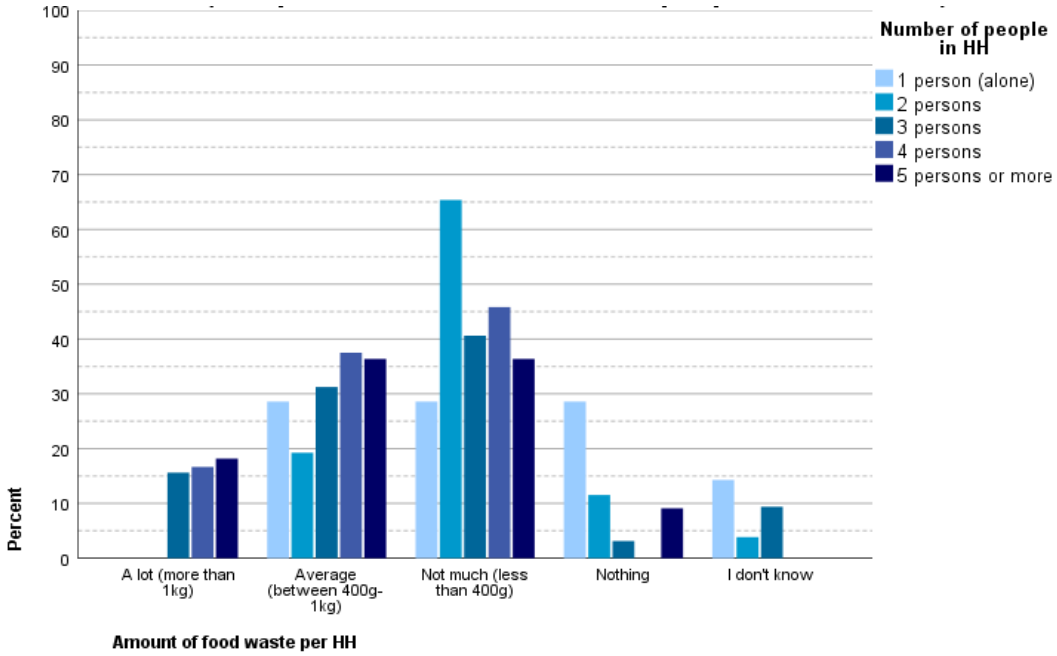


Figure 13: Difference between amount of food waste and the number of people in the household

In the graph above we see that the most common answer was that there is not much food wasted. The participants stating the above have different numbers of persons in their household. The most common number is two persons. Only participants with three or more people in their household throw away more than one kilogram of food per week.

Is there a difference in the amount of food waste and where the household will go grocery shopping?

The table (cfr. appendix: table 18, p. -48-) contains a crosstab in which the cells are in column percentages. In that way, the difference between the different places for grocery shopping can be compared. The Cramer's V test was used to see what the link is between where the household goes for grocery shopping and the amount of food waste per household. The value of Cramer's V is 0,164. It can be concluded that there is a **weak coherence** between the amount of food waste and the place of grocery shopping for that sample only. The crosstab will not be used for further testing due to the weak coherence between the two variables.

Is there a difference in the amount of food waste and how many times the household will go grocery shopping?

The table (cfr. appendix: table 19, p. -49-) also contains a crosstab in which the cells are in column percentages. Thus, the difference between the frequency of the household going grocery shopping can be compared. The Cramer's V test was used to see what the link is between the how many times the household will go grocery shopping and the amount of food waste per household. The value of Cramer's V is 0,279. It means that there is **a relatively strong link** between the amount of food waste and how often the household goes grocery shopping for that sample only.

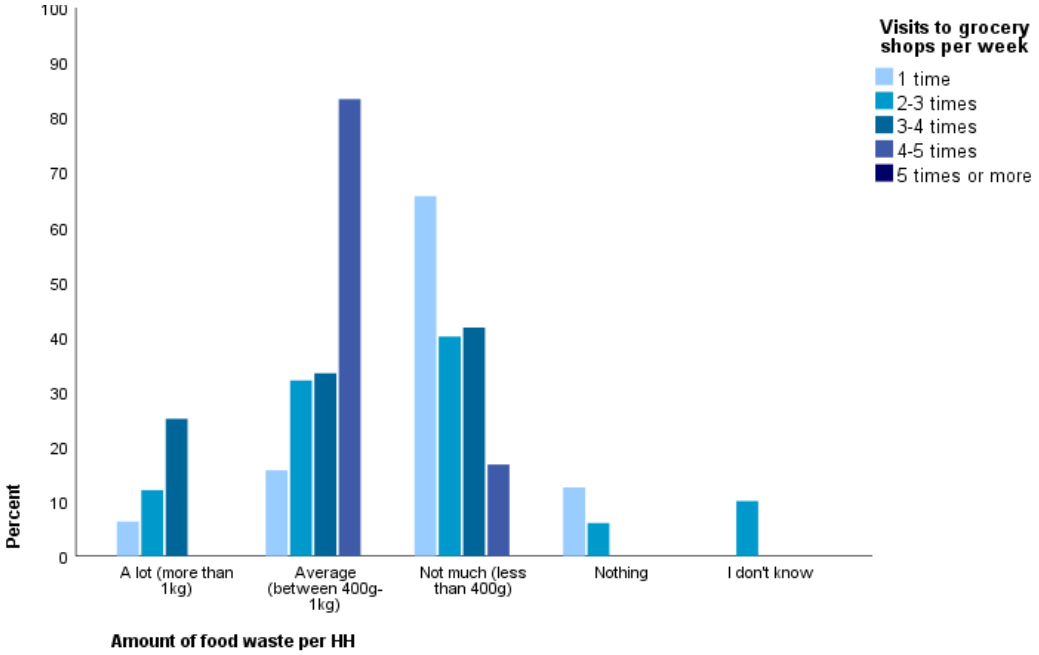


Figure 14: Difference between amount of food waste and how many times a week the household goes grocery shopping

The graph above highlights that people who throw away between 400 g and 1 kg go shopping four to five times a week. Which is a huge difference with participants stating they don't throw away much and that go for grocery shopping one time a week.

Is there a difference in the amount of food waste and the planning of groceries?

Again, the table (cfr. Appendix: table 20, p. -50-) contains a crosstab in which the cells are in column percentages. Hence, the difference between grocery planning in the household can be compared. The Cramer's V test was used to see what the link is between if the household plans it grocery shopping and the amount of food waste per household. The value of Cramer's V is 0,179, indicating that there is **a weak coherence** between the amount of food waste and the planning of grocery shopping for that sample only. As there is a weak coherence, the cross tab won't be used for further testing.

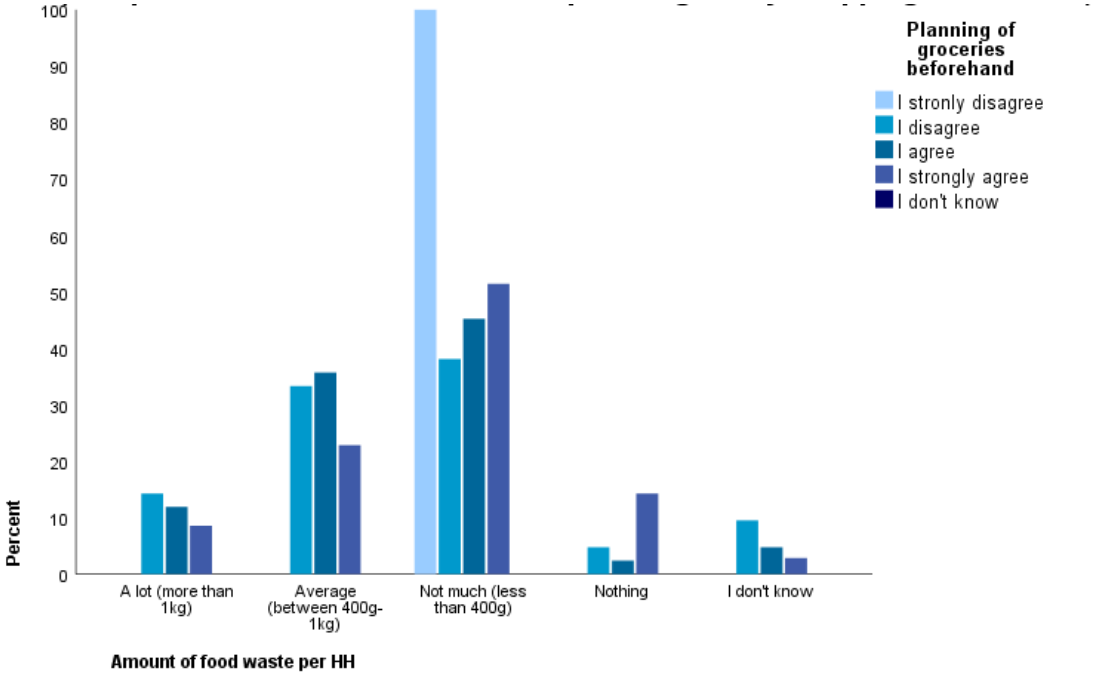


Figure 15: Comparison between grocery planning and food waste per week

Scaling techniques

As mentioned in the outcome of the online survey, 99% of the respondents was ready to change something about their food waste per household. The table below shows to what intent the respondents want to change and what they're willing to do.

Table 16: Willingness to change habits

	I strongly disagree	I disagree	I neither disagree nor agree	I agree	I strongly agree	Total
Willingness to go to organized workshops	6	24	29	38	3	100
	6%	24%	29%	38%	3%	100%
Willingness to go to paid workshops	20	41	23	15	1	100
	20%	41%	23%	15%	1%	100%
Willingness to take waste from someone else for free	9	34	17	31	9	100
	9%	34%	17%	31%	9%	100%
Willingness to pay for waste from someone else	32	37	18	11	2	100
	32%	37%	18%	11%	2%	100%
Willingness to buy revalued food waste at specialized shop	2	16	8	64	10	100
	2%	16%	8%	64%	10%	100%

The majority of the respondents strongly agree (3%) or agree (38%) to follow an organized workshop. Such a workshop could be organized by a company such as Fruitopia or FruitCollect, but it could also be interesting if supermarkets offered that option. However, more than 60% is not prepared to pay for a workshop.

The first open question (14) considers the reason why respondents would be interested in a workshop or not. Let's start with why people are interested to attend such a workshop. A lot of people expect tips and tricks about grocery management, meal planning, preservation, recipes with leftovers. However, it is important to say that they also await the recipes, tips and tricks to be innovative. A lot of information about the topic can be found online. That is also why several respondents state that they would not want to pay for a workshop. Online research is for free. In addition, respondents are not interested in coming to workshops state that they have no time. Another reason for not participating is because they already do a lot at home and don't need any help regarding that issue. A minority think a workshop will yield nothing. So, a suggestion would be to offer free workshops rather than paying for it and to maybe offer some online alternatives for people who don't want to go all the way to the location of the organized workshop.

Another suggestion was to recycle food waste from someone else, such as a neighbor or a family member. If it's for free, 34% does not agree in taking it and 31% agrees. Also 17% is neutral about its option. If one has to pay for it, almost 70% of the respondents are not interested.

A last, but very interesting point is that almost ¾ of the respondents are willing to buy revalorized food waste in a specialized shop. It could be very interesting for SME's like FruitCollect. It indicates that there is market opportunity to tackle for companies who want to start transforming food waste into a revalorized food product.

Conclusion

One third of the entire food production worldwide never sees the light of day on our plate. It gets lost during the process or it is wasted by the end-consumer. The circular economy approach could be seen as a strategic answer. Together with the Brussels government, a lot of initiatives and organizations have been launched in order to facilitate the transitioning from the linear system to circularity. The objective of the master thesis is to give an appropriate answer to the following question: What is the impact of Circular Economy on the Food Industry in Brussels?

Implementing the circular economy in Brussels could have a lot of advantages. It has been proven that there are several positive and economic advantages such as the weakening of the interdependency of importation and as such strengthen the competitive advantage of Brussels to reuse, recycle and redistribute the resources. It could also signify cost reduction, GDP growth and thousands of euros saved per year. In addition, there is also the social impact. For example, starting a sharing economy, creating job opportunities for all levels of education and evolving to more sustainable consumers. Furthermore, the circular economy surely has a big impact on the environment of Brussels and the health of its citizens. It decreases carbon dioxide in the greenhouse gas emissions and it improves the air, water and soil quality.

Regarding the food industry in Brussels, it is a fact that, here too, food wastage and losses occur. The yearly food waste in Brussels accounts for 134 000 tonnes and an average of 350 kilograms of waste is created per inhabitant on a yearly basis. Sure, the end consumers play a big role in that part, but it is affected by all the actors of the food supply chain. 12% of the total food waste already happens at the beginning of the food process, during the farming process or immediately after harvesting. For example, fruit that got bruised during the pickings or the threshing. It could also be crops that did not meet the quality standards and supermarket restrictions or crops left behind because of a drop in pricing or due to poor mechanical harvesting tools. Sometimes a mismatch in supply and demand can also create a surplus, which in the end can be part of the food loss. During the next stage of the food supply chain, the waste and losses appear after the products leave the farms for handling, storage and transport. For the distribution, the biggest problems are the inventory of the supply and the demand forecasting. A miscalculation in one of those two subjects can cause a surplus, which will then lead to waste. 53% of the food that consumers buy is being wasted afterwards. It also includes food losses and waste at restaurants or cafés. The food waste in the last part of the food supply chain consists of food that was bought, but not consumed, or food that was cooked, but not eaten.

If the circularity were to be applied to the food industry in Brussels, a lot of the food waste and losses could be prevented or lessened. In the considered sector, creating waste can certainly be seen as wealth. Here also, those impacts can be divided into three categories: economic, social and environmental.

Firstly, the economic advantage is that produced waste is literally at the base of many business concepts. Thanks to a very fertile context in Brussels a lot of new companies have been launched. That has been made possible by several organizations and initiatives, but mostly with the help of Be Circular and the BRCPE. It gives a big boost to the local economy and therefore it creates jobs. The interviewed companies for present thesis are all wonderful examples of the growing local economy. Some of those companies have been active in Belgium for several years, but the emergence of circular economy has pushed them into a new direction. That was the case for Maison Dandoy with its collaboration with Brussels Beer Project and the Act For Food initiative from Carrefour. Färm was created thanks to the growing interest in sustainable food consumption. MadLab, Fruitopia, FruitCollect and Too Good To Go were established with a view to take matters into their own hands in the fight against food waste.

Nonetheless, a lot of the founders faced difficulties while starting their business concepts. The biggest challenge is finding the necessary financial aid. Next to finding an adequate location, defying transportation and logistics of the “raw” materials and profitability were also mentioned. Luckily, thanks to the many organizations and initiatives such as Be Circular, social entrepreneurships, incubators, 1819 and frenemies some of the above challenges can be overcome. As to the financial support, different kinds of funds and subsidies can be obtained via Be Circular and other organizations. Crowdfunding is also a modern way of finding capital and investments. For some companies, the solution can lay in the company itself.

The base of the studied businesses lays in the waste produced by others. Hence, “raw” materials are being collected, transformed and redistributed. Maison Dandoy and MadLab have spent grain and beer draft as the base of their cookies and crackers. Fruitopia and FruitCollect save fruits from rotting and redistribute them, whether or not retransformed. Too Good To Go handles as a distributor for restaurants, cafés, hotels and supermarkets. Usually, companies don’t have to pay for “raw” materials, which will also decrease their purchasing costs.

A second category concerns the social aspect of the economy. Circularity founds a platform where products and ideas can be exchanged and shared. And in doing so, it can bring several entrepreneurs together. For example, Brussels Beer Project and Maison Dandoy found their way to each other and collaborated. Furthermore, through several initiatives from the government, knowledge and business concepts can be experienced by others. As follows, different kinds of hotlines can be consulted by companies.

For some of those companies, making profit is not the only reason for existing. Their biggest objective is to bring awareness and sensibilization around food waste in the food industry. They want to have an impact on the society we are facing today and as a consequence on the consumer behavior. MadLab wants to set an example with its savory and sweet crackers made from spent grain. The founder wants to raise awareness to the problem faced by a lot of breweries in Brussels: the huge amount of spent grain. Then there is Fruitopia which organizes workshops in order to teach people how to prevent food waste at home. FruitCollect wants to help kids in shelters have healthier food options by collecting the surplus of fruit in private gardens. Lastly, Too Good To Go shares a lot of educational material with schools and through their website.

An online survey was also conducted to analyze the consumer behavior for the thesis. With its limits to a sample of only 100 respondents, those findings cannot be generalized. In the questionnaire, people stated that they do not throw away much. The most common answer is less than 400 g per week per household. That is impressive given that on average, around 350 kg organic waste gets thrown away per person per year. So it could be concluded that the customer often doesn't have the notion of the amount of food that they throw away. A very positive note about the outcome of the online customer survey, is that 99% of the respondents stated that they wanted to do something about their behavior of throwing away food. People are ready to change their habits. That could be a great opportunity for supermarkets, big or small, organic, bio or classic and for new business concepts.

Furthermore, a mix between the economic and social aspect is creating jobs. Thanks to the new companies implementing the circular economy, a lot of jobs are created. Also, a lot of volunteers offer their free labor force to small enterprises or initiatives in order to help them around. The employees working for those companies are very involved in the mission and vision of the company they work for.

And last but not least, there is the environmental impact of the circular economy on the food industry in Brussels. The concept of sharing resources and reusing food waste can contribute to a decrease in pollution. It will not only help to better the air quality, but also purify the water and decrease soil degradation. Also both the biodiversity will be positively impacted, and the climate change and general waste too. So, it will definitely help reduce environmental pressures linked to extraction, emissions and waste. Besides, the process for the food being wasted, from farm till fork, was not for nothing. The energy, labor force, soil and water used for creating one food product, will be revalorized and put back into the cycle. So it will have an impact on the amount of food waste and losses throughout the whole food supply chain.

Another environmental impact of the circular economy is global health. Recycling can affect the health of citizens directly by redistributing edible food waste. Thanks to the circular economy, a shift will happen towards a healthier food production. In addition, by recycling less waste needs to go through waste management. Therefore, incineration, landfill and more emissions are reduced. On top of that, the resource-efficient agricultural processes ensure that less fertilizers and pesticides are used, which also affects the health of their consumers positively. Furthermore, the sharing economy mentioned previously, also affects the health indirectly via reduced manufacturing emissions.

Respondents of the online customer survey gave several suggestions regarding reducing their food waste at home. However, not everything is the perfect solution against food waste. If food waste is not recycled appropriately, it can have negative effects on people's health. Those negative impacts are unintentional consequences. That is why they have to be managed during the transition from linear to circular. For example, asthma or extrinsic allergic alveolitis, which is a lung disorder caused by organic dust, can be caused by composting. Thus it seems safe to say that composting is not the best solution for food waste, as seen in the food waste hierarchy. However, it is better than doing nothing at all. Also, food poisoning can happen if the food safety is compromised. Some food can still be consumed after its expiration date, but one still has to be careful. And lastly, if the recycling process is not done right, people, the soil, the water and food can get exposed to several toxic chemicals.

To conclude, circularity can have several impacts on the food industry in Brussels. Some impacts are bigger than others, but they all have advantages. We all have to contribute and work together in order to reduce to the utmost the food waste in the food industry in Brussels. As the saying goes: Rome was not built in one day. But, at least the transition is already happening in Brussels.

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