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# Designing the Zero Waste Experience

Master's Thesis

Towards the academic degree of

Master of Science in Engineering (MSc)

Submitted by

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Submitted to:

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# Declaration

I hereby declare and confirm that this thesis is entirely the result of my own original work. Where other sources of information have been used, they have been indicated as such and properly acknowledged. I further declare that this or similar work has not been submitted for credit elsewhere.

Date and place of signing

Student's signature

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## Abstract

The assumption of this master thesis is that the majority of modern supermarkets has no proactive interest in sustainability related to the reduction of material streams. The vision of this thesis is to design a sustainable grocery market with focus on the customer experience. *Zero Waste* is a movement originating from sustainable development to save resources, preventing them from becoming disposable in the first place. The research question of this thesis is whether a grocery market based on the idea of *Zero Waste* offers a special shopping experience and in further consequence, under which circumstances *Zero Waste* can create a better customer experience.

Based on the analysis of scholarly literature and empirical studies dealing with the topics of food and markets, packaging and *Zero Waste*, as well as sustainability and ecologic design, an interview guide was developed. Nine experts from Austria and Germany specialised in food and market related topics, were interviewed. By means of the *Scenario Technique* it could be evaluated, if *Zero Waste* is more sustainable and thereby results in a better experience. Both, opportunities and obstacles were qualitatively analyzed, providing a basis for an innovation workshop attended by volunteers from different fields of expertise. With the *Design Thinking* method, the ideas of the participants were turned into tangible prototypes. These prototypes provided the basis for the final design of the product concept. Within the framework of a design and product development process, those inputs were refined, formulated and visualized by creating a cardboard model, an application prototype and a persona-based customer journey.

The results obtained from the expert interviews revealed that *Zero Waste* can lead to a better shopping experience for customers, if particular conditions are met. By focusing on the opportunities of *Zero Waste* as well as taking account of the obstacles the final product concept illustrates that with the use of *Zero Waste* in grocery markets positive effects can be achieved related to the experience of the customer and an overall sustainable system.

# Kurzfassung

Die Annahme dieser Master Thesis ist, dass der Großteil der modernen Lebensmittelmärkte in Bezug auf die Vermeidung von Abfällen keinen besonderen Wert auf Nachhaltigkeit legt. Die Vision dieser Arbeit ist die Gestaltung eines nachhaltigen Lebensmittelmarktes mit Fokus auf das Einkaufserlebnis des Kunden. *Zero Waste* ist eine Strömung in der Nachhaltigkeitsentwicklung, um Ressourcen präventiv einzusparen, damit diese erst gar nicht zu Abfall werden. Die Forschungsfrage in dieser Arbeit befasst sich im Detail damit, ob ein Lebensmittelmarkt basierend auf dem *Zero Waste* Gedanken ein besonderes Einkaufserlebnis bietet und in weiterer Folge, unter welchen Umständen mit dem Einsatz von *Zero Waste* ein besseres Einkaufserlebnis für den Kunden gestaltet werden kann.

Auf Basis einer Analyse von theoretischen Arbeiten und empirischen Studien zu den Themen Lebensmittel und Märkte, Verpackung und Zero Waste, sowie Nachhaltigkeit und ökologisches Design ist ein Interviewleitfaden entwickelt worden. Neun Experten/innen aus den Bereichen Lebensmittelhandel, Landwirtschaft, Ernährung, Verpackung und Nachhaltigkeit sind im Rahmen eines Experteninterviews befragt worden. Mittels der Szenariotechnik ist ermittelt worden, ob Zero Waste aus Sicht der Experten nachhaltiger ist und ein besseres Erlebnis zur Folge hat. Im Detail sind Chancen und Hürden qualitativ erfasst und analysiert worden. Die von den Experten wahrgenommenen Chancen und Hürden stellten die Basis für einen Innovations-Workshop dar, an dem 31 interessierte Personen aus verschiedenen Fachbereichen teilgenommen haben. Mit Unterstützung der Design Thinking Methodik sind innerhalb des eintägigen Workshops Ideen der Teilnehmer zu greifbaren Prototypen weiterentwickelt worden. Im Rahmen eines Design- bzw. Produktentwicklungsprozesses sind diese Konzepte zu einem Kartonmodell, einem Applikationsprototypen und einem Kundenszenario verfeinert, textuell ausformuliert und visuell dargestellt worden.

Die Ergebnisse aus den Experteninterviews zeigen, dass Zero Waste zu einem besonderen Einkaufserlebnis für den Kunden führen kann, aber hierfür bestimmte

Rahmenbedingungen erfüllt sein müssen. Mit dem Fokus auf den Potentialen von *Zero Waste* in Kombination mit dem Vermeiden der Schwächen (u.a. vor allem Zeitverlust beim Einkauf und Hygienebedenken) kann mit dem Produktkonzept dargestellt werden, dass der Einsatz von *Zero Waste* im Lebensmittelmarkt, sowohl hinsichtlich Nachhaltigkeit als auch beim Erlebnisfaktor für den Kunden, positive Effekte erzielen kann. Damit werden neue Impulse in Richtung einer Neugestaltung bestehender Supermärkte gesetzt.

## 1 Introduction

In former days, over many centuries groceries were offered without packaging on markets or in local grocery stores. Although, the procedure of weighing and packaging the groceries at the market place was time intensive for vendors and customers. Further, people became more aware of hygienic issues, because of epidemics and other illnesses caused by bad hygiene. Around the 19th century, this new demand and need for packaging resulted in new specialized companies developing machines and factories to produce better packages for groceries. During the next 100 years the development was going further and the machines were finally able to fill packages with food (König, 2013).

Finally, in the last decades the packaging industry eliminated completely the dosage with hand or shovel, the scale, and the paper bag and glass bottles. According to the packaging industry the effects of this development were an increased hygienic standard and high efficiency saving costs and time (Piringer, 1992). At the same time, packaging was added with a new function. With the development of brands, advertising became a crucial aspect to communicate the benefits and functions of the product. In self-service stores packages took over the roles of silent vendors (König, 2013).

## **1.1 Problem Statement**

In our product culture, sustainable principles as the reduction and reuse of materials do not play a major role (Papanek, 1985). At this very moment mankind needs 1.5 earths to cover the current living standard. Historian Wolfgang König (2013) states that the modern consumer society is reaching its borders due to the ecologic crisis where self-limitation is the only solution. In practical numbers, mankind has to reduce its ecologic footprint by at least 50 percent (König, 2013). However, the packaging of goods is one area that has high potential to eliminate or reduce material streams that go directly to waste bins. Especially in the food industry packaging requirements due to advertising and law regulations produce tons of waste. The staging of grocery products with packaging is not only very costintensive, but also not very sustainable. By the example of a one-time-use-only water bottle, it can be seen that the resource utilization is not very ecologic in the first place. Further, the bottle design is only focused on the sequence of opening, drinking and discarding the bottle. Further, there is no deposit system in place to reuse the bottles. Reusable glass bottles vanished completely from the supermarket systems in the last years. In the trash bin the bottle became an ecologic problem the second time, either for recycling purposes or for waste combustion (Ullrich, 2013).

Obviously, there is a problem with waste that cannot be returned to the material's original life cycle. Recycling is one hope to overcome this challenge. But latest studies showed that in the European Union the recycling rate is on average at 35 percent. Austria is by far the leader in this ranking with approximately 63 percent in the year 2010 (Umweltbundesamt, 2013). The downside is that recycling processes cost a lot of energy, time and effort. Overall the recycling system makes the process even more complicated for the customer, as for example the correct separation of waste streams. From the production of the packaging material to the customer many mechanisms have to fit together to make recycling even possible and efficient (Braungart et al., 2013).

In contrast, the so-called *Precycling* is one alternative to get rid of waste and replace recycling and waste combustion systems. In the last years *Precycling* initiatives pointed towards a new alternative of so-called *Zero Waste* grocery markets operating in Spain, Italy, Germany, and United Kingdom etc. The main idea of this approach is to store groceries in the market in special bulk containers, so-called *Gravity Bins*. Customers can bring their containers or rent or buy containers in the market to fill in the groceries in the amount they need or want. Such *Zero Waste* grocery markets do not offer the groceries unpackaged, but enable customers to reuse alternative packaging systems and avoid one-time-use-only packaging materials (Johnson, 2013). *Zero Waste* grocery markets grow slowly but steadily in Europe. However, they are still small roots that are far away from mass market utilization due to practical and emotional barriers for customers. This thesis will explore the status quo of *Zero Waste* with the focus on grocery markets.

## **1.2** Research Question

The underlying assumption of this master thesis is that the majority of modern supermarkets does not have a proactive interest in sustainability related to the reduction of material streams. As a consequence, the main vision of this thesis is to design a sustainable grocery market concept based on *Zero Waste* principles that increases the customer experience while shopping groceries. Therefore, the hypothesis is defined as follows:

A grocery market based on Zero Waste can provide a better customer experience compared to ordinary grocery markets with packaged goods.

Derived from this assumption the following question is defined:

*I: Can a grocery market based on Zero Waste principles provide a better customer experience than an ordinary supermarket with packaged goods?* 

Whereas the first research question analyzes if there is a relationship between *Zero Waste* and the customer experience, the second question focuses on the question how the experience can be improved if *Zero Waste* principles are used in a grocery market:

*II: How should a grocery market based on Zero Waste principles be designed to provide a better customer experience?* 

## 1.3 Research Design

Based on theoretical research in the fields of groceries and markets, packaging and *Zero Waste*, sustainability and ecologic design, an interview guide is developed to consult experts. For this purpose, the experts need practical knowledge in the fields of food and markets. The final expert list consists of grocery store owners, organic farmers, dieticians, food and packaging experts and founders of alternative grocery market concepts. The main targets of the expert interviews are as follows:

- Extracting the status quo of *Zero Waste* and similar initiatives to reduce packaging material and food garbage.
- <sup>D</sup> Identifying opportunities and obstacles of Zero Waste grocery shopping.

- Determining the expected as well as the desired future in the grocery market sector related to sustainability
- Figuring out if the focus on experience can be a major driver for grocery market concepts in the future.

Based on the findings of the expert interviews and the theoretical research, critical issues related to *Zero Waste* grocery shopping processes are selected for the following phase, the innovation workshop. Participants from various disciplines (e.g. engineering, business, design, arts, health, food, politics, etc.) take part in an interdisciplinary workshop that is conducted with the *Design Thinking* methodology. The goal of *Design Thinking* and the workshop is to ideate very fast based on many different perspectives and create concepts and prototypes at the end (Brown, 2008). The main targets of the workshop are as follows:

- Getting multiple perspectives on the topic of *Zero Waste* to broaden the problem and solution space.
- Extract ideas, concepts and prototypes that are promising to provide a better customer experience.

The results from the workshop are the input for the final product concept design. The most promising workshop results are developed further in more detail. The product concept solution integrates a product concept including a customer journey, a hardware prototype, and screen and process visualizations.

## 1.4 Thesis Structure

Based on the hypothesis and research questions different fields of interest are described in the chapter *Theoretical Findings* (see Chapter 2). In the next chapter - *Empirical Research* - the organization, design and conduction of the expert reviews are explained (see Chapter 3). The results of the interviews are extracted and prepared as the input element for the workshop that is outlined in the chapter *Innovation Workshop* (see Chapter 4). The findings of the workshop represent the idea stream for the final product concept design that is shown in the chapter *Design Concept* (see Chapter 5). All results, findings and future work/research are discussed in the last chapter (see Chapter 6) - *Conclusion*. This structure is visualized to get a

better overview. The thesis itself is organized as a design research project (see Figure 1.1).



Figure 1.1. Roadmap

# 2 Theoretical Findings

## 2.1 A Short History of Grocery Markets

"All this is not overly appetizing; the fruits have no juice, are small and hard; the flesh is of dubious quality, the cheeses anything but enticing; but after all, the Agora<sup>1</sup> is seething of life." (Schwedt, 2006, p. 14)

The quote shows vividly that grocery markets have changed over the centuries in the Western world. *Open* markets and bazaars have vanished almost completely except some examples in the southern countries. Also, the behavior while shopping has changed. Whereas in former times it was essential to talk to sellers and other customers, nowadays communication is nearly off and grocery shopping is limited to a daily, unpleasant routine.

The next section discusses the change of grocery markets from the Ancient world to the supermarkets nowadays. It should be considered that for this research only the Western perspective is relevant, due to the fact that the outcome of this thesis focuses on a new grocery market concept based on the Western market.

#### 2.1.1 The Ancient World of Groceries

Since the human race had a nomadic culture for thousands of years, there were no known market systems in those times. It can be assumed that hunted and collected food was either eaten immediately by the hunter or the collector or shared with the family or tribe. As long as there were migrations of tribes in the ancient Near East, there was no reason for central exchange or market places. Only with the sedentary life and domestication of animals and plants in the 7<sup>th</sup> and 6th millennium BC, the foundation for development was laid. Ultimately, this led to the first forms of urban society. Furthermore, permanent settlements also led to the increased exchange between the settlements. Trade has become increasingly important in the last thousand years due to the greater settlement and urbanization. Nevertheless, self-

<sup>&</sup>lt;sup>1</sup> Agora is the former Roman central marketplace.

sufficiency with home-grown food was the rule and not the exception (Escher & Buddeberg, 2003).

Only with the rise of industrialization about 200 years ago, the principles of the market - supply and demand - changed society completely. The book *The Great Transformation* describes this transition from an embedded to a market society. This transition refers to the replacement of a society, in which the social cohesion was based on self-sufficiency to a large extent through the production of bread and butter with a new commercial type of society, in which the people defined their rights to access food and other resources with money. Through the mechanisms of supply and demand production and consumption have been decoupled. Increasingly, self-sufficiency has been squeezed out of the economic life. The food sector has changed towards a market-driven industry (Escher & Buddeberg, 2003).

Four related developments led to this change in the food sector (Escher & Buddeberg, 2003):

#### The agrarian revolution

The agrarian revolution refers to enormous productivity gains, starting in the 18<sup>th</sup> century. Due to an improvement of the seeds and the introduction of new crops and agricultural implements, the revolution gained a real boost in the 19<sup>th</sup> century by the use of mechanical equipment and chemicals in agriculture.

#### **Emergence and Growth of Food Companies**

Through productivity gains in agriculture, increasing imports of cereals and other colonial goods, developments in machinery, chemical and electrical industries, food could be produced in capital-intensive, mechanized production. This has favored the emergence of various industries such as pasta, soup cubes, cooking oil, chocolate, baby food and many more.

#### Establishment and Development of an Efficient Transport Infrastructure

At the time of industrialization, the interaction between railway, maritime navigation and telegraphy was particularly important. It came to an intensification of transnational trade relations and thus to subsequently decreased transaction costs. Transportation and communication systems are the basis for supermarkets nowadays.

#### Duplication and Broad Application of New Methods of Preservation

The modern can is a product of industrialization. Since conservation was usually accompanied not only with durability, but also with compression, metering and packaging, it also offered a starting point for the development of a new type of product. The branded product continued to grow rapidly in the food sector.

In summary it can be said, that the interaction of mechanization, preservation, communication and transportation led to a comprehensive transformation of society and nutritional behavior. Unfortunately, with the progress of commercialization the knowledge about the origin of food was lost more and more. It is no longer comprehensible which stations the products have run through and in which state they are offered in the final sale (Escher & Buddeberg, 2003).

Whereas there were many specialized shops, butchers or bakeries, there were also shops that traded with different types of groceries. These mostly small-sized grocery markets were called the *Mom-And-Pop-Stores*.

### 2.1.2 The Mom-And-Pop-Store

This kind of store, also called *Tante Emma Laden* in Germany or *Greißler* in Austria, is referred to as a central meeting place in the neighborhood. In this shop around the corner people were getting the latest gossip on the fly when shopping groceries (Schwedt, 2006).

The purchase in the *Mom-And-Pop-Stores* required time from both sides, from the client as well as from the seller. The client presented his desires or was addressed by the sales person. The seller managed to achieve what the client wanted. Particularly lavish was the weighing of *open* goods with old scales and weight stones. Not only were the goods weighed, but also the vessels that were often brought to the shop by the customers (König, 2013).

Since the late 19<sup>th</sup> century, the supply of colonial goods widened steadily. According to statistics from 1912, customers received not only traditional products from overseas in the grocery store. Besides spices, sugar, coffee, tea, chocolate, citrus fruits and rice, there was also rapeseed oil, lard, sauerkraut, herring, onions, baking powder and pudding: The grocery store was already on its way to the supermarket of today. With the increasing spread of the classic colonial goods, the product

coverage expanded to a comprehensive range of everyday goods. Accordingly, it could hardly be spoken of grocery markets anymore, but rather of supermarkets since the 50s of the 20<sup>th</sup> century (Schwedt, 2006).

The self-service of the supermarket eliminated a part of the work of the *Mom-And-Pop-Stores* or moved it to a different context. The manufacturer took over the weighing and packing, the customer selection and transport and the central cash desk the computational work. The new system required a change of habits and needed some adjustments for all stakeholders. However, they saw it as a time saver and they felt greater autonomy and freedom. Most of the customers did not view the reduction of social communication due to the self-service-system as a loss. Customers even welcomed the new shops that did not deal with *open* goods. Instead, they trusted in the food industry's packaging methods (König, 2013).

Nowadays, *Mom-And-Pop-Stores* are not extinct completely. Small Turkish and Greek businesses and those of other immigrant nationalities have continued the tradition (Schwedt, 2006).

#### 2.1.3 The Rise of the Supermarket

Over many centuries groceries were offered without packaging on markets or in local grocery stores, although the procedure of weighing and packaging of the groceries at the market place was time intensive for vendors and customers. Over the years, people became more aware of hygienic issues, because of epidemics and other illnesses caused by bad hygiene. Around the 19th century, this new demand and need for packaging resulted in new specialized companies developing machines and factories to produce better packages for groceries. During the next hundred years the development was going further and the machines were finally able to fill packages with food and close the packages afterwards. The grocery shopping and its underlying system of trading changed in these years in a far-reaching way. No more self-sufficiency dominated, but the market supply. Fewer and fewer people lived in the countryside, where self-reliance was an easy option. And more and more people lived in the city, where they were dependent on the supply of the market. The markets themselves widened out from local and regional to national and global scale. This development was relatively slow until the breakthrough of the selfservice markets in the grocery sector after World War II (König, 2013).

According to the Brockhaus Encyclopedia from 2001, the self-service principle was introduced in 1917 in the United States. The first self-service shop in Germany was opened in 1939. Frank W. Woolworth (1852-1919) had already observed in its early years of operation that many customers like to take the product into their own hands to buy it afterwards. Californian merchants grabbed this idea to save staff salaries and to reduce overall costs and perhaps to stimulate the consumer's desire to buy. The principle of a self-service store was simple: The customer enters, looks around, collects the goods and pays at the store exit. If the goods are neatly positioned and easy understandable, the bias of the customer wanes and his decision is impulsive. Other simplifications provide further incentives. There is no need to wait until it's the customer's turn, because the packages are already done. Though, this concept was totally unfamiliar for the customers at the beginning, the supermarket system spread especially very fast across the United States. Michael Cullen was finally known as the inventor of the supermarket (Schwedt, 2006).

#### 2.1.4 The Modern World of Groceries

Finally, in the last decades the packaging industry has completely eliminated the dosage with hand or shovel, the scale, the paper bag and glass bottles used earlier to carry the groceries from the store to the home place. According to the packaging industry the effects of this development were an increased hygienic standard and high efficiency saving costs and time (Piringer, 1992).

At the same time, packaging was added with a new function, namely advertising. With the development of brands, advertising became a crucial aspect to communicate the benefits and functions of the product. The brand was characterized by standardized and therefore uniform quality and differed from the traditional goods by the external appeal. An elaborate, color-designed packaging and the brand should trigger purchase incentives and ensure recognition by the customer. As a consequence, the brand was equally as important for customer loyalty as for attracting new buyers. Nowadays, the advertising space is used in the first place to attract the customer's attention. This is not surprising, because many very similar products fight for the customer's attention. As a result, the design of the package is the only differentiator. In self-service stores packages took over the role of silent vendors (König, 2013).

With the rise of the supermarkets another development was happening. A dramatic decline of food prices came together with the rise of families incomes. In 1800, American and German families spent 80 to 90 percent of their income on groceries. Around 1900 half of their income was spent on groceries. Nowadays it is only 10 to 15 percent. The largest decrease took place after the Second World War (König, 2013). It can be assumed that the loss of value for groceries in terms of money and importance correlate with the emergence of market-supply and self-service of supermarkets.

Nowadays, discounters dominate 40 percent of the food trade. Few food trade corporations dominate the food business nationally and internationally in such diverse markets such as Western or Eastern Europe, Asia, North and Central America. The retail landscape is varied and mercilessly be set by price wars. New concepts of various kinds are constantly evolving, such as convenience stores, concept stores. Even the *Mom-And-Pop-Store* celebrates its revival (Umdasch, 2011).

### 2.1.5 User Experience in Grocery Markets

Due to market saturation, declining product loyalty, reduced length of stay in the store, interchangeability of products (*me-too products*) and increasing stimulation, the quality of the *User Experience* at the point of sale is becoming a more pertinent reason to buy or not to buy.

Eric Reiss (2011), member of the *Interaction Design Foundation*, explains *User Experience* as the perception left in someone's mind following a series of interactions between people, devices, and events. Further these interactions can be active (e.g. giving a waiter your order at a restaurant) or passive (e.g. viewing a beautiful sunrise will trigger the release of reward chemicals in our brain). This applies to all of the human's five senses. But there are also secondary interactions that can not be experienced directly but are still there (e.g. the food tastes good because the chef chose quality ingredients and prepared them well and the ingredients are of good quality because the farmer tended his fields).

Based on the ISO 9241-210:2010 User Experience is defined as follows:

"A person's perceptions and responses that result from the use or anticipated use of a product, system or service." (Allanwood & Beare, 2014, p. 12).

Pine & Gilmore (1999) define the transformation to a post-materialistic experience society related to business terms as *The Experience Economy*. As mentioned earlier, retail has to face many challenges. Today, it is known that 70 to 80 percent of purchase decisions are made unconsciously and emotionally (Lach, 2011). This increases the relevance of a well-designed experience for the customers that provide joy and excitement when interacting with the grocery market.

However, many retailers provide overabundance at the point of sale that leads to increased stress for the customer. These stressors add up through the entire overstimulation of the store environment: wealth of information through a forest of signs on the ceiling or in the room, disturbing diversity in colors and material layout of the facility design, over-motivated light show, acoustic pollution, etc. *Consumer Confusion* marks a scientific theoretical construct of environmental psychology research, which has a clear effect-relationship between information overload and the resulting individual purchase avoidance or reduction strategies. A permanent sensory overload leads not only to disruption of information processing at the cognitive level, but also dissolves negative emotional reactions (Traindl, 2011).

In this context, *Multisensory Enhancement* means that it is important that sensory stimuli can be enhanced by pulses that are addressed to other senses. Such an event is several times more intense and is experienced when different sensations interact and thereby fit together in meaning. *Cue Management* is the coordination and choreography of the various sensory stimuli (Ulrich, 2013).

One approach to reduce the *Consumer Confusion* in today's supermarkets and enhance at the same time the *Multisensory Experience* is to return to former grocery market concepts. There, a customer went into a store welcomed by the vendor. The customer had a particular need, was served by the vendor and received the required product (Leitl, 2011). This simple concept was already discussed earlier as the famous *Mom-And-Pop-Store* (see Section. 2.1.2). This *old* store concept is now revitalized by the means of another approach that is explained later in detail (see Section 0).

However, the rise of the supermarket and the principle of self-service facilitate the packaging of groceries. In the next section the functions and the problems of packaging are discussed in more detail.

## 2.2 The Packaged World

"In China for more than two thousand years, it tells the story of a businessman who traded with pearls. Because he wanted to achieve the best possible price, he used a particularly fine packaging. For the box he chose valuable timber, stocked it with expensive jewels and perfumed it with expensive additional flavors. The highest bidder finally got the box. The beads, however, he gave back to the dealer, but what he really liked was just the packaging." (Ullrich, 2013, p. 31)

The first packaging of groceries arose in ancient times. In order to protect and transport the goods of pottery the Romans used special carafes. Though, most of the food was presented and bought in an unpackaged way over the last centuries. But about 60 years ago something important changed. Shops popped up, where no longer a seller stood behind the counter, who advised and served customers. In modern supermarkets the products had to speak for themselves. They had to prevail against the competition. Packaging got a new function: it had to sell (Zeug, 2014). This and all other functions of packaging are discussed in the next section. Afterwards, the problems and challenges of packaging are elaborated. Finally, possible solutions are explained.

#### 2.2.1 Functions

In Stehle (1989) three target groups of packaging can be identified as follows:

- Customer: The first target group the customer expects that the groceries are easy to identify in a store space. Product information should be easy to read (e.g. price, quantity, quality, minimum durability). Further, transparency in terms of visibility of the food itself should be guaranteed. The package allows suitable portioning and protection against external influences. The usability of grabbing, stacking, opening, closing and disposing is another relevant function of the package for the customer.
- Retailer & Wholesaler: For this target group the functions for storage and transportation are the most important ones. Standardized packages make it easier to load, move and stack packages. Finally, standardization is spaceefficient and saves storage costs. The function of storage should protect the groceries against oxygen (vacuum-packed), high humidity and/or dryness,

(radioactive) contamination, dust, temperature variations exposure and pathogens, micro-organisms, bacteria, rodents and insects.

Producer: For the producer the protection of the foodstuffs is the core function of the package. For instance, preservation of the flavor is critical for some products (e.g. tea). In general, the extension of the minimum durability of food products is the basis for the globalized food system. They are more and more often on a long journey from the place of production to the place of consumption. Therefore, packaging plays a key role in extending the minimum durability of foodstuffs. Besides these issues, the designed package should be able to be produced by automated packaging machines.

Based on the three target groups and their different needs and expectations Piringer (1992) addresses the three basic function categories of packages.

- Protection: The most important excellence criterion of packaging is to maintain the quality of the foodstuffs. From the point of production to the point of consumption a package should provide protection against all external influences (e.g. mechanical damage) during transportation and storage and maintain the quality of the foodstuffs against chemical deterioration and/or the loss of ingredients and substances (e.g. flavors).
- Distribution: The modern self-service in supermarkets is only possible due to an optimal organized distribution system of standardized packages. Further, packaging can support the customer with integrated dosing equipment, nozzles and other tools for easier use. Finally, packaging assists the customer with appropriate portions to know how much is needed for a meal (König, 2013)
- Labeling: The third core function is the labeling of foodstuffs. This information is especially important for the customer to inform about minimum durability, ingredients, supplements, quality, quantity, price, producer and origin.

Besides these core functions there are several secondary functions that have become more relevant in the recent history of the packaging industry.

 Hygienic Function: Especially in the western world, hygiene is a crucial aspect for customers to buy or not to buy groceries. Based on past epidemics and increased awareness of bacteria and pathogens people have gotten more sensitive concerning hygienic issues. The food industry reacted on this trend with special advertising campaigns, which emphasize that products are produced completely sterile and are touched by no human hand (König, 2013).

 Advertising Function: The product packaging is above all advertising space to get the attention of the customer that makes it easy to be recognized in store spaces. Packages took over the role of the sales personnel of former grocery markets (König, 2013). Customer associate feelings and emotions with the aesthetic design of the package, but not directly with the groceries itself (Ullrich, 2013). Schwedt (2006) mentions in this context the temptation or manipulation of customers to buy groceries. Advertising and marketing aim to exploit these possibilities of communication with packaging (Schwedt, 2006).

Stehle (1989) and Piringer (1992) emphasize on the one hand the high importance of packaging for the quality of the groceries, but on the other hand they admit that packaging has also negative implications on society. Piringer states that packaging is a symbol of the so-called *throw-away-society*. Another problem is the transmission of chemicals from the package into the food (e.g. plastic particles). These and further issues with packaging are discussed in the next section (see Section 2.2.2).

## 2.2.2 Problems

It is easy to open, keeps the innards fresh and in good quality, visualizes if the product is mellow and is very easy to dispose without toxic debris. This extraordinary package is the ordinary banana peel. Unfortunately, commercial packages are not so smart (Lunzer, 2012). Further, packaging lead to several problems that are discussed in the following sections.

### **Economic Cost of Packaging**

More and more money is spent on the staging of products where the package plays the leading role. The staging of groceries with packaging is relatively costly. Papanek (1985) stated that beginning in the 80s more money was spent for packaging than the farmer got as income. An example: A bottle of beer can cost five times as much as the liquid beer in it. This was expected to rise year by year. Although this development has not been seen in the following years, packaging is a crucial factor due to material and energy consumption. By an example of a typical water bottle made out of plastic, it can be seen that the resource consumption is not very ecologic in the first place. Further, there is no deposit system in place to reuse the bottle. Reusable glass bottles vanished completely from the supermarket systems in the last years. Also, the bottle design is clearly focused only on the sequence of opening, drinking and discarding of the bottle. In the trash bin the water bottle became an ecologic problem the second time, either for recycling purposes or for waste combustion. In both ways energy is needed, e.g. for transport, machinery and processing (Ullrich, 2013).

It is estimated that annually in the United States alone the movement of waste to landfill costs about 50 billion dollars. If we add the costs incurred in collecting, transporting, sorting and land filling of waste the result is about one trillion dollars. These trillion dollars apply in the national accounts as an investment in productive activity, but in fact this type of waste management is an unproductive sector. The use of land as landfill is unproductive. Further, pollutant infiltration and the costs of avoiding are at the expense of society (Pauli, 2010).

#### **Ecologic Cost of Packaging**

When considering product packaging from an ecological perspective, it seems likely that they have an extremely poor ecological footprint. Most fossil fuels such as oil are used to produce films that bring a product safely from the production site to the customer. Once arrived there, the package immediately ends up in the trash bin. The result is high resource consumption for short-term benefits (Lunzer, 2012).

Obviously, there is a problem with packages that cannot be returned to the material's original life cycle. Recycling is one hope to overcome this challenge. But latest studies showed that the European Union hast an average recycling rate of 35 percent. Austria is by far the leader in this ranking with approximately 63 percent per year (Umweltbundesamt, 2013).

The downside is that recycling processes cost a lot of energy, time and money. Overall the recycling system makes the process more complicated for the customer. From the production of the packaging material to the customer many mechanisms have to fit together to make recycling even possible (Braungart et al., 2013).

Although recycling is not the ideal solution, nevertheless, it seems more promising than depositing on landfills. Most remains of our consumer culture are collected centrally and as soon as space is limited the waste is burned. It is misleading to claim that the incineration of waste produces energy. Garbage is usually burned only in order to reduce the volume through the escape of fluid. Most components maintain except water (Pauli, 2010).

But, it is not only the ecologic impact of packaging as waste, but also the outcome of emissions during production of packaging. Nowadays, most processed foods are packaged. The manufacturing of the packaging (e.g. aluminum, plastics) accounts for 70 to 80 percent of the overall emissions of the food industry (Thackara, 2010).

#### Food Waste

In private households enormous quantities of food are thrown away, about a third even unopened and untouched. The reasons for waste are eclectic and concern the whole value chain from farmer to consumer. This is due to bad planning, improper storage, too large commercial packs and tempting bargains. Experts regret the lack of knowledge by consumers about the minimum durability of packaged groceries. Due to the minimum durability of food products a huge percentage is thrown away by consumers. Some of these issues refer directly (large packages) and indirectly (storage and planning) to packaging. When it comes to the consumer one major reason for waste are too big units of packages combined with quantity discounts that attract people to buy more and cheaper groceries. The fact that groceries are packaged supports that the consumer lacks care and knowledge (Kunz et al., 2013).

The effect is increasing food waste, especially in the western world. Based on the Food and Agriculture Organization of the United Nations (FAO) roughly a third of all produced groceries are thrown away worldwide (approximately 1.3 billion tons of food products). Especially in the Western countries this number is even higher. Approximately 100 kg of groceries are thrown away per capita and per year in the European Union (Kunz et al., 2013).

#### 2.2.3 Solutions

Regarding the problem of packaging in the food industry and its ecological implications for our society, possible solutions are discussed as follows.

#### Shortage of Minimum Durability

The shortage of the minimum durability of foodstuffs would decrease the requirements for packaging and therefore would lead to a reduction of packaging volume and complexity (Piringer, 1992).

#### High Technology Packaging

Technological improvements in reducing the wall thickness of glass, metal or plastics could further decrease the package volume to a minimum, nevertheless, there is not so much potential left (Piringer, 1992).

#### **Eco-Balance Sheets for Packaging**

Dr. Thomas Lindenthal works at the University of Agricultural Sciences and the Research Institute of Organic Agriculture (FiBL) and calls for the evaluation of product packaging with regard to sustainability. So-called eco-balance sheets are useful because they could motivate retail, wholesale and industry to use packaging with low environmental impact. It would also help to enlighten the customer and provide an important basis for shopping decisions (Lunzer, 2012).

#### **Digital Package Information**

Product packages are full of information as for example product name, brand, manufacturer, price, country of production, (food) ingredients. The future is to digitalize this information and transfer it to online resources. QR-Codes<sup>2</sup> could be one potential technology to access this information very quickly by the customer (Lunzer, 2012). Depending on the function of the information it can be replaced as shown in the following examples:

- Identification Information: It must be visible which product is offered in the store. The objective term, type, sort is information that must not directly be printed on the package itself (Lunzer, 2012).
- Differentiation Information: Brand names, slogans, logos and other brandrelated information in order to differentiate from competition could be separated from the product with in-store solutions (Lunzer, 2012).

<sup>&</sup>lt;sup>2</sup> Quick-Response-Codes

- Merchandise Management Information: This type of information is mostly represented by barcodes nowadays, but could be replaced in the future by RFID-Technology<sup>3</sup> or QR-Codes (Lunzer, 2012).
- Law-Binding Information: Allergen information on foodstuffs is typical data that is required by law. Also here, detailed information could be more useful in digital form as compared to a small print on the package, as for example: "May contain traces of nuts." (Lunzer, 2012)

#### **Reusable Packaging**

Another possible solution to reduce waste is the reuse of packages as often as possible (Piringer, 1992). Mostly, external packages are used to protect the internal packaged food. They are only in use until the product is in the retail store. Through reusable package systems huge amounts of packaging can be avoided (Lunzer, 2012).

#### **Recycle Packaging**

Another wide-spread solution is to recycle used packages and use it again for food packaging. This is only possible for packages that can be cleaned without contamination. Unfortunately, with many packages recycling cannot be achieved very easily. Instead, *Downcycling* is the only option (Piringer, 1992).

### **Avoid Packaging**

The bundling for sale units is only relevant for liquid products and so-called bulk goods (e.g. milk packing, toothpaste tube). Piece goods, however, could also be sold in bulk. This is useful for fruits and vegetables, where this is partly the case. Waste prevention must be treated as a priority, and therefore it is important to reduce packaging in the first place (Lunzer, 2012).

This research focuses on the latter solution to avoid packaging in the first place (see Section 0). Problems and challenges in the packaging industry relate directly to sustainability issues. The next section deals with sustainability in general and especially with sustainable strategies to overcome the challenges of packaging waste (see Section 2.3).

<sup>&</sup>lt;sup>3</sup> Radio-Frequency-Identification-Technology

## 2.3 A Sustainable World

"What people produce is especially garbage and mostly toxic." (Braungart, 2013, p. 23)

Broadly speaking, the term sustainability is not that clear as one might think. Based on a survey in 2006 only 11 percent of Germans were able to match the term sustainability correctly. Similar findings can be observed in other countries. Further, sustainability is a relatively modern term that was formed by the ecologic movements in the second half of the 20<sup>th</sup> century. Also experts are not able to agree on one definition (Stengel, 2011). An internationally well-known definition is given by the Brundtland-Report *Our Common Future*:

"Sustainable development is the development which meets the needs of the present without compromising the ability of future generations to meet their own needs." (Brundtland Commission, 1987, p. 87).

Brunner (2005) notes that sustainable development means that social development is examined worldwide for their ecological viability, their economic tolerance, social justice and their time persistence and optionally changed in this direction. Sustainability was interpreted for a long time exclusively in ecological terms. Nowadays there is a three-pillar model in place that integrates not only ecological and economic, but also social dimensions (Brunner, 2005). In the view of many critics, the model describes the economic, ecological and social sustainability equally to one another. However, the objective of environmental sustainability must be a priority, since the protection of natural conditions is a prerequisite for economic and social stability. This led to the development of the so-called *sustainability egg.* Ecology, society and economy are organized hierarchically. The nature forms the existential basis of society, whose economic activity is a partial sphere of the social context (Busch-Lüty, 1995).

#### 2.3.1 Sustainable Dimension of the Food System

From the perspective of energy and material flows it can be recognized that the food system is characterized by a high primary energy consumption and high material intensity. Studies in different countries have shown that the food sector is next to home and construction, energy supply and transport one of the sectors with the greatest environmental impact. The direct share of consumers is estimated at about a quarter. Other environmental impacts are given by the modes of procurement, storage, preparation and disposal (Brunner, 2005). The association of *Food Coops*<sup>4</sup> states that the social, environmental and energy balances of today's agriculture system are negative. The associated effects range from soil degeneration and devastation, greenhouse gas emissions and high transport, energy and packaging costs. At the same time supermarkets play a major role in spreading this system. They promote a so-called *throw-away capitalism*, where 30 to 50 percent of the food is thrown away on the way from the field to the home (Food Coops, 2014).

In section 2.2.2 it is stated that packaging production plays a major role in the total emissions of the food sector. Mostly, processed and packaged food is purchased in supermarkets that consume electricity to keep foods frozen, especially in open display units for convenient take-out. In the larger supermarkets up to a quarter of their energy budget goes on lighting to make the food look good. And more than 50 percent of food in developed countries is retailed under refrigerated conditions (Thackara, 2010).

### 2.3.2 Waste Management

In Bilitewski & Härdtle (2013) the modern waste management can be dated back to the 60s in Germany where legal prerequisites were established to remove waste in a controlled manner. Although, thousands of years before that, humans had no means of waste management. Many epidemics in the last centuries arose due to bad or no waste management. Bad hygiene was one serious consequence. At the end of the 19<sup>th</sup> century the first waste incineration plants were established in Europe. The reasons for these plants were to combat landfill and to produce energy by burning waste (Bilitewski & Härdtle, 2013).

#### Recycling

At the turn of the 20<sup>th</sup> century the first time recycling was introduced to retrieve reusable materials out of waste. In the first facilities the reusable materials were collected manually whereas nowadays machines do this work (Bilitewski & Härdtle,

<sup>&</sup>lt;sup>4</sup> Food Coops are an alternative food distribution concept based on the community.

2013). Although, only a maximum of 30 percent of the moving masses are technically recyclable. And no recycling process can be traced back 100 percent of the materials used. Aluminum is considered to be highly recyclable, since it can be recovered to 90 percent. However, this process consumes a lot of energy, machinery and transport services and only 20 percent of the originally used mass of aluminum is available after 15 recovery cycles. This type of recycling can also be called *Downcycling* (Stengel, 2011).

#### Downcycling

Leonard (2007) discusses the materials and waste economy from a critical point of view. In the short movie *Story of Stuff* it is visualized that the stages from extraction, production, distribution, consumption and finally disposal are designed linear in today's economy, whereas a closed loop should be in favor. Leonard differentiates between true recycling, which achieves a circular closed loop production process (e.g. a bottle into a bottle into a bottle) and *Downcycling* which re-processes a material into a lower grade material and a secondary product (e.g. a plastic jug into carpet backing). True recycling seeks to eliminate the natural resource input and the waste output of making the product. On the other hand, *Downcycling* at best reduces the natural recourse input for the secondary item but does not reduce the natural resources needed to make the original item. In fact, by advertising a product as recyclable the demand for that first item may actually rise, ironically creating a greater demand for natural resource input (Leonard, 2007).

As a solution Leonard mentioned inter alia *Zero Waste* (see Section 0) and the *Closed-Loop Economy* that can be classified as sustainable means of dealing with materials and energy. A sustainable world is not just idealistic, but has many valuable reasons that have high economic impact as well (Leonard, 2007).

#### Deposit versus Non-Disposable System

In *Closed-Loop-Systems* it has to be differentiated between deposit and non-disposable systems. Disposable containers are packages made of glass or plastic (usually PET<sup>5</sup>), aluminum or iron, which can be filled only once. The packages should be recycled

<sup>&</sup>lt;sup>5</sup> PET, Polyethylenterephthalat

after a single use and fed separately to waste collection. Deposit containers are glass or plastic packages (usually bottles). When purchasing a deposit, an amount will be charged which is refunded upon return of the deposit package at the supermarket or at the point of sale again. The container comes from the supermarket back to the bottling plant, where it is cleaned, refilled and comes back to the market again (Pladerer, 2013).

By the example of glass bottles it can be clearly seen that the use of a deposit system is more ecological than a disposable system. There are several advantages that are characteristic for a deposit system in contrast to a disposable system (Pladerer, 2013):

- The multiple refilling of containers helps to save resources and energy. Nonreturnable glass containers need about 50 times more raw materials. Disposable plastic bottles need about 17 times more raw materials.
- Disposable plastic bottles are already 100 percent waste after a single use (residual waste, separate waste collection of recyclables or littering). In any case, this is associated with an additional transport and energy expenditure that are not needed with a reusable system.
- Beverage bottles without deposit are increasingly thrown away (littering).
   Reusable bottles are an active contribution to the prevention of littering.
- Only 2.5 percent new material is required per cycle in a deposit system (screw caps, demolished bottles).
- Refillable containers help to save CO<sub>2</sub> emissions.
- Deposit systems strengthen the regional economy.

#### **Closed-Loop Economy**

The *Closed-Loop-Economy* sets its target to think in a closed loop instead of a linear loop of resource extraction, production, distribution, consumption and disposal. Starting from the basic ranking of the waste hierarchy (see Figure 2.1) always the measure of waste prevention gets the highest priority that ensures the protection of human health and environment best.



Figure 2.1. Waste Hierarchy of the Closed-Loop-Economy<sup>6</sup>

The most important measures for waste prevention are the following (Bilitewski & Härdtle, 2013, p. 18):

- The system-internal cycle management of materials within production plants.
- The product responsibility for low-waste product design.
- The behavior of consumers that is focused on the acquisition of waste and lowemission products and the use of reusable packaging.

Especially, the latter two points are of interest for this research. The product responsibility of product design is discussed later on (see Section 2.5). The behavior of consumers focused on low waste is discussed under the term *Precycling* or *Zero Waste* in chapter 0.

<sup>&</sup>lt;sup>6</sup> Bilitewski & Härdtle, 2013, p. 17

#### Upcycling

Beyond the *Closed-Loop-Economy* there is another concept that is called *Upcycling* as opposed to the dilemma of *Downcycling*. The goal of the so-called *true recycling approach* is visionary as the following definition might assume.

"Goal of upcycling is a wonderfully diverse, safe, healthy and just world with clean air, clean water, clean soil, and clean energy - a world which we can delight us in many ways and in boundless harmony." (Braungart, 2013, p. 26)

One of the most important concepts of *Upcycling* is *Cradle-To-Cradle* opposed to *Cradle-To-Grave*. The latter term is used to describe a linear model for materials that begins with resource extraction, moves to product manufacturing, and ends with a grave, where the product is disposed in a landfill. *Cradle-To-Cradle* is a term used in life-cycle-analysis to describe a material or product that is recycled into a new product at the end of its life, so that ultimately there is no waste. It focuses on designing industrial systems so that materials flow in closed loop cycles which means that waste is minimized and waste products can be recycled and reused. *Cradle-To-Cradle* simply goes beyond dealing with issues of waste after it has been created, by addressing problems at the source and by re-defining problems by focusing on design (McDonough & Braungart, 2014).

In the concept of *Upcycling* the *Cradle-To-Cradle* idea is developed further. Materials can be designed that they differ between the biosphere and the technosphere and be eternal nutrients (see Figure 4). Thus, the waste of an animal becomes the food for microbes, fungi, plants, trees, reptiles, mammals, etc. and maybe even for humans. The term *Technical Nutrients* include metals, plastics and other materials which can not be re-created from the biosphere continuously. Instead of becoming waste in a landfill, these products could be food for another product, which in turn could be food and this can go on and on (Braungart, 2013).



#### **Biologischer Kreislauf**

#### **Technischer Kreislauf**

#### Figure 2.2. Biological and Technical Cycles<sup>7</sup>

The biological and technical cycles can be described as follows: A typical juice pack is a mixture of aluminum, plastic and raw paper that is not easy to recycle. There is a very special and rare plant required that separates the components from each other again and the material reassembles. Aluminum alone - a technical nutrient - can be recycled, as long as it is clean, again and again without losing its value. But if cardboard and plastic is put together the quality of aluminum is harmed as a technical nutrient. The biological nutrient cardboard itself is tainted by the combination with aluminum. This leads to mountains of primitive packaging on the heap of an incinerator. The precious aluminum is lost to an endless cycle. Soil and air are contaminated. This conventional design can be called *Cradle-To-Grave*. It aims at single use, after which the material is discarded and finally thrown away (Braungart, 2013).

#### 2.3.3 Reasons for Sustainable Products

Although there is a consciousness for the problems of the waste management nowadays, new concepts as for example the *Closed-Loop-Economy* or *Upcycling* (*Cradle-To-Cradle*) are still not very common. Surprisingly, because Knappich (2010) identifies several advantages of a sustainable product world.

<sup>&</sup>lt;sup>7</sup> Braungart, 2013, p. 26

- Ecologic products act as innovation drivers: Markets for environmental products and services imply tremendous growth and innovation potential. Both aspects are in times of saturated markets of great importance. In particular, it plays an important role to achieve innovation edges and to fill gaps in the markets as early as possible, as the success of the innovators can not be caught up very easily by the imitators.
- Ecologic products enforce save environment and nature: An intact nature and the resources contained within it are the main livelihoods of the people and thus the companies. People and therefore employees, customers and companies settle preferentially in a pleasant, stimulating and not in a life-threatening environment.
- Saving resources provides advantages in pricing: Conservation of resources is regularly associated with the benefit of cost reduction, which is not least also yields a greater scope for the price policy. Savings are possible in raw materials, materials and energy. In addition, an immediate realization of environmental protection measures is cheaper than any later addition based on newly introduced environmental regulations. Often ecologically oriented companies gain additional opportunities to receive funding as research and investment, or they may get better terms for loans.
- Ecologic products are good for the image of a company: There could be massive behavioral consequences if significant environmental and hazardous practices are demonstrated. Image loss and reduced sales may occur, which may endanger the existence of the companies involved.

#### 2.3.4 Strategies for Sustainable Development

Stengel (2011) noticed that due to the increasing population in the world and the increasing prosperity in the developed, but also in the emerging and developing countries an increasing consumption of material and energy is forecasted in the next decades. At this very moment mankind needs 1.5 earths to cover the current living standard. Historian Wolfgang König (2013) comes to the same conclusion that the modern consumer society is reaching its borders due to the ecologic crisis where self-limitation is the only solution (König, 2013). In practical numbers, mankind has to reduce its ecologic footprint by at least 50 percent. In the *United Nations Summit* of

2002 in Johannesburg it was clearly stated that the changing patterns of consumer and the production methods are the prerequisites for a sustainable development. Therefore a reduction of consumption and production are the overarching objectives. In the last 30 years four strategies have been developed to reach these targets. Whereas the first two strategies (efficiency and consistency strategy) rely on technical innovations, the latter two strategies (regulation and sufficiency) focus on changing behavior. The four strategies are discussed as follows (Stengel, 2011):

#### **Efficiency Strategy**

As their name suggests, this strategy aims towards making processes more efficient to reduce the total amount of material and energy for the produced good, and generate as less waste as possible (Stengel, 2011).

The shortage of the efficiency strategy is that all processes become more efficient and materials are not as much wasted as before, but nature is still polluted in one or another way. The disadvantageous development is only slower (Stengel, 2011). In reality, this slower destruction of the human environment is even not true. The rebound effect shows that even high efficiency improvements are not keeping track with social developments and technical progress. For example, on the one hand the automobile is getting more and more efficient in terms of gas consumption, but on the other hand the overall traffic is increasing year by year. In the end the overall gas consumption is higher although the efficiency is getting better (Stengel, 2011).

In terms of waste management, recycling (or *Downcycling*) can be named as an example of the efficiency strategy (see Section 2.3.2).

#### **Consistency Strategy**

This type of strategy aims at the development of products that can be re-used as technical or biological raw materials after use and/or consumption. The vision is to reach 100 percent recycling rate whereas nature is the ideal model. The aim is to re-integrate all materials back into the natural and technical cycles. Natural and technical metabolism should complement each other. Consistency means in this context that nature and industrial production are compatible to each other (Stengel, 2011).
The strategy of consistency has made some impressive achievements in the last years, but related to a system change there is more time and research in basic innovations needed to realize fully *Closed-Loop-Systems* (Stengel, 2011)

In terms of waste management, *Upcycling* can be named as an example of the consistency strategy (see Section 2.3.2).

### **Regulation Strategy**

Whereas the efficiency and consistency strategy focus on the technical perspective, the regulation strategy is concerned with the control of human and/or social behavior through rules and laws. Politics is the main force of regulation strategies. Either obligations or incentives are used to change people and society to a more ecologic and sustainable behavior. The deficit here is that political processes are slow and dependent on the public opinion (Stengel, 2011).

In terms of waste management, recycling (or *Downcycling*) can also be named as an example of the regulation strategy (see Section 2.3.2), because recycling is often imposed by regulators.

#### **Sufficiency Strategy**

This strategy is a so-called *Dematerialization Strategy*, because material and energy is reduced in volume by changing the lifestyle of consumers without compulsion. In contrast to the efficiency and consistency strategy the sufficiency strategy focuses not on reduction of material and energy in the first place, but on the change of human behavior to consume in a reasonable way. Sufficiency comes original from the Latin term *sufficere* and means *enough*. Small is beautiful, less is more or quality over quantity are some catchphrases that stand for the sufficiency strategy. The biological need is more or less the sufficient consumption. Although, in the European Union the not sufficient consumption amounts to 75 percent of the total consumption.

The sufficiency strategy is innovative compared to other strategies, because the attention is shifted from the producer to the consumer, from the input to the output. In detail, if this strategy changes the output, the input is changed as well, because the mass of consumption, the demand, is responsible for the overall worldwide production and resource utilization.

Two aspects of the sufficiency strategy are interesting for further research. First, materials are not produced in the first place if not absolutely necessary. Second, the change of the lifestyle is at the core of the strategy. Both aspects are related in the concept of *Zero Waste* or *Precycling*. This concept is explained in the next section (see Section 0). Due to that, in terms of waste management, *Precycling* can be named as an example of the sufficiency strategy.

# 2.3.5 Paradox of Sustainable Consumption

This research focuses on the sufficiency strategy. Therefore, the consumer behavior is researched more deeply. At least, three general paradoxes are visible when it comes to the relationship between consumer behavior and sustainable products:

### Paradox I: Increased ecologic awareness neglects sustainable products

The environmental awareness should be associated with corresponding types of consumption. Despite their increased environmental awareness the majority of consumers prefer the less environmentally friendly product variants. As a consequence, the companies will just continue to produce on the basis of their market orientation, the ecologically problematic products. For companies, this fact provokes a confusing situation. On the one hand, the demand of consumers concerning the environmental qualities of products and services rises. On the other hand, the higher ecologic costs and/or curtailments in the convenience in consumption are hardly rewarded by the markets. Thus, massive innovations rarely appear lucrative (Kroeber & Weinberg, 2003).

However, there is an intensive discussion about the possibilities of influencing the consumer to an increased sustainable or ecologic behavior. The prevailing opinion shows here clearly an emphasis on factual aspects, combined with ethical reasoning and moral appeals to favor. However, the limited achievements raise doubts about this strategy (Kroeber & Weinberg, 2003). Later on design is discussed as another influencing factor for changing the consumer behavior (see Section 2.5).

#### Paradox II: Information overflow prevents from buying sustainable products

Because of the general information and decision overload purchasing decisions are often simplified by the customer. As a consequence, there is only little room for an exploration of the ecologic relevance of consumer goods. Advertising claims, key information or advice by other consumers is trusted uncritically compared to selection processes based on ecologic criteria. Often, habitual purchases are made to simplify purchasing decisions (Knappich, 2000).

### Paradox III: Ecologic knowledge does not include ecologic actions

It could be shown that people, even though they have a sufficient environmental knowledge, do not act accordingly environmentally responsible, and thus also not sufficient. Conversely, it could also be shown that individuals follow a sufficient lifestyle, although their environmental knowledge is low. They respect the environment without having an adequate knowledge (Stengel, 2011).

Thus, environmental protection for 96 percent of EU citizens is an important and for two thirds it is actually a very important concern. The vast majority of respondents (86 percent) think their behavior plays a role in environmental protection. Nevertheless, most of them act in their daily lives as if neither their ecological concerns nor their environmental responsibilities are of greater importance. Many say that they separate their waste (59 percent) and save energy (47 percent). However, if there are more complex measures needed with changes in their lifestyle and their consumer habits (purchase environmentally conscious products, reducing the consumption of disposable products), 70 to 80 percent remain passive. It can be assumed that the numbers in reality are even less favorable because respondents often tend to give socially acceptable answers (Stengel, 2011).

However, the sufficiency is dependent on the willingness of consumers to change their own lifestyle and this readiness is at present insufficiently available, at least for the majority of consumers (Stengel, 2011).

In this context, Brunner (2005) notes that for the consumers easily understandable recommendations that can be integrated into everyday routine must be made available to allow alternative courses of action, which can be realized without high transaction costs.

# 2.4 Zero Waste & Precycling

In this chapter the definitions and principles of the terms *Zero Waste* and *Precycling* are discussed in detail. Further, the combination of the *Zero Waste* philosophy with grocery markets is described showing a typical grocery shopping process with examples from already existing grocery markets.

### 2.4.1 Definition

The term *Zero Waste* is not widely known and used based on online and literature research. There is a lack of definitions in terms of quantity. Often, definitions are very fuzzy and not specific. The most cited definition is from the *Zero Waste International Alliance*:

"Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health." (Zero Waste International Alliance, 2014)

From the perspective of how to successfully implement *Zero Waste* systems and products the phrase *to guide people in changing their lifestyles and practices* is critical. Although, there is much information about the *Zero Waste* movement and their principles and guidelines there is no information available about how to change to a more sustainable lifestyle according to the *Zero Waste* principles. The issue of how to change a consumer's behavior is discussed later on (see Section 2.5).

A more practical definition comes from Bea Johnson that sets up a *Zero Waste* home in practice:

"Zero Waste is a philosophy based on a set of practices aimed at avoiding waste as much as possible. In the manufacturing world it inspires cradle-tocradle design; in the home it engages the consumer to act responsibly." (Johnson, 2013, p. 14)

This *set of practices* is discussed in detail in section 2.4.3. Johnson separates the *Zero Waste* philosophy in more detail into two spheres: the production sphere and the consumer sphere. The *Cradle-To-Cradle* idea was already discussed in section 2.3.2 and focuses on cyclic thinking in production of goods. From the consumer perspective Johnson demands *to act responsibly* that aims towards the individual responsibility of the consumer. In this context, sustainable behavior has several barriers to overcome as already explained (see Section 2.3.5).

# 2.4.2 Goals

More specifically - according to the *Zero Waste* International Alliance (2014) - *Zero Waste* strives for the following goals:

- Zero waste of resources energy, materials and human
- Zero waste in production activities recycling, reclamation, sourcing
- <sup>D</sup> Zero waste in product life go to market, use, end of life
- Zero emissions –air, soil, water, solid and hazardous
- Zero use of toxics –processes and products

In general, Zero Waste is about preventing waste rather than managing it.

# 2.4.3 Principles

The Zero Waste hierarchy, or also the 5 R's called, connects the waste management techniques - *Refuse, Reduce, Reuse, Recycle, Rot* - in a pyramid where the best technique is on top of the pyramid (see Figure 2.3). The first and second R addresses the prevention of waste, the third R thoughtful consumption and the fourth and fifth R the processing of discards. If all techniques are not applicable the last and not desirable option is to discard or dispose the waste using today's waste management infrastructure (Johnson, 2013).





### Refuse (what you do not need)

The most preferable step in the hierarchy is to encourage producers to provide products or packaging that limit waste or emissions (Zero Waste International Alliance, 2014). On the consumer side it means to refuse what is not really needed. In fact, when something is not consumed ultimately it will not be discarded. In Johnson (2013) several actions for refusing are described:

- Avoid single-use plastics
- Reject junk mail
- Reject business cards, freebies, receipts, newspapers, magazines and other stuff for temporary use only
- Avoid buying products with excessive packaging

#### Reduce (what you do need and cannot refuse)

In general, the actions - use less, buy less, less packaging, bring your own and reduce toxic products and replace them with less toxic or non-toxic alternatives - are at the core of this step (Zero Waste International Alliance, 2014). Johnson (2013) mentions in this context the environmental crisis that on the one hand humanity lives on a planet with finite resources and on the other hand consumes in an infinite way year by year. *Reduce* highlights the *quality-over-quantity* and *experience-versus-stuff* mentality (Johnson, 2013).

<sup>&</sup>lt;sup>8</sup> Johnson, 2013, p. 15

#### Reuse (what you consume and cannot refuse or reduce)

On the manufacturer side reuse means to set up systems that require producers to take back products and packaging that create waste or emissions (Zero Waste International Alliance, 2014). The returnable sparkling water or milk bottle was an example for such a system. 20 years ago nearly 100 percent of these bottles were reused in a *Closed-Loop-System*. Nowadays, with total 18 percent this system is nearly vanished (Schuh, 2013). Many people are confused by the terms reuse and recycle. Whereas recycling is reprocessing a product to give it a new form, reusing is utilizing the product in its original manufactured form to maximize usage and extend its product life (Johnson, 2013). Fisher & Shipton (2009) propagate an *Open-Loop-System* where for example packaging stays in people's houses and serves as a new purpose. This strategy emphasizes the inventiveness and creativity of people to reuse stuff to save resources. Although packaging is made to be used just once, it can be shown that the consumer still finds ways to reuse it.

Johnson (2013) states that reusing is the tipping point of *Zero Waste*, because it can eliminate wasteful consumption, alleviate resource depletion and extend the useful life of the goods purchased. One major practice is to shop with reusable containers and reduce at the same time the need for consumer packaging (see Section 2.4.5).

#### Recycle (what you cannot refuse, reduce or reuse)

In the book *Cradle-To-Cradle* by McDonough & Braungart (2014) recycling is compared with an aspirin alleviating a rather large collective hangover due to overconsumption. With recycling there is not only the problem of *Downcycling* (see Section 2.3.2), but also that the process requires additional energy resources and lacks very often regulations to guide and coordinate the efforts of manufacturers, municipalities, consumers and recyclers. Recycling is a very complicated system with too many variables to make it a dependable solution to the general waste problems. It relies for example on the following prerequisites (Johnson, 2013):

- Manufacturers communicate with recyclers
- Products are designed for durability and recyclability
- Consumers are aware of local recycling policies
- Consumers purchase responsibly, buy recycled to create a market for recyclables
- Municipalities provide curbside recycling and collection locations

- Material recovery facilities to sort effectively
- Recyclers communicate with manufacturers

According to the *Zero Waste* hierarchy recycling is not the first option, but it is a better option than bringing waste to landfill, because it does save energy, conserve natural resources, divert materials from landfill and create a demand for recovered materials (Johnson, 2013).

#### Rot (the rest)

Rotting is simply the recycling of organic materials with the difference that it is not *Downcycling* but *Upcycling*. It is nature's way of recycling and allows for organic discards to decompose over time and return their nutrients to the soil (Johnson, 2013). As stated in Johnson (2013) composting represents the kind of *Closed-Loop-Economy* upon which our manufacturing model should have been based from the beginning.

### 2.4.4 Precycling

*Precycling* is - similar to the concept of *Zero Waste* - mostly unknown in literature. *The Environmental Encyclopedia* contains the only definition available as follows:

"Precycling is source reduction and reuse. In most waste management planning the hierarchy is Reduce, Reuse, and Recycle. Reduction and reuse are the first lines of defense against increasing waste volume. Precycling are those actions that can be taken before recycling becomes an option. It is the decision on the part of a consumer to not purchase an unnecessary product or the decision to purchase a reusable as opposed to a disposable item." (The Gale Group Inc., 2003, p. 700)

As an example, Precycling means to buy china plates instead of purchasing paper or plastic plates that are for one-time-use only. Furthermore, *Precycling* means to buy goods in bulk or to buy refillable containers and then use bulk containers to refill the containers with dispensers (The Gale Group Inc., 2003). This type of bulk bin with integrated dispenser system (see Figure 2.4) is seen in all *Zero Waste* grocery markets available (see Section 2.4.5).



Figure 2.4. Bulk Bin with Dispenser<sup>9</sup>

The *3 R's - Reduce, Reuse and Recycle -* are not equally relevant for *Precycling.* It emphasizes reducing and reusing, while questioning the momentum and popularity of recycling. This is justified by the fact that recycling requires large amounts of energy to melt down and then re-manufacture packaging items. While this may cut down on the amount of trash that is going to landfills, it is not sustainable unless the underlying energy supply is sustainable (The Gale Group Inc., 2003). Further, as it is discussed in section 2.3.2, recycling often means *Downcycling* and involves at least some loss of original material or quality. *Precycling* reduces these problems by using fewer resources in the first place. As a consequence, less has to be recycled.

Similar to the *Zero Waste* philosophy all measures of *Precycling* target the consumer who has to change the behavior. In general, both terms - *Precycling* and *Zero Waste* - have similarities with the sufficiency strategy (see Section 2.3.4). As sufficiency forces a dematerialization strategy (material and energy is reduced in volume by changing the lifestyle of consumers without compulsion), *Zero Waste* and *Precycling* aim towards the same direction.

# 2.4.5 Markets

In the last years the *Zero Waste* philosophy and principles were taken up by new supermarket concepts and individual initiatives in Europe and the United States.

<sup>&</sup>lt;sup>9</sup> Source: https://www.allcandycontainers.com/assets/images/509.jpg

Most Zero Waste markets rely on the first 3 R's - Refuse, Reduce and Reuse. The following list of Zero Waste markets in Europe and the United States may not be comprehensive, but covers all Zero Waste markets that can be found online (see **Table 2.1**).

Shop Name	City, Country	Opening	Web
Unpackaged	London, Great Britain	2007	http://beunpackaged.com
Effecorta	Capannori, Italy	2010	http://www.effecorta.it
in.gredients	Austin, United States	2011	http://in.gredients.com
Granel	Barcelona, Spain	2012	http://granel.cat
Effecorta	Milano, Italy	2013	http://effecortamilano.com
Maß-Greißlerei	Vienna, Austria	2014	http://mass-greisslerei.at
Unverpackt	Kiel, Germany	2014	http://www.unverpackt-kiel.de
Biosphäre	Berlin, Germany	2014	-
Original Unverpackt	Berlin, Germany	2014	http://original-unverpackt.de

Table 2.1. Overview of Zero Waste Markets

Pioneer of the *Zero Waste* trend is the market in London (see Figure 2.5). Whereas the shop in the United Kingdom already closed in 2014, many shops and small chains opened in the last years or will open in the next months and years. As this development shows, the number of markets has increased year by year. However, the real breakthrough of this new shopping experience can be seen in the future.

#### How it works

Although the design and size of the shops are different, the system of purchasing groceries is similar. The groceries are offered in bulk in containers or dispensers. The customers can come to the market with their reusable containers or just can buy containers in the shop. In general, the containers are reusable, but also recyclable alternatives as paper bags are provided. Taking into account the tare weight of the packaging in the final price, the containers must be weighed beforehand, either by the customers themselves or by a shop assistant. After marking the container with the tare weight, the customers can fill it with groceries according to their needs. At the cash desk the filled container has to be weighed for the second time calculating the net weight and the final price. This procedure has to be repeated for each grocery. At home, the customers can put their containers directly in the kitchen shelves without disposing any packaging. This procedure was experienced in the *Zero Waste* grocery market in Vienna in February 2014 (see Figure 2.9).



Figure 2.5. Unpackaged, London<sup>10</sup>



Figure 2.6. Effecorta, Italy<sup>11</sup>

<sup>&</sup>lt;sup>10</sup> Source: http://4.bp.blogspot.com/-3\_yK5u-p-Sk/UidAG0MRsTI/AAAAAAAAAAAQ/6aVx8pR6slY/s1600/13\_003Unpackaged\_440\_S hop\_Gravity\_Bins\_Landscape.jpg

<sup>11</sup> Source: http://designbusters.files.wordpress.com/2014/01/2012-effecorta-milanoitaly.jpg



Figure 2.7. ingredients, United States<sup>12</sup>



Figure 2.8. Granel, Spain<sup>13</sup>

<sup>&</sup>lt;sup>12</sup> Source: http://vivmag.com/wp-content/uploads/2013/02/MG\_7094.jpeg

 <sup>&</sup>lt;sup>13</sup> Source: http://1.bp.blogspot.com/ V24\_JeDLgo8/UOdMJq4ONKI/AAAAAAABATA/Hr2SD9Ps240/s1600/20130102+Gr
 anelL64A9656R.jpg



Figure 2.9. LUNZERS Maß-Greißlerei, Austria<sup>14</sup>

<sup>&</sup>lt;sup>14</sup> Source: http://diepresse.com/images/uploads/b/c/d/1510349/706AC774-60CD-4BD9-8F56-14695420B60C\_v0\_1.jpg

# 2.5 Change by Design

"If the container did not have all the printing embedded into the plastic, but rather a peel-away label or removable ink, the small package would certainly be considered cute enough to re-use and, if the product is effective, the item would be purchased again - for both the product and the packaging." (Fisher & Shipton, 2009, p. 133)

This chapter discusses briefly the role of design in today's production and consumption system. On the one hand design is the creator of the product culture as it is today. On the other hand design is also the trigger to change things. The quote above by Fisher & Shipton (2009) shows the power of design if a product contributes to a more sustainable use. In this context, also tiny changes in the product appearance and handling can have large impacts on the overall system that can result in creative reuse and less waste. Finally, this chapter describes the connection between sustainability and design and their power to change systems.

# 2.5.1 Product Culture

In general, today's product culture is characterized by a *one-time-use-and-throw-away-behavior* of the consumer. The roots of this culture can be traced back to the *Industrial Revolution* in the 19<sup>th</sup> century. As the *Industrial Revolution* speeded up, people just wanted that supply could meet demand. As a consequence, the thinking and designing was more hectic. The designers and manufacturers reached for the nearest short-lived idea that emerged. Long-term considerations rarely played a role (Braungart, 2013).

Not only products were designed for one-use-only or at least short use cycles, but also the packaging as Papanek (1985) reminds us in his book *Design for the Real World*. Industries uses so-called *creative packaging* in order to sell goods that may be shabby, worthless, or just low in cost, at grossly inflated prices. In 1981, Americans for the first time paid more for the packaging that contained their food than was paid to farmers as net income (Papanek, 1985). When we speak about pollution through products, the cycle is more complex than it is usually thought. According to Papanek (1985) it consists minimally of seven parts as follows:

- Natural resources are destroyed; moreover, these resources are usually irreplaceable.
- The very destruction of these resources by strip-mining, open pit mining, and so forth, creates a pollution phase.
- The manufacturing process itself creates more pollution.
- The same manufacturing process also brings worker alienation and anomie.
- Packaging
- The use of the product creates more pollution and user alienation and user anomie.
- Finally, discarding the product creates even more lasting sources of pollution.

If modern engineers and designers create a product today, it is usually designed only for the first use and not for other possible uses. The product comes in a descending cascade, it is always worth less. A good example is a plastic bottle containing food, then thrown away, melted down with other plastic and finally processed into a soil threshold. Not only that it is getting worth less, it becomes toxic, such as wood with using glue and formaldehyde-based on composite boards. What people produce is especially garbage and mostly toxic (Braungart, 2013).

Papanek (1985) added that design is one of the most harmful professions on earth. And also nowadays, Esslinger (2012) stated that design has contributed to the massive global problems facing at the beginning of the 21<sup>st</sup> century, but it should also be able to provide important impetus for a more sustainable system. Unfortunately, most design work of today, which is mostly of aesthetic nature, is helpless in the face of complex global problems, and finally, is mainly intended to produce more products and increase consumption behavior just to strengthen the problem (Esslinger, 2012). In the same way Kretschmer (2014) stated:

"Despite the many positive aspects of this influence of design, phenomena such as the climate change also indicate that our industrial product culture with all its designed artifacts has very decidedly evolved into a massive global problem with far-reaching consequences for all of us." (Kretschmer, 2014, p. 179)

# 2.5.2 Changing Behavior

Changing behavior of consumers can be very difficult, as what is described as normal, changes rather like the background landscape. It might be noticed out of the

window in a train. The fields have given way to a forest or a mountain and the person in the train is not aware that this was happening consciously.

For example, the introduction of the supply of milk and juice drinks in plastic bottles happened relatively quick without people realizing what was really happening. The new plastic bottles were freely available in the supermarket, lightweight, convenient, hygienic, unbreakable, but finally throw-away containers. The economic system that provides consumers with the convenience of food bought in plastic bags and packages is usually experienced through a narrow consumption window of use that leaves its environmental consequences to others to deal with (Lehmann & Crocker, 2012).

It seems it is far easier to change a system to a more unsustainable state than the other way round. This is backed by Ehrenfeld's notion (2008) that producing sustainability takes much more than simple problem-solving and incremental improvements. In this context, Ehrenfeld (2008) analyzed different levers to change behavior on a system level. Among other levers, as the dialectic model of Hegel, rationalism or education or scientific revolutions, the author puts all his hopes into design. Design is a natural, spontaneous process that emerges during the course of routine action. If a problem becomes persistent in spite of the actor's repeated efforts or are created by structure far distant from the actor's consciousness or competence design is needed. In the author's point of view design is the key for sustainability, to unlock and change unsustainable routines and actions of consumers (Ehrenfeld, 2008).

The sufficiency strategy (see Section 2.3.4) and the *Zero Waste* philosophy (see Section 0) lack in definition, because there is no advice *how* to change daily routines or actions to be sufficient and to adapt to *Zero Waste* principles. Thereby, design can be the missing link.

# 2.5.3 Sustainable Design or Eco Design

According to Braungart (2013) the responsibility lies in the hands of designers and engineers. One direction towards this responsibility of designers is sustainable design or so-called *eco design*. Unfortunately, a long time little attention was paid to the ideas of Papanek back in 1971. Even though, at this time the environmental

consequences of mass consumption could have already been foreseen, a repositioning of the design profession did not take place at that time (Kretschmer, 2014). This is surprising, because design is needed, especially in the context of sustainability. Acaroglu (2013) raises in her speech at  $TED^{15}$  the question, if a plastic bag or a paper bag is more sustainable to use. The answer is that there are no universal sustainable ecologic materials, because it is not only the question of the material itself, but also the issue of production, usage and/or consumption and finally of disposal. This whole process of creating alternative and sustainable products, services and systems is the fusion of design and sustainability.

As a consequence, sustainable design or *eco design* evolved in the recent years closely linked to the reflection of the entire life cycle of a product (Kretschmer, 2014). This type of reflection work can be called *life-cycle-thinking* that considers each step from the raw material to the end of the product's life cycle. *Life cycle assessment* is a tool to evaluate the effects of a product on the ecosystem (Acaroglu, 2013). In this context, *eco design* describes a systematic approach which aims to incorporate environmental considerations in the process of product planning and design development as early as possible (Tischner et al., 2000).

Consistently applied *eco design* reduces the negative environmental impacts of products. Various methods and tools emerging from the concept of *eco design* have found their way into the early stages of product development and design to minimize the consumption of resources and the environmental impact caused by products (Kretschmer, 2014).

# 2.5.4 Design-Led System Change

Design-led system change is design dictating the way in which the system can be far more sustainable. Acaroglu (2013) exemplifies this with a refrigerator. Once it was developed it was a major help for preserving food and getting rid of food waste. Unfortunately, this promise could not be kept. Today, nearly half of the food produced is not consumed, but thrown away. One main reason in Western countries is the refrigerator. The promise of preservation is just half-true, because

<sup>&</sup>lt;sup>15</sup> Source: http:www.ted.com

poorly designed chambers inside the refrigerator lead to dehydration of vegetables that are disposed afterwards.

Design-led system change does not mean to increase efficiency to save energy or use renewable or bio-degradable materials for machines, but to change behavior by design towards sustainable actions and routines. Acaroglu (2013) emphasizes that the use of a product is far more a problem than production and other steps of the life cycle. The solution is to design behavior-changing products that motivate people to adapt their behavior towards sustainable use. Consumption is the biggest problem, but design is the best solution.

This systematic approach can also be found in Kretschmer (2014), whereas a strategic sustainable design integrates sustainable design, *eco design* and product design to a holistic and systemic approach (see Figure 2.10).



Figure 2.10. Strategic Sustainable Design

# 2.6 Designing the Zero Waste Experience

Based on the long history of grocery markets (see Section 2.1) it can be stated that packaging is a relatively new phenomenon due to historical developments as the industrialization and global food companies incorporating brands and advertising. With the rise of the supermarkets in the Western world and highly saturated markets the shopping experience has become more and more important for both, markets and consumers.

Although there are many reasons for packaging that made life more convenient for consumers, there are still many unsolved problems (see Section 2.2). The use of different packaging materials for groceries led to economic as well as ecologic costs. Especially, food waste is a growing problem.

When it comes to food packaging, waste is the next logical step. Packages are designed for one-time-use that is not very sustainable in the long run (see Section 2.3). Waste management is the form or organization people deal nowadays with the *throw-away-culture*. However, there is no waste management in place to close the loops. Sufficiency focusing on the change of consumer's behavior is a strategy that can be implemented just now with little investments.

Sufficiency is translated into *Zero Waste* as a concrete practice with defined principles to guide people to refuse, reduce, reuse, recycle and rot waste (see Section 0). This so-called *Precycling* has the advantage - opposed to other waste management methods that material is not coming into the cycle in the first place. If so, reuse is better than recycle. Similar to the sufficiency strategy the *Zero Waste* philosophy is dependent on the change of the consumer's behavior.

Therefore, design as a change-enabler is discussed (see Section 2.5). However, today's product culture is based on the work of designers and engineers. Unfortunately, the spheres design and sustainability have not been combined until now, so that unsustainable products are in the majority on the market. Still, there is hope that design is a powerful tool to change behavior to the better. This thesis aims towards a design solution that is sustainable and provides a better experience for the customer at the same time. With designing the *Zero Waste* experience, the task is not only to get back to the early days of grocery shopping in former *Mom-And-Pop-Stores*,

but to re-interpret the function of packaging in the context of a sustainable grocery market. To dig deeper, it is necessary to extract potential opportunities and obstacles of *Zero Waste* shopping processes in the real world. This task is part of the empirical research that is described in the next chapter (see Chapter 3).

# 3 Empirical Research

This chapter describes the empirical research methodology (see Section 3.1), the selection criteria for the sample and the final participant list (see Section 3.2), the data collection (see Section 3.3), the structure of the interview guide (see Section 3.4) as well as the evaluation of the most relevant research results (see Section 3.5). The primary target is to extract the critical opportunities and obstacles concerning a *Zero Waste* grocery market shopping scenario based on an expert's perspective. Secondary targets are the examination of how many experts know or implement *Zero Waste* principles in their past, present or future activities as well as the question if *Zero Waste* leads to a more sustainable grocery market and if *Zero Waste* leads to a better shopping experience for the customer.

# 3.1 Methodology

According to Bortz & Döring (2009) the empirical research is divided in methods of quantitative and qualitative research. In this work the qualitative research strategy is chosen. Gläser & Laudel (2010, p 27.) describe this strategy as follows:

"Qualitative Methoden beruhen auf der Interpretation sozialer Sachverhalte, die in einer verbalen Beschreibung dieser Sachverhalte resultiert. Sie standardisieren die Informationen über die sozialen Sachverhalte nicht (oder zumindest nicht im selben Ausmaß wie quantitative Methoden)."

The selection for the qualitative research strategy has the following reasons:

- The insufficiently research status of studies in the scientific literature related to Zero Waste and/or Zero Waste in combination with grocery shopping.
- The relatively low incidence of *Zero Waste* grocery markets.

### 3.1.1 Expert Interview

According to Gläser & Laudel (2010) mostly common observations (e.g., participant observation, ethnographic method) can be used for qualitative data collection, as well as interviews with people who are involved in the processes of

interest. In this work, the interview was chosen, as the *Zero Waste* concept is still not widely used and observations are therefore not yet possible.

Bogner & Littig (2009) describe the expert interview as a special form of survey. This includes all interviews that are not standardized and not quantitatively evaluated. The specifics of the expert interviews are in the sample, strictly speaking, in the selection of experts, and in the kind of conversation with the help of an interview guideline.

Gläser & Laudel (2010) classify interviews after the standardization of the survey:

- Full standardized interviews: solid formulated questions in a fixed order with possible answers
- Semi-structured interviews: solid formulated questions in a fixed order, but the interviewee can choose the answers free
- Non-standardized interviews: no standardization of answers and questions

Non-standard interviews are further divided into the following types (Glasses & Laudel, 2010):

- Structured interviews contain predefined themes and a list of questions in the form of a guide, which is a guideline for the survey. Neither the wording of questions nor the order of the questions is compulsory. Demands in the form of depth and/or additional problems are possible.
- <sup>o</sup> Open interviews contain predefined themes and freely formulated questions.
- Narrative interviews begin with a complex, introductory question that is answered with a longer narrative of the interviewee

As for this purpose the interview has a special target namely to analyze the strengths and weaknesses of *Zero Waste* processes, therefore, structured interviews are chosen as the favorite interview style.

# 3.1.2 Interview Guideline

Blandford (2013) emphasizes the importance of careful preparation for interviews, and particularly the preparation of an interview guide. The focus is on identifying topics to cover rather than particular questions to ask in the interview. It can be useful to have prepared important questions, not because the question should then be asked rigidly as prepared, but because it identifies one way of asking it, which is

especially valuable if the interviewer has a blank during the interview. In Blandford (2013) the following frame should be followed:

- Introduction
- Opening questions
- Core in-depth questions
- Closure

Blandford (2013) emphasizes the importance of building a relationship, noting that the interviewer is a research instrument, but also that researchers need a degree of humility, the ability to be recipients of the participant's wisdom. The overall interview process has six stages, all of which need to be planned (Blandford, 2013):

- 1-- Arrival: The first meeting between interviewee and interviewer has a crucial effect on the success of the interview.
- 2-- Introducing the research: This involves ensuring that the participant is aware of the purpose of the research.
- 3-- Beginning the interview: The early stages are usually about giving the participant confidence and gathering background facts.
- 4-- During the interview: The body of the interview will be shaped by the themes of interest for the research.
- 5-- Ending the interview: The end of the interview should be signaled so that the participant can prepare for it.
- 6-- After the interview: Participants should be thanked and told what will happen next with their data. Many participants think of additional things to say once the recorder is off, and these may be noted.

# 3.2 Sample

Concerning the selection of the sample, the target was to gain a broad spectrum of experts on the topics of sustainability, food and markets, consumption and nutrition. The term *Expert* is defined by Meuser & Nagel (2009) as a person that has a knowledge that not everyone has access to. The methodology of an expert interview targets this competitive advantage (Meuser & Nagel, 2009).

Based on the field of interest various groups of people were targeted as for example:

- Grocery market owners
- Dietologists and nutritionists
- Food cooperations
- Food-related non-profit organizations
- (Organic) Farmers and the agricultural sector
- Food startups
- Food policy organizations

Through mail and phone communication finally nine experts could have been confirmed to participate in the interview. The experts came from different fields, as listed above, and were finally clustered in market- and food-related knowledge (see Table 4.1).

Expert	Organization	Classification	Web
Claudia Schmid	Food Coop Linz	Market	http://foodcoops.at/?p=527
Gerhard Zwingler	NETs.werk	Market	http://netswerk.at
Günter Achleitner	Biohof Achleitner	Food, Market	http://www.biohof.at
Max Wittrock	MyMüsli	Market	http://www.mymuesli.com
Philipp Braun	SlowFood OÖ	Food	http://www.slowfoodlinz.at
Erika Mittergeber	Die Essperten	Food	http://www.dieessperten.at
Wolfgang Holzer	Lebensministerium	Food	http://www.lebensministerium.at
Helmut Eiselsberg	Ökosoziales Forum OÖ	Food	http://www.oekosozial.at
Hans Neuburger	Unimarkt Filialleiter	Market	http://www.unimarkt.at

#### Table 3.1 List of experts

In total, 9 experts were interviewed. The experts differ in gender (7:2, men: women) and in the type of expert knowledge. More interviewees were experts in food (6) than in markets (5), whereas multiple annotations were possible.

# **3.3 Data Collection**

The expert interviews were held between 7<sup>th</sup> of March and 16<sup>th</sup> of April 2014. Nearly all interviews were conducted in a personal setting, face-to-face. One interview was conducted via an online communication channel. All interviews lasted between 45 and 60 minutes. The interviews were recorded and transcribed afterwards.

# 3.4 Interview Guide

The interview guide consists of predominantly open questions and two exercises that represent the main part of the expert interview. Due to the selection of the structured interview, the answers of the interviewee were not standardized. The following sections describe the different parts of the interview according to the structure described earlier (see Section 3.1.2).

### 3.4.1 Introduction

At the beginning of the interview there was a short introduction including a presentation of the interviewer, the scope and goals of the interview. Further, the interviewee was prepared to answer as comprehensive as possible. Finally, the interviewee was asked if a voice recording is allowed. If yes, the voice recorder was started. At the end of the interview, the interviewee was asked to sign a written consent form to give an agreement to the recorded interview and further use.

### 3.4.2 Opening Questions

The goal of the first questions was to create a comfortable atmosphere and to get into the topic. Some of them are listed below:

- "Beschreiben Sie bitte kurz Ihre Organisation?"
- " "Beschreiben Sie kurz die Ziele, Vision, Mission etc. Ihrer Organisation?"
- " "Beschreiben Sie bitte kurz Ihre Tätigkeit und Position in Ihrer Organisation?"
- "Wie würden Sie persönlich den Begriff Nachhaltigkeit beschreiben?"
- "Können Sie mir Maßnahmen bzw. Beispiele von Nachhaltigkeit in Ihrer Organisation nennen?"

The issue of sustainability is relevant, because there is a close relationship between the *Zero Waste* philosophy and the term sustainability as discussed earlier. In this context it is interesting what the experts understand under this term, and further, if they can name examples or implement sustainability processes in their organization.

### 3.4.3 Core-in-depth Questions

The third section was deeply concerned with the topic Zero Waste. First, the interviewee was directly asked if the term Zero Waste is known or not. If not, the

term was described with the official *Zero Waste* definition and principles (see Section 2.4.1 and 2.4.3). Additionally, *Zero Waste* practices were described by the example of grocery stores, so that the interviewee gets a better understanding of the implications of *Zero Waste* for a consumer. Therefore, a sack of rice, preserving jars with groceries or spice shakers were shown as illustrations for *Zero Waste* shopping in combination with a mood board of different *Zero Waste* stores across Europe and the United States (see Figure 3.1)



Figure 3.1. Interview: Mood Board of Zero Waste Stores

Based on that description, the interviewee was asked if such a concept is known and/or in use in his or her organization. If not, the interviewee was asked why *Zero Waste* is not so known or is not used in his or her organization.

### Exercise 1: Zero Waste Grocery Shopping

The first exercise was a hypothetical scenario of a grocery shopping trip in a *Zero Waste* market. The shopping process was divided into the following steps:

- <sup>o</sup> Step 1 -- Requirements planning & transport of shop equipment
- Step 2 -- Orientation in a Zero Waste market
- Step 3 -- Search for certain groceries
- Step 4 -- Search for information about the grocery

- Step 5 -- Shopping of other groceries
- Step 6 -- Purchasing
- Step 7 -- Transportation and storage of groceries

Steps 2 to 6 show scenarios of *Zero Waste* markets and how they might look like based on existing stores (see Section 2.4.5). Rice was taken as a well-known example for a typical grocery shopping process. Each step consisted of a title (shopping process step), a picture to visualize the scene and the question if it is an opportunity or an obstacle for the expert (see Figure 3.2). If it is a chance, it is further asked if the expert can imagine how to utilize this chance in the real world. And if it is an obstacle, it is asked if the expert can describe how to do better. The scenarios included also a persona named *Susi*. The reason behind was to increase the empathy in this abstract shopping scenario.



Figure 3.2. Interview: Zero Waste Shopping Scenario

The goal of this exercise was to extract strengths and weaknesses or opportunities and obstacles that are related to *Zero Waste* in combination with daily grocery shopping.

#### **Exercise 2: Future Food (Market) Scenarios**

The second and last exercise is concerned with the future of our food system. Based on the study initiated by the *German Bundesumweltamt* and the *German Bundesumweltministerium* seven scenarios were presented (see Figure 3.3) that lead to a more or less sustainable future (Fink & Rammig, 2013).

- Scenario 1 -- Public Supply
- Scenario 2 -- Subsistence Farmers
- Scenario 3 -- Farmer's Markets

- Scenario 4 -- Self-purchased and Self-cooked
- Scenario 5 -- Organic Commercialization
- Scenario 6 -- Food Innovations
- Scenario 7 -- Agricultural Imports
- Scenario 8 -- Experience Market (added)



Figure 3.3. Future Food (Market) Scenarios<sup>16</sup>

The 8<sup>th</sup> scenario - *Experience Market* - was added intentionally. This scenario describes a grocery market that combines a special shopping experience with sustainability. The idea behind this scenario was to find out if experts recognize this scenario as a potential future scenario. The question was, if in a pool of more and less sustainable future scenarios a scenario focusing on experience can make a difference in the expert's mind.

All scenarios were presented on separate cards to make it easier for the expert to grasp the content of the scenario at the first glance. A scenario consists of a catchy title, a short description and detailed actions that exemplify this scenario (see Figure 3.4).

<sup>&</sup>lt;sup>16</sup> Fink & Rammig (2013, p. 33)

Szenario   3	Szenario   4			
DER WOCHENMARKT	SELBST GEKAUFT UND SELBST GEKOCHT			
Individualistische Konsumenten sehen in regionalen und saisonalen Lebensmitteln eine Möglichkeit der Identitätsbildung	Nachhaltig orientierte und kritische Verbraucher treffen auf innovative Landwirtschaft und Lebensmittelproduktion			
<ul> <li>Nachhalige Ernährung und Essenszubereitung gehören für die Menschen zu einem erfüllten Alltag und steigern die Lebensqualität</li> <li>Erfordert aber von den Bürgern, sich umfassend zu informieren und so Expertenwissen aufzubauen.</li> <li>Der tägliche Umgang mit den frischen Produkten ist zwar zeitaufwendig, wird aber als positive Stimulation des Alltags empfunden: Kochen hat Kultstatus (gemeinsam mit Familie und Freunden).</li> <li>Landwirtschaft und Lebensmittelindustrie richten sich in der Produktion nach den Kundenwünschen. Wochenmärkte erfreuen sich großer Beliebtheit.</li> </ul>	<ul> <li>Konsumenten wollen sich bewusst und nachhaltig ernähren. Sie sind bereit, dafür sowohl Geld als auch Zeit zu investieren.</li> <li>Die Zubereitung eines guten Essens danf ruhig ein wenig länger dau- ern, auch wenn oftmals weiterverarbeitete Lebensmittel verwendet werden.</li> <li>Die Beschaffung von Lebensmitteln erfolgt über den gut sortierten Lebensmittelhandel.</li> <li>Discounter als auch spezialisierte Läden tragen der Nachfrage Rech- nung und bieten ein breites Sortiment an hochwertigen und nach- haltig produzierten Lebensmitteln.</li> </ul>			

#### Figure 3.4. Interview: Future Scenarios of the Food System

For each scenario the expert was asked to think about, if it is realistic on the one hand and desirable for the expert on the other hand. The goal of this exercise was to find out when the consumer gets a special experience in a sustainable market and if this scenario could be more realistic and more desirable than other scenarios that purely focus on more or less sustainable market approaches.

# 3.4.4 Closure

After the two exercises the expert was finally asked if there was still more to add that was not covered in the interview. According to the principles of an expert interview (see Section 3.1.2) the expert was informed what will be done with the data and what comes next. The final question was, if the expert could be cited and declared with his official name in the thesis. After that, the consent form was signed by the expert.

# 3.5 Evaluation

In the following sections the evaluation of the answers by the experts are discussed based on quantitative as well as qualitative criteria.

### 3.5.1 Definition and Implementation of Zero Waste

Over 50 percent of the experts were aware of the term *Zero Waste* or have heard it before (5 out of 9). Although only half of the experts could have been provided a rough definition. The other part of the experts has never heard of the term (4 out of 9). Though, some of the experts were aware of the principles or implemented *Zero* 

*Waste* in their activities, they were not aware of the term itself. Nevertheless, the exact definition was given to all experts after this question, so that everyone had the same basic understanding of the term. In total, 5 out of 9 experts implemented *Zero Waste* principles in their organization or in their personal activities.

# 3.5.2 Opportunities and Obstacles of Zero Waste Shopping

In this exercise it was noted how many of the experts saw a single process step more as an opportunity or as an obstacle, or both. After the quantification (see Table 3.2) of the results it can be stated that there were no significant process steps that are only an opportunity for the consumer or vice versa. Except the process step of information retrieval (6:3) and the purchase of the goods (3:7) all other process steps were almost balanced. The reason behind this could be that the experts always tried to find a positive and a negative comment about *Zero Waste* in each process step in order to talk about possible opportunities and obstacles.

Step No.	Description of Process Step	Only Chance	Only Obstacle	Both	Not Sure	Total Chance	Total Obstacle
1	Requirements	0	2	6	1	6	8
2	Orientation	3	1	4	1	7	5
3	Search	3	1	4	1	7	5
4	Information	4	1	2	2	6	3
5	Shopping	2	0	6	1	8	6
6	Purchase	0	4	3	2	3	7
7	Transport & Storage	3	1	5	0	8	6

Table 3.2. Chances & Obstacles for Experts in a Zero Waste market

Nevertheless, the value of this exercise were especially the verbal comments, experiences, examples, opportunities and obstacles named by the experts that were captured in the form of quotes. Some examples can be given as follows (see Table 3.3):

Step No.	Description of Process Step	Quote by the Expert (in the original language)
1	Requirements	"Wenn man seinen eigenen Behälter mit ins Geschäft nehmen muss, dann ist das eine große Hürde. Die Leute haben entweder keinen Behälter oder vergessen ihn daheim."
2	Orientation	"Auf den ersten Blick schaut alles so toll aus, aber es ist in Wahrheit eine Katastrophe. Keiner kennt sich aus. Es gibt eine Genussregel: Was ich nicht kenne, kann ich nicht schmecken."
3	Search	"Du stellst dir vor, du gehst gestresst nach der Arbeit um 17.00 Uhr in

		den Supermarkt und du hast voll den Hunger. Wenn du dann in so ein verpackungsloses Geschäft gehst, ist das sicher eine Hürde. Ich würde schätzen, man braucht sicher doppelt so lange."
4	Information	"Die Informationen müssen natürlich in anderer Form zur Verfügung gestellt werden. Die Chance ist, dass man mehr Information mitgeben kann. Da sind die neuen Medien gefragt. Die persönliche Beratung ist zudem gefordert."
5	Shopping	"Die Chance ist für alle speziell sinnlichen Menschen wieder ein Gespür zu kriegen, wieder eine Rückverbindung mit der Natur zu bekommen. Fast wie Hautfühlung."
6	Purchase	"Wenn ich mit meinen ganzen Produkten zur Kasse gehen müsste und dort wird alles extra abgewogen, dann würde ich dies als Hürde sehen, weil das Warten ist langweilig. Warum nicht so wie bei Ikea, wo ich mir die Sachen selbst zahlen und hier auch wiegen kann?"
7	Transport & Storage	"Es ist die Frage wie man die Vorratsbehälter konzipiert, lassen sie sich gut stapeln, nebeneinander stellen, gut verschließen, gut umfüllen, etc. Das wäre eine große Erleichterung, wenn ich keinen Papier- oder Plastikmüll mehr habe."

#### Table 3.3. Quotes by the Experts

The most occurring opportunities of Zero Waste grocery shopping are as follows:

- Addressing all human senses
- Selection of individual quantity
- Reduce total waste
- More sustainable
- Saves times at home (recycling, waste bin)
- Increases awareness for groceries and food waste
- Better shopping experience
- <sup>o</sup> Better product presentation (e.g. no brands, standardized product information)

However, for this research especially the obstacles were relevant to analyze in detail. The most occurring obstacles stated by the experts are summarized in the following list:

- Hygienic considerations (diseases, bacteria, pests)
- High personnel costs
- Too complicated shopping process (e.g. planning, weighing, transporting, paying, selection of quantity, ...)
- Too time-consuming shopping process
- Preservation considerations
- Orientation problems in the market (no brands)
- Missing product information/availability

- Spontaneous shopping not possible
- Difficulty with glass containers
- Scalability of the market for many customers

The individual obstacles are the input stimuli for the workshop participants described in the next section (see Section 4.4.2).

# 3.5.3 Experience and Sustainability Effects of Zero Waste

Most experts say (7 out of 9) that *Zero Waste* can provide a better experience, but with the limitation of the discussed obstacles that have to be overcome first (see Table 3.2). The majority of the expert group (6 out of 9) is sure that this type of shopping experience is more sustainable too.

# 3.5.4 Future Grocery Market Scenarios

For the future scenarios of the food system for both, consumer and producer, the experts had the choice to say if the scenario is realistic or desirable or both (see Table 3.4).

Scenario No.	Description of Future Scenario	Realistic	Desirable	Neither Nor	Both	Not Sure
1	Public Supply	1	2	6	0	0
2	Subsistence Farmer	0	5	3	0	0
3	Farmer's Market	0	5	1	3	0
4	Self-Purchased & Cooked	0	5	0	3	1
5	Organic Commercialization	0	2	0	6	1
6	Food Innovation	5	0	2	1	1
7	Agricultural Import	8	0	1	0	0
8	Experience Market	0	1	0	6	2

Table 3.4. Realistic and Desirable Scenarios for Experts in the Food System

Relevant for the evaluation is the answer *both*. This means that this scenario is realistic according to emerging trends in society and also desirable for a sustainable future. The scenarios *Organic Commercialization* and the *Experience Market* have by far the most votes by the experts.

# 3.6 Summary

From the expert's perspective a grocery market based on *Zero Waste* principles is not only more sustainable than other markets, but can also provide a better experience for the customers, because all senses are addressed, the direct interaction with the groceries and the choice to select the right amount of groceries. But, within the interviews, especially during the constructed *Zero Waste* scenarios, many experts expressed feelings that this new way of shopping would not be that easy to handle for the average consumer. Further, the new process is too long and too complicated in a world where time is getting less and less and at the same time people are striving for more convenience.

# 4 Innovation Workshop

"Design thinking, a way of thinking that parallels other ways of thinking – like science thinking – but offers a way of approaching issues, problems and opportunities almost uniquely suited to innovation." (Owen, 2006, p. 1)

As cited above *Design Thinking* is an innovation method whereas the strengths are in the first phases of the innovation process. This chapter describes *Design Thinking* as the selected methodology for the workshop (see Section 4.1), the selection criteria for the sample and the final participant list (see Section 4.2 and 4.3), the workshop setting and the process (see Section 4.4) as well as the evaluation of the workshop results in form of the final prototypes (see Section 4.5). The main focus of the workshop is to obtain various ideas and concepts related to the extracted opportunities and obstacles of the *Zero Waste* grocery shopping process (see Section 3.5.2).

# 4.1 Methodology

"It is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" (Brown, 2008, p. 2)

There are several definitions for *Design Thinking*. Depending on the background of the author and perspective. *Design Thinking* can be seen as a method or methodology, a process, a mindset or as a discipline as cited above.

- The Method: *Design Thinking* is a novel method for developing innovative ideas in all areas of life. The method is based on the belief that true innovation can only happen when strong multidisciplinary groups unite, form a common culture and explore perspectives and different options (HPI School of Design Thinking, 2011).
- The Process: *Design Thinking* can be used as a process in terms of a logical stepby-step procedure with a defined input (problem, question, etc.) and a defined output (prototype, implementation, etc.). A process is clearly structured (e.g.

phasing) and rule-based (e.g. time frames for phases). The process character is described in Bauer & Eagen (2008), Brown (2008), Dunne & Martin (2006), Kelley (2004) and Lindberg et al. (2010).

The Mindset: *Design Thinking* as a mindset or way of thinking emphasizes the different way of thinking. This can be found in Boland & Collopy (2004), Brown (2009), Martin (2009) and Thompson (2009), which speak of *a set of mind-sets*, *way of thinking*, thinking *as a designer* or *design attitude*.

For a practical *Design Thinking* workshop it is not important in which way *Design Thinking* is defined, but it is useful to communicate the different modes to the workshop participants. They should know that there is a clearly structured process with time frames, but it is also a different way of thinking, doing and approaching problems, and finally a method that is characterized by important key elements as for instance interdisciplinary team work.

# 4.1.1 Goals

On the one hand *Design Thinking* is used in practical applications for solving complex problems, and on the other hand for the generation of creative, innovative ideas. In the first case *Design Thinking* addresses problems that are inaccurate, out of focus and not really definable (*ill-defined*), so-called *wicked problems* (Lindberg et al., 2010).

According to Bauer & Eagen (2008, 2010), due to their complexity, ill-defined and wicked problems can not be dealt with a purely rational and analytical approach. They argue further that *Design Thinking* can close the gap between the analysis of existing alternatives and creating a new one. As Bauer & Eagen (2008) emphasize, *Design Thinking* is not just to solve problems, but also to create something new.

# 4.1.2 Process

In the *Design Thinking* literature several process models can be found which differ in actuality, abstraction level and maturity. As examples T. Kelley (2004), Dunne & Martin (2006), Bauer & Eagen (2008), Brown (2008) and Lindberg et al. (2010) can be named. According to the workshop setting and the time constraints, a short and catchy process model should be preferred. The d.school (2014) in Stanford has a process that fulfills these requirements perfectly (see Figure 4.1). This special course

focuses on *Design Thinking* projects teaching non-design students how to think as designers in a very short time.



Figure 4.1. The Design Thinking Process<sup>17</sup>

The different *Design Thinking* phases are explained as follows:

### Empathize

Empathy means to feel what someone else feels or to walk in other ones shoes. This is the very first step in the *Design Thinking* process and ultimately sets the foundation for true innovation to occur by putting all assumptions and ideas aside and letting the users be the inspiration for the key problems to solve. The objective is to help people articulate the latent needs users may not even know they have. The three ways to empathize are:

- Immerse: Become the users and actually live their experiences.
- Observe: Observing is about seeing the users' actions and hypothesizing why they are acting a certain way.
- Engage: Engage in conversations that allow users to tell stories of their experiences.

### Define

Define means to process and synthesize the findings from the empathy work in order to form a user point of view that can be addressed with design. The goal of the *define* stage is (d.school, 2014):

<sup>&</sup>lt;sup>17</sup> Source: d.school (2014)
- To develop a deep understanding of the users and the design space.
- To create an actionable point of view that works as the foundation for brainstorming.

## Ideate

Ideation means to explore a wide variety of possible solutions through generating a large quantity of diverse possible solutions. The goal is to step beyond the obvious frame and explore a range of ideas (d.school, 2014).

## Prototype

Prototyping means to transform ideas into a physical form, so that it can be experienced and interacted with it. In the *Design Thinking* process this means also to learn and develop more empathy about problem, solution and the user (d.school, 2014).

## Test

Test means to try out high-resolution products and use observations and feedback to refine prototypes, learn more about the user, and refine the original point of view (d.school, 2014).

# 4.1.3 Key Elements

*Design Thinking* integrates several key elements. For the workshop setting the following key elements were selected:

## Interdisciplinary Teamwork

*Design Thinkers* usually work together with other experts and customers, each from different disciplines. They must therefore be able to communicate across disciplines and collaborate (Brown, 2008; Owen, 2007). For working in an interdisciplinary environment a *Design Thinker* needs strengths in two dimensions, the so-called *T-shaped-concept*. This concept became popular by the company McKinsey & Company (Brown, 2009). The vertical axis of the *T* symbolizes in-depth knowledge in a particular discipline, while the horizontal axis of the *T* represents broad knowledge of another discipline. The strength of people that are *T-shaped* lies in their communication skills which are a crucial ability for idea generation processes.

#### **Optimism & Fun**

*Design Thinkers* believe to find a solution that is better than existing alternatives (Brown, 2008). It is difficult to be creative when you have a pessimistic attitude, so they try to balance ups and downs and find a proactive way to deal with it. To have fun while doing *Design Thinking* goes naturally hand in hand with an optimistic attitude within the process (Owen, 2007).

#### Empathy

*Design Thinkers* can assume different perspectives, such as the perspective of the customers or their colleagues. Thus, they are able to generate solutions that meet the obvious, but also the hidden needs of users. *Design Thinkers* can observe their environment precisely, discover details and use this to generate new ideas (Brown, 2008).

#### **Holistic Thinking**

Essential for working in *Design Thinking* is holistic thinking and systems thinking. There are not only individual products or services considered, but also their environment and interactions with other products and services (Bauer & Eagen, 2008; Owen, 2007).

## Constraints

*Design Thinking* projects are initially defined only vaguely. Exploring the conditions for such projects is therefore particularly important because the problem and solution space can be limited. Brown (2009, p.18) suggests for example the following constraints:

"Constraints can best visualized in terms of three overlapping criteria for successful ideas: feasibility (what is functionally possible within the Foreseeable future); viability (what is likely to become part of a sustainable business model); and desirability (what makes sense to people and for people)." (Brown 2009, p.18)

Nevertheless, also other constraints are useful depending on the type of the project and assignment (see Section 4.4.1). Regardless of the criteria names, a *Design Thinker* will try to balance the selected criteria (Brown, 2009).

#### Time

Apart from the constraints listed above, time constraints are used to structure a *Design Thinking* process. Planned periods for individual design activities help to bring the project to a temporary result (Brown, 2009).

#### Prototyping

The experimental approach is closely connected to *Design Thinking*, such as discussed in Bauer & Eagen (2008), Brown (2009), T. Kelley (2004), and Schneider & Stickdorn (2010). A central characteristic of *Design Thinking* is to create prototypes with varying degrees of maturity. These are used on the one hand for the communication of ideas and on the other hand, for a concrete testing with users and experts. The goal is - with little effort and resources - to achieve a maximum gain of knowledge about the assumptions at the beginning of the project, as well as strengths and weaknesses of an idea or concept. The principle is to try out as early as possible, to make mistakes, and thus, to learn a lot about the problem and solution space. Examples of prototypes include persona descriptions, storyboards, prototypes made out of various materials (e.g. paper, wood, metal, cardboard, clay, Lego), but also animations on the computer or a role play.

# 4.2 Data Collection

The data collection was done within a workshop setting. The workshop was conducted in an open space office in the Tabakfabrik in Linz on the 10<sup>th</sup> of May 2014. The workshop started at 10 in the morning and ended at 6 in the evening, interrupted by a one hour lunch break.

The invitation for the workshop started about four weeks before the workshop. Information about the workshop was spread over social communities, online food groups, communities and blogs, various universities (design, arts, business, engineering, and food), friends and friends of friends that are interested in the topic of the workshop. The goal was not to get only food experts, but people from different areas with diverse backgrounds, but they should have in common that they were highly interested in the topics food and markets, nutrition, consumerism and sustainability. Finally, 31 people took part in the workshop (see Table 4.1).

# 4.3 Sample

The final participants have various backgrounds (food, design, engineering, politics, health, social affairs, business, arts & culture) and experience in different disciplines according to the key element of interdisciplinarity within a *Design Thinking* setting (see Section 4.1.3).

Participant	Age	Background	Role
Altmanninger, Anna	21	Food	Participant
Atteneder, Rita	26	Design	Participant
Bauer, Andrea	27	Engineering	Participant
Birn, Sarah	27	Politics	Participant
Diephuis, Jeremiah	38	Engineering	Participant & Coach
Donner, Christoph	28	Engineering	Participant
Duschlbauer, Thomas	46	Business, Design	Participant & Coach
Einsporn, Ines	26	Business, Engineering, Design	Participant & Coach
Ferihumer, Anita	41	Health	Participant
Filipp, Sabine	25	Social Affairs, Health	Participant
Fischer, Bernd	44	Business, Food	Participant
Gardiner, My Trinh	38	Design	Participant
Greil, Laura	27	Design	Participant
Grünzweil, Sonja	26	Health	Participant
Gutenbrunner, Martin	35	Engineering	Participant
Hartig, Marie-Edwige	34	Arts & Culture, Social Affairs, Health, Politics	Participant
Jansesberger, Daniela	32	Social Affairs	Participant
Kargel, Rainer	41	Design	Participant & Coach
Kofler, Christian	30	Business, Engineering	Participant
Lechner, Carina	20	Business	Participant
Mayr, Iris	43	Arts & Culture	Participant
Öllinger, Pia	28	Engineering, Arts & Culture, Design	Participant & Coach
Pranzl, Heidemarie	43	Health	Participant
Rehberger, Cornelia	37	Business, Engineering, Design	Participant & Coach
Roth, Anna	23	Design, Arts & Culture, Social Affairs	Participant
Schauerhofer, Johanna	23	Business, Engineering, Design	Participant
Schobesberger, Richard	29	Engineering	Participant
Schwarzenlander, Magdalena	22	Business	Participant
Süß, Sassimas	34	Business, Food	Participant
Wagner, Sarah	25	Business	Participant
Wild, Julia	28	Business	Participant

Table 4.1. Workshop Participants

Most participants were female (74 percent). The youngest participant was 20 years and the oldest participant 46 years old, whereas the average age was 31 years. Related to the background and profession the majority of the workshop participants came from business (11), engineering (10) and design (9). Also, four people are engaged in the food sector including grocery markets, farmers or nutritionists. Among the participants were also experienced designers and *Design Thinkers* (6) that had a special role during the workshop that can be described as a coach. The coach was also a *normal* participant within the creative process. The role was only relevant when the workshop teams had troubles in the design process itself.

# 4.4 Workshop Setting

According to the *Design Thinking* phases discussed earlier (see Section 4.1.2) the setting for the workshop is explained as follows.

# 4.4.1 General Setting

The workshop started with a short presentation (see Figure 4.2) to support all participants with the necessary information to start a creativity process afterwards. In the presentation the following topics were discussed:

- Grocery markets
- Future trends in the food sector
- Problems of today's food system
- Pros and cons of packaging
- Introduction of *Zero Waste* philosophy
- Introduction of the Design Thinking method

All these topics are discussed in sections 2.1, 2.2, 2.3, 0 and 0.



Figure 4.2. Workshop Presentation

The overall assignment of the workshop was to design the grocery store of the future that is personally desirable for the workshop participant (see Figure 4.33).

For the further process and target of the workshop it was necessary to define relevant constraints to focus the ideas of the participants:

- Zero Waste (described in section 0)
- Sustainability (described in section 2.3)
- Experience (described in section 2.1.5)



Figure 4.3. Workshop Assignment and Zero Waste Definition & Principles

The workshop was separated in several phases (see Table 4.2) that are similar to the *Design Thinking* steps already discussed (see Section 4.1.2).

Phase	Design Thinking Phase	Time Frame
Introduction Presentation	Empathize	10:00 - 10:30
Open Space & Vernissage	Empathize & Define	10:30 - 11:30
Topics & Teams	Define	11:30 - 12:30
Lunch Break	-	12:30 - 13:30
Creative Thinking	Ideate	13:30 - 15:00
Creative Doing	Prototyping	15:00 - 17:00
Final Team Presentations	-	17:00 - 17:30

Table 4.2. Workshop Phases

# 4.4.2 Empathize

In the first phase of the *Design Thinking* method it was important to understand the problems and challenges of the main task. Therefore, the extracted quotes of the experts discussed in sections 3.5 were presented to the workshop participants (see Figure 4.4). The quotes were selected based on the shopping process step combined with strengths and weaknesses of *Zero Waste* integrated in a grocery market. In addition, articles about *Zero Waste* markets and new trends on the food sector and also books about food-related topics were laid out for browsing and reading in detail. Furthermore, short video clips about sustainability and food were presented to the crowd.



Figure 4.4. Workshop Phase Empathize

# 4.4.3 Define

Based on the phase of empathizing it was the task for each workshop participant to define at least one topic that was interesting for him/her. The topic and the problem

statement or question was written on a card. *Defining* means to cluster the topics according to their relationship to each other. For this step each participant mentioned his/her topic and added it on a table. If there was a relationship with an existing topic then the card was put close to it. If there was no relationship, the card was put on an empty space on the table (see Figure 4.5).



Figure 4.5. Workshop Phase Define: Cluster of Topics

After all participants were finished with their topics of interest it was the task to form six groups, because there was the limit of six coaches available for this workshop. Therefore, each participant had the choice to vote for a special cluster that he or she was interested in. All suggested topics and clusters are presented in the following table (see Table 4.13).

Торіс	Problem Statement / Question	Cluster
Bedarfsermittlung	Wie kauft der Kunde ein?	Product Information
Information	Information über Lebensmittel	Product Information
Fleisch	Woher kommt das Fleisch?	Product Information
Fehlende Information	Wie komme ich zu Hause an zu der Information, die ich mir wünsche?	Product Information
Hygiene	Wie kann man garantieren, dass alles hygienisch ist?	Container & Hygiene
Behälter	Wie Behälter spontan mitnehmen?	Container & Hygiene
Behälter	Möglichkeiten, Produkte im Vorbeigehen mitzunehmen	Container & Hygiene
Behälter	Wie kann die Menge von nicht verkauften Produkten verringert werden	Container & Hygiene
Frische	Lebensmittel und Haltbarkeit	Container & Hygiene
Verpackung	Sackerl? Materialien? Druck?	Container & Hygiene
Recht	Rechtliche Möglichkeiten und Hygienebedenken	Container & Hygiene
Glas	Glas in Österreich? Warum nicht?	Container & Hygiene
Behälter	Verpackung von zu Hause mitnehmen? Plastik? Hygiene?	Container & Hygiene
Berührungsangst	Offene Behältnisse, das ist anstrengend	Container & Hygiene

Pfand	Wo könnte das noch funktionieren?	Container & Hygiene
Planung	Wie schafft man es unüberlegt einzukaufen?	Planning
Bedarfsermittlung	Wie kauft der Kunde ein?	Planning
Spontaneinkauf	Wie mit umgeplantem Einkauf umgehen?	Planning
Liefern	Wie geht verpackungslos liefern?	Shop Concept
Liefern	Wie kann ich nachhaltig liefern?	Shop Concept
Einfach & Effizient	Einsatz fürs Einkaufssackerl, Entscheidung beim Kauf unterstützen, Neues entdecken, weniger Auswahl	Shop Concept
Lagerung & Design	Offene Wohnküchen, flexible Gebinde, flexible Mengen, Schönheit	Shop Concept
Familie	Wie kann man Familien ansprechen?	Target Groups
Produzent	Wie kann man Produzenten und Verbraucher zusammen bringen?	Target Groups
Convenience	Wie können faule Konsumenten animiert werden?	Target Groups
Überfluss	Managen von Überfluss	Target Groups
Kunden	Wie spricht man Personen an, die das Thema Nachhaltigkeit nicht interessiert?	Target Groups
Gamification	Highscores für wenig oder nachhaltige Verpackung als Motivation	Target Groups
Massentauglich	Stressfrei, umsetzbar, leistbar, unkompliziert	Target Groups
Spontanität	Fertigprodukte	Target Groups
Alltag	Kann man auf Verpackung verzichten ohne gleichzeitig auf Bequemlichkeit zu verzichten?	Target Groups

Table 4.3. Workshop Topics & Clusters

## 4.4.4 Ideate

Each *Design Thinking* phase was accompanied with short presentations about the theoretical and practical background. *Ideate* means to give information about how to do it, some practical tips and possible outcomes of this phase. Brainstorming in the group or separately in the style of brain writing were common tools for the six workshop groups. Post-it's and other material was provided to support the ideation. The main goal of this phase was to create a common problem understanding and a common solution vision to the selected topic of the group (see Figure 4.6).



Figure 4.6. Workshop Phase Ideation: Brainstorming, Post-It's & Co.

# 4.4.5 Prototype

In the prototyping phase the teams had the task to translate their ideas and solution vision into a material manifestation. The idea of this phase was that the teams were able to communicate their ideas visually, so that any other person can understand the solution they created. Again, material was provided (cardboard, modeling clay, Lego, waste materials etc.) to support the teams in their creative work (see Figure 4.77).



Figure 4.7. Workshop Phase Prototyping: Lego & Co.

## 4.4.6 Test

At the end of the workshop, all teams presented their prototypes to the other teams. It was possible to ask questions or give feedback.

# 4.5 Evaluation

The results of the workshop were six different prototypes explained as follows:

# 4.5.1 Prototype 1: Product Information

The *Product Information* team has figured out that not every type of information of the grocery is relevant at the same time. Furthermore, people have different needs, are for example allergic, have little time for shopping, decide to use only certain media channels or prefer to get personal advice. The prototype consists of three main parts:

- The Info Sheet: Directly on the product, the most important information can be found (e.g. name, product origin and preparation). With the info sheet there is the possibility to carry the information of the grocery easily anywhere. On the sheet there is an area left blank, so that the customer can stamp the expiration date on it. The sheet can then be inserted into a lug in the container brought to the shop.
- The Info Screen: Via the info screen the customer can learn more about the product. The customer has to enter a product number and can check who the producer is (including detailed descriptions about the product, linking to other related products of the producer, recipe ideas and so on).
- The Info Counter: At the information desk trained nutrition and food professionals are available for the customer with further advice.
- The Info Platform: Online via the info platform all information about all products in the shop is provided.



Figure 4.8. Prototype 1: Product Information

# 4.5.2 Prototype 2: Planning

The *Planning* team focused on both, the target group of the simple and efficient customers, as well as on the target group that see grocery shopping as an experience. The relevant elements of this concept are the following:

- Fast Lane & Easy Order: The fast lane and easy order process is designed for customers who just want to have it simple. This service can be ordered directly via an "Easy-Order-App" either via Smartphone or website or directly at the counter in the shop where the groceries can be picked up on the spot.
- 24/7 Machine: If a customer has forgotten to order something and want to have groceries outside the opening times, then the 24/7 machines can assist the customer. In this machine there is food shortly before its expiration date that is offered at a special discount, so that nothing needs to be thrown away.
- Mail Delivery Service: In order that the customer does not have to worry about any containers, the postal service takes containers back either directly after the goods have been delivered or in the course of the next order of the customer.
- Easy Order App: On the app or website the customer can order both, groceries as well as menu suggestions or recipes. Of course, the customer can also search for specific criteria (themes, cooking times, nutritional information, availability, etc.).
- Menu Suggestions: Special offers are the menu suggestions. The customer can smell, taste and see the ingredients of the menu. The recipes can either be ordered via QR Code or taken directly in the shop.



Figure 4.9. Prototype 2: Planning

# 4.5.3 Prototype 3: Shop Concept

An outstanding feature of the prototype of the team *Shop Concept* is the separation of the shop in an experience area and an area for the assembly and logistics.

- The Concept: The shopping process is designed for the customer as a unique experience for all senses. Products can be experienced and grasped. Food samples, sample menus and an open kitchen and bar area in the center of the shop complement the experience. Additionally, the experience offers as a side-product the possibility of product information and foster social interaction between the shop and the customer.
- The Goal: Shopping is quality time. The customer should like to be in the shop, just as people enjoy spending time with friends in the coffee house. Experience, inspiration and the grocery shopping itself happens almost incidentally.
- The Idea: The challenge when buying open products is the hygiene of the products and the shelf maintenance. Both can be achieved by the separation of these two areas. At the front the presentation of fresh products happens on a daily basis. At the rear the just-in-time assembly of the individually required amounts is conducted.
- Fast Lane & Checkout: Customers identify and buy primarily through an app. After shopping the virtual shopping cart is confirmed the purchase is done. The freshly made-up products are available within ten minutes at the logistics area and handed over to the buyer.



Figure 4.10. Prototype 3: Shop Concept

# 4.5.4 Prototype 4: Container & Hygiene

The prototype of team *Container & Hygiene* is based on a beer bottle rotation system. The concept is explained in detail as follows:

- Container: The containers are equipped with color-marked lids and caps. This serves to a better guarantee of hygiene. For example, in containers with yellow lids exclusively cereal products, in containers with green lids teas and in containers with blue lids only vegetables are stored. The containers are made of either glass, ceramic or fine Plexiglas. They are ergonomically and aesthetically designed so that they are easily stackable and portable, and beautify the image of the kitchen or pantry.
- Procedure: According to content and weight the shop provides standardized containers for shopping. The customer can take these containers in different sizes and weight classes for a deposit fee. The customer packs the filled containers in a carrying bag that is designed for ergonomic and practical use, so that the containers are protected and easy to transport.
- Rotation System: Similar to beer bottles, these containers are fed to a rotation system. The containers are issued in the shop and filled with groceries. After that, the customer can return the empty containers to a specially developed return location right in the shop. The customer always gets a new container for the next grocery shopping tour.



Figure 4.11. Prototype 4: Container & Hygiene

# 4.5.5 Prototype 5: Target Groups 1

The first group concerned with the topic of *Target groups* concluded that there is no single target group, but rather a community that finds a platform in the shop, where you can exchange not only groceries, but also ideas and social relationships.

- The Concept: The concept is to rethink the process of consumption and the associated roles within this process. From this alternative logic of a *prosumers* (producer & consumer) a different experience can be generated.
- The Experience: The experience focuses on social interactions and the exchange of people who grow food, process and consume food. In this community anyone can change its role to a different one.
- The Sustainability: Sustainability can be achieved by not rotting vegetables, herbs and fruits that are subjected to use. The higher value in the course of further processing and preservation (jams, pickles, fruit juices, etc.) is likely to raise the economic sustainability, whereas social sustainability is created by the integration of people who demonstrate, share and develop their knowledge. The shop is rather a platform or community that teaches and nourishes people (see Figure 4.12).



Figure 4.12. Prototype 5: Taget Groups 1

## 4.5.6 Prototype 6: Target Groups 2

The second team figured out that the members of the target group have in common that they demand higher quality and more information about food, are dissatisfied with the current offer in grocery markets, but at the same time have also too little time in general. At the core of the concept is a central information system described as follows:

- The Information System: Based on the needs of the target group an information system is needed that serves customers not only with details about the products, but also offers several more features. A website and an app provides customers with the following services:
- Online Order: A primary functionality of the website is the order page that allows customers to order their desired products before visiting the store. Previous orders can be repeated easily on a regular basis, and further the desired amount of groceries can be specified within the order.
- Product Information: The product information page provides detailed information about all products and suppliers.
- Product Range & Suggestions: Suggestions by customers for new products can be shared with other customers and be supported by them. Thus, the shop can quickly and efficiently adapt to the customer requirements.
- Community: Food sharing services can be offered on the community page.
  Customers can share their further produced good (jams, cakes, cookies, etc.) with other community members.

Based on these services a paper prototype was developed illustrating the functions of a future web application (see Figure 4.13).



Figure 4.13. Prototype 6: Target Groups 2

# 5 Design Concept

This chapter describes the methodology in the form of the design process (see Section 5.1). The following sections are about the different phases of the design process. In general the entire thesis is a design process (see Section 1.4). Therefore, the research and analysis phase (see Section 5.2) covers the empirical research, whereas the concept phase (see Section 5.3) relates to the workshop results and their analysis and interpretations. The core part of this chapter is the design phase (see Section 5.4) showing the product concept design. The main target is to develop a product concept design embracing the opportunities and tackling the obstacles of *Zero Waste* grocery shopping. The inputs of the innovation workshop act as general design principles for the further design process.

# 5.1 Methodology

Based on Heufler (2009) the design process consists of the following four main steps:

- Research and analysis with the target of problem definition.
- Concept with the target of solution options.
- Design with the target of single solution option.
- <sup>o</sup> Implementation with the target of implementation.

These steps are explained in the next sections and act as the guide for this chapter. Implementation is not subject of this research, because the focus was on the conceptual and prototype part of the design process. The results of this thesis build the basis for the implementation stage.

## 5.2 Research & Analysis

Target of the first stage of the design process is a detailed problem definition (Heufler, 2009). Firstly, the design task and/or the design question should be defined as done in the first section of this thesis (see Section 1.2). Based on these questions the design research focuses on the status quo of current *Zero Waste* 

practices (see Section 0). Further, it is essential to know the context and/or the environment. For this purpose the field of grocery markets (see Section 2.1), packaging (see Section 2.2) and sustainability (see Section 2.3) were elaborated.

The first research question was analyzed and evaluated by the method of expert interviews (see Chapter 3). Based on their knowledge, experiences and competence in the food industry and food-related organizations they stated that in general *Zero Waste* can have a positive impact on the customer experience when shopping groceries, but is also connected to various obstacles (see Section 3.5.2).

Therefore, the second research question deals with the question how to design a better *Zero Waste* experience. This is part of the concept phase (see Section 5.3).

# 5.3 Concept

To tackle the second research question an innovation workshop was initiated with the main theme to design the grocery market of the future regarding to *Zero Waste* and a special shopping experience for the customer. The workshop setting was on a conceptual level. As a consequence, real implementation issues as technology or budget were not considered on purpose to release full creative potential of the participants. In the concept phase the main idea was to generate a large spectrum of solution variants or alternatives where unconventional and odd ideas are welcomed (Heufler, 2009). *Design Thinking* principles were the general guidelines of the workshop (see Section 0). In the divergent mode of the workshop (Lindberg et al., 2010) there were no wrong ideas. The target was to develop as many solution options as possible. The next step was to narrow the solution space to develop concrete concepts and (physical) prototypes. This can be also called the convergent mode of *Design Thinking* (Lindberg et al., 2010).

Based on the workshop results there are five key areas that are used as general design principles for the further design process.

## 5.3.1 Product Information Availability

A workshop group was concerned with the issue that *Zero Waste* groceries basically contain no packaging information at all. As a result, it needs other ways to display relevant and obligatory information on the unpackaged product. The solution of the

team (see Section 4.5.1) was a mix of digital (terminal and online platform) and analogue (info sheets, consultancy by staff) solutions. The relevant output for the conceptual phase was that certain product information plays a role at different stages of the shopping process. Whereas some information is needed at the purchase stage (e.g. which product to choose), some information is only relevant at the aftersale stage (e.g. preparing of the ingredients).

## 5.3.2 Easy Planning Process

Another issue was the planning phase of a grocery shopping based on *Zero Waste*. The workshop group dealing with this issue identified convenience people as the most important target group (see Section 4.5.2). For this customer easy and simple processes are critical to buy groceries at all. All solutions in the concept targeted these needs (fast lane, 24/7 machine, instant delivery, easy app and so on). One output relevant for the conceptual phase was the order by menu and recipe suggestions. Recipes rely heavily on the exact amount of groceries by definition. At the same time, *Zero Waste* has its strength when the customer needs an exact amount of groceries for some purpose.

## 5.3.3 Experience & Logistics Area

A workshop group was focused on the difference between experience and logistics area in a *Zero Waste* market (see Section 4.5.3). As hygiene issues are a major weakness for the use of *Zero Waste* principles in grocery markets the team separated the experience area (show and taste room of groceries) and the logistic area (storage of food; packaging and assembly of customer orders). The main idea is that the customer has no direct connection with the logistic part of the grocery order. This decoupling of the experience and the logistic part as a concept can be beneficial for a successful *Zero Waste* experience.

## 5.3.4 Shopping Bag & Grocery Containers

This group was concerned with the challenge how to carry the unpacked groceries from the market to the homes of the customers (see Section 4.5.4). The suggestion was a complete returnable system where the customer has to rent special containers in the market. For the containers the customer gets special bags. For the next

grocery shopping all containers have to be returned at the market entrance to clean them properly. The basic idea of a returnable system and a suitable carrying system for the single grocery containers are the main points identified as relevant in this concept.

# 5.3.5 Target Groups & Community Building

The last group worked out a concept for the target groups of a completely new *Zero Waste* market (see Section 4.5.5 & 4.5.6). One major outcome was that there are of course different target groups that are interested in this market approach. Many people are not very satisfied with today's supermarkets. At the same time, many people have not much time to organize their grocery shopping properly. On a conceptual level it can make sense to provide different shopping modes for different target groups, whereas the focus is on the convenient target group that has special needs concerning time and quality.

A second outcome is that such a special market has not only target groups, but has to build communities to be successful (e.g. producers, consumers, *produsers* and other stakeholders). For the concept it can be crucial to use community-oriented functions.

# 5.4 Design

Certainly, the design is the core stage of the whole design process. This phase is characterized by creativity processes whereas the former phases have logical and analytical parts as well (Heufler, 2009). First of all, the *Zero Waste* grocery shopping process is translated into three different shopping modes (see Section 5.4.1) that give an overview about the range of potential modes of *Zero Waste* shopping experiences.

# 5.4.1 Shopping Modes

The vision of a new Zero Waste grocery market experience offers three different shopping modes: *Classic, Convenience* and *Comfort.* 

#### (1) Classic

The classic shopping mode describes the traditional procedure of *Zero Waste* shopping (see Figure 5.1). As described in Section 2.4.5 the customer can bring his or her own containers to the market and has to weigh the containers before the customer can fill them with groceries. Afterwards, the container has to be weighed again to calculate the price. The customer pays and leaves the market. In total, twelve steps are part of this shopping mode.

This procedure is obviously the most sustainable approach, because no additional containers have to be bought or produced. Existing kitchen infrastructure can be used again and again. The drawbacks for most people are the total shopping time, the need to bring containers to the grocery market and the exclusion of spontaneous shopping tours. If the customer has to buy several food items the procedure gets even more complex. The classic approach lacks in practicability, although it provides the customers a kind of special experience when filling the containers on their own. Although, this shopping mode is not directly part of this research.



Figure 5.1. Classic Shopping Mode

#### (2) Convenience

The convenience shopping mode decreases the shopping steps of the classic mode to a minimum. If the grocery shopping is planned there are in total five steps (see Figure 5.2) and if it is spontaneous there are in total six steps to do for a customer (see Section 5.4.3). In this mode technology is combined with *Zero Waste* principles. Groceries can be ordered beforehand via an online application or directly in the market on an online terminal. The goal is to decrease total shopping time and reduce the overall complexity. The whole buying process step is eliminated in the convenience mode. The weighing and organization of groceries is delegated to the market itself. Whereas in the classic mode it was the task of the customer, in convenience mode the market staff selects the groceries, filling the provided containers according to the desired amounts and finishes the process with packing it in a box ready for pickup by the customer. This shopping mode is described in detail in the customer journey (see Section 5.4.3).



Figure 5.2. Convenience Shopping Mode (Planned)

#### (3) Comfort

The comfort shopping mode relies heavily on the convenience mode and is therefore the logical continuation. The basic idea is to deliver grocery boxes that are the result of the convenience mode, in a sustainable way by bicycle within a city. With this mode, people are targeted that have either too much stress to pickup their groceries in the market or are elderly, ill or impaired people. This mode is certainly the most comfortable one, because only four steps are needed to bring groceries to home (see Figure 5.3). However, this shopping mode is not directly part of this research.



Figure 5.3. Comfort Shopping Mode

## 5.4.2 Shopping Process

The entire grocery shopping process is presented as a circular closed system. At its core is the customer's desire to get food. In this new system, food is translated to a service. *Food-As-A-Service* means that groceries are not an independent unit. Additional value is generated when groceries are combined with other groceries resulting in meals of lower and higher complexity. Meals are normally eaten at a fixed place - a restaurant or home - but in this context meals can be ordered flexible as a service in the grocery market itself. There is no need for the customer to think about collecting the right groceries for a meal at home or the time loss at the supermarket queues.

With the use of *Zero Waste* in a market groceries lose basically their form. Normally, the package creates the form to restrict the groceries to a certain amount. The drawbacks of such fixed packages are that they have a fixed quantity that has to be stored in the kitchen if it is too large or creates even more packaging waste if it is too little and several units have to be purchased. With the process of combining different groceries in the right amount to a meal and bundling this into a box, groceries are transformed to a service that adds value for the customer. The result is a convenient meal box that target people that want to save time with grocery shopping, but still have needs related to the quality and freshness of the meal itself. This *Food-As-A-Service-Process* consists of several steps that are illustrated in the following circular model (see Figure 5.4):



Figure 5.4. Food-As-A-Service-Process

The steps of this circular model are described in the next section (see Section 5.4.3).

## 5.4.3 Customer Journey

This *Food-As-A-Service-Process* focuses on the convenience shopping mode (see Section 5.4.1). With the support of the *Customer Journey Map* (Stickdorn & Schneider, 2010) the convenience mode is shown in detail based on a concrete customer scenario. This method consists of several types of information that are explained as follows:

- Stages give orientation which tasks of the customer are part of which superior unit.
- Actions are the concrete active and visible parts of the customer.
- Emotions show the internal and invisible parts of the customer. Depending on the situation the customer feels better or worse. Obviously, the goal is to bring the customer in a better mode when interacting with the tool or system.
- Touchpoints are the points when the customer interacts with the designed or observed tool or system.
- Moments of Truth are very critical situations in the whole process. Especially in these situations the customer should be supported by the system or tool or should perceive a special experience that releases positive emotions.
- Personas are prototypical customers extracted out of a target group to simplify the design process.

The following customer journey shows a purchase of a special meal by a female office worker (see Figure 5.5). The persona description is as follows:

She works and lives in the city. After a long office day she is tired and hungry. After work she meets her boyfriend and wants to spend a nice and relaxing evening together at her place. She likes to cook fresh meals, but lately she was too stressed and tired to cook on her own. Further, she is very chaotic in her food stock planning, so she is unsure what groceries are already at home. She feels stressed again, because a visit in a crowded supermarket after work makes her unsettled.



Figure 5.5. Customer Journey Map

#### 5.4.3.1 Stage: Pre-Sale



Figure 5.6. Pre-Sale Stage (Customer Journey Map)

#### Stage & Actions

In this journey the customer is in the role of a female office worker sitting in front of the computer. It is late afternoon and she is looking forward to the end of the work day meeting her new boyfriend in her flat. On an emotional level she has several feelings:

- "I am so hungry."
- "I want something fresh and healthy."
- "I am not sure what is in the fridge."
- "I have only short time for shopping."
- "I hate it that all people are shopping for groceries now."
- " "I want to cook something special for my boyfriend."

## **Emotions & Moment of Truth**

Due to the fact that it is a very long office day her emotional status is getting more and more negative. Additionally, she is unsure how to handle the entire shopping procedure with long waiting hours at the cash desk, and further, the pressure to buy convenience food due to lack of time and knowledge what groceries are available at home. However, somewhere she gets a hint about a new market that provides an online ordering system accessible via computer or mobile device. She checks out her smart phone app to give it a try.

## Touchpoint: The App

In this scenario the app and the market is called the *holis market*. In this case the brand name *holis* stands for holistic (shopping experience). The app offers in general two ways to buy groceries (see Figure 5.7). Firstly, the customer can buy a meal consisting of several ingredients or groceries and a recipe to cook it at home. The recipes of the meals are provided by the community of the market and shared with other members. Depending on the available product range in the market the app provides the possible meals to order. Secondly, the customer can buy the groceries and amounts needed via an online shopping list.



Figure 5.7. Smartphone App: Overview

#### 5.4.3.2 Stage: Order



Figure 5.8. Order Stage (Customer Journey Map)

#### Stage & Actions

She is very pleased that the interface offers not only groceries but bundled meals based on recipes of community members. Based on her search she finds a meal that looks good and fulfills her needs. She orders this meal for two people. After ordering she gets notified when the meal box is packed in the market via sms or mail message.

The recipe is maintained by the community (e.g. food bloggers) that are interested in publishing their recipes on the web. They get the information about the current product range in the market and create their recipes based on this information. If the recipe is created it is confirmed by the market and is inserted into the online system where other customers can order the recipe.

When a meal or recipe is ordered in the market, the sales staff packs the groceries into a box including the recipe. This is done in the shop itself where also other customers buy their groceries in classic shopping mode (see Section 0).

#### **Emotions & Moment of Truth**

On an emotional level she feels very positive about the opportunities to buy by recipe. She feels positively surprised by the pre-packaged box and the fitting amounts of groceries. Further, there is no stress for her to check what is already at home and no time issue of collecting all needed groceries in the market. Finally, food waste can be prevented, because everything is in the right amount depending on the people involved in the meal.

#### Touchpoint: The App

After selecting the menu deal option the app shows various recipes with their prices, photos and for how many people prepared. By clicking on a recipe<sup>18</sup> the customer gets more details about the ingredients, the recipe instructions and additional options for ordering (e.g. sms or mail notification). By pressing the order button the customer has the choice to buy online to speed up the pickup process later in the market. In both cases the market staff is triggered to prepare the menu box.



Figure 5.9. Smartphone App: Ordering

<sup>&</sup>lt;sup>18</sup> Photos and recipes provided by Sarah Holzer, http://lebenamland.wordpress.com

#### 5.4.3.3 Stage: Purchase



Figure 5.10. Purchase Stage (Customer Journey Map)

#### Stage & Actions

After notification via sms or mail by the market, she arrives at the counter and gets her box already packed with the ordered meal for two persons. If she has already paid via the online service there is no waiting time for her at the cash desk and she can leave the market immediately.

#### **Emotions & Moment of Truth**

Emotionally, it is always a mixed feeling not to know how long the waiting time in the market is and if the meal is fitting to the order. Due to the fact that everything went smooth with no stress and friendly staff she feels positive about the experience.

## Touchpoint: The Box

The ingredients for the meal are perfectly packed in a square-like box (see Figure 5.11). The box has a top panel that can be opened and closed depending on the situation. Further, there are four side panels that are loosely coupled with the box

structure itself. The ingredients of the box are visible after opening the side panels. There is the opportunity for direct access from all sides of the box. The role of the side panels is explained in more detail in the next stage (see Section 5.4.3.4).



Figure 5.11. Box Showcase

The internal structure of the box is similar to a smaller chess field (see Figure 5.12). The box is divided into four large areas by cardboard material. Each square-shaped area can be divided into another four areas (not by material, but conceptually).



Figure 5.12. Box Ground Plan

The background of this organization of space is the fact there are three general types of food container, each for another purpose:

- Stray goods as for example spices and herbs
- Pour goods as for example rice, pasta, nuts.
- Liquid goods as for example oil and vinegar

These three types of food containers fit perfectly into the box structure. Additionally, the containers are independent of the shape (round, edgy), but should have a special diameter in size to fit in the chessboard structure. The reason of this system is to enable reuse of existing food containers and prevent producing special containers for the box.

The removable info panels (see Figure 5.13) on the sides of the box contain different information:

- About recipes: An info panel for recipes created, maintained by the food blogger community and double-checked by dietologists.
- About groceries: An info panel for information about the product like growing area, nutrients, vegetarian/vegane, prices and so on.
- About the farmer: An info panel for additional offers or advertising for the farmer like farmer's store, holiday on the farm, guided farm experience and so on).

 About the market itself: An info panel for additional explanation about the market system (*Zero Waste*, sustainability programs, deposit system and so on).

As an example the product info panels can be reused by other customers in the market. Each product information panel can be stored next to the grocery bin. If customers are interested in more information about the grocery they can grab a panel for their own use at home. Alternatively, the logistic staff of the market uses the product side panels for the assembly of the meal boxes.







Figure 5.13. Box Flexible Info Panels

## 5.4.3.4 Stage: After-Sale



Figure 5.14. After-Sale Stage (Customer Journey Map)

#### Stage & Actions

She transports the box to her flat (see Figure 5.15). In the kitchen she opens the top panel of the box to see all ingredients. The recipe is printed on a side panel. She removes the side panel to use the recipe next to the cooking area. When her boyfriend arrives, she is not finished with the meal. The boyfriend interacts immediately with the box and hands over the missing ingredients that are still in the box. By chance he recognizes an offer for a holiday package on a farmer's place that delivers the ingredients of the meal to the market.



Figure 5.15. Box in Action

## **Emotions & Moment of Truth**

Emotionally the whole interaction with the box is positive. From the easy transport to the unwrapping of the box (top and side panels). Each step gives a unique experience that can not be compared with a supermarket purchase.

## Touchpoint: The Box

The box integrates into the kitchen environment as a temporary rack or shelf (see Figure 5.16). For people with only few time left for grocery shopping and irregular meal times such a system can replace the inventory holding at home.


Figure 5.16. Box in the Kitchen

The last step of the customer journey is the return of the box and the food containers. Whereas the food containers are part of a deposit system, the box is part of a rewarding system. If the box is returned without damage the customer is honored with bonus credits for the next purchase. A rewarding system is more positive, because sustainable behavior is appreciated, but is not mandatory. As a side effect, customer loyalty can be established, because the customer has to enter the market again to return the box with a chance to buy some groceries again.

### 5.4.4 The Holistic Box

In this chapter the core artifact of this thesis - the *Holistic Box* - is discussed in more detail from an aesthetic and functional perspective (see Figure 5.17).



Figure 5.17. Holistic Box

The box consists of different separate parts that have to be stacked together (see Figure 5.18 and Figure 5.19). Each part can be cut out of a corrugated cardboard sheet. If staff is a little bit trained the box can be assembled together in less than 30 seconds. The construction of the box is only done by stacking. There is no glue or other tools needed for assembly.

The material costs of such a box are very small (20 to 30 cent per box<sup>19</sup>). The logistic advantage is that the box can be delivered by a cardboard supplier in flat and lightweight planes that are very space-efficient in storage and transportation. Due to the fact that the cardboard consists of recycled paper (77 percent<sup>20</sup>) the box has a high degree of sustainability. Additionally, the box should be used more than once. The customer is motivated to return the box by a rewarding system that is explained in the last stage (see Section 5.4.3.4).

<sup>&</sup>lt;sup>19</sup> Information provided by Kartonfritze, http://www.kartonfritze.de

<sup>&</sup>lt;sup>20</sup> Information provided by Kurtl, https://www.kurtl.com/karton



Figure 5.18. Box Construction Guide



Figure 5.19. Box Construction Set

As it is a holistic box it has to fulfill several functions that are listed below organized in specific design requirements.

#### Aesthetics

One major principle in design is aesthetics (Lidwell et al., 2003). The customer should like the overall appearance of the box. The reduced and natural appearance of the box should remove the barriers for the customer, as a menu box is a radical new object.

### **Protection & Transportation**

The box should protect the groceries included, but should also be easy to transport. The material cardboard can be very robust if the right thickness and a stable construction pattern are used. Cardboard is also very lightweight and suits perfect for transportation purposes.

### Assembly & Packaging

The box is arranged as a frame construction with separate parts that have to be stacked together. The construction design principle is crucial to carry various loads of groceries and containers (Lidwell et al., 2003). The box can be constructed in different sizes depending on the sizes of the individual parts (e.g. small, medium, large).

### Usability

The ease of use or usability as an overall design principle plays a major role when it comes to the acceptance by the customer (Lidwell et al., 2003). The design principle affordance aims for hints in the design that enables intuitive user behavior (Lidwell et al., 2003). The top panel is a good example for an affordance, because the open and close parts are directed outwards, so that it can be easily seen how to open the box. The grab in the center of the top panel visualizes where to carry the box. Another example of affordance is the internal structure of the box. The chess-like structure symbolizes the employee how to pack the box with containers. Access is another design principle to enable the ease of use and reduce barriers for users (Lidwell et al., 2003). If the box is opened the customer has just a top view on the groceries. To get full access the customer can remove the side panels to get direct access to all groceries. This is associated with another design principle called

stepwise reveal (Lidwell et al., 2003). As the side panels are removed the customer can interact with the information on the panel provided. Piece by piece the customer learns more about the box and its content.

### Modularity

The containers filled with different groceries act as independent modules that should fit into the box according to the design principle of modularity (Lidwell et al., 2003).

### **Information Presentation**

According to the design principle of visibility (Lidwell et al., 2003) there should be not more information on the box as necessary. As the side panels contain information related to the recipe, the producer and the product, iconic representation (Lidwell et al., 2003) is used for easier recognition. The side panels can also be used for branding purposes of the market.

### **Reusability & Sustainability**

As the cardboard box is part of a reusable system in the context of the Food-*As-A*-*Service* process (see Figure 5.4) the box is returned as often as possible by the customer. Certainly, cardboard has a natural expiration date. Cardboard has a very high recycling with which the *Holistic Box* can be called as very sustainable.

### Extensibility

As it is a rectangular, nearly square-like shape the box can be stacked on each other. In the kitchen environment several boxes stacked over each other and revealed of all side panels can work as a temporary rack to store groceries or other stuff. The extensible property of the box in stacking and arranging several boxes to each other can also support the comfort shopping mode (see Section 0). As a result, a freight bicycle can transport easily several boxes for delivery to customers.

### 6 Conclusion

### 6.1 Discussion

Related to historical developments, grocery markets evolved from markets offering groceries without packaging to markets offering industrially packaged groceries. Various drivers for this development were the industrialization, new packaging techniques, increased hygienic requirements, new convenience-oriented consumer types, self-service supermarkets and the growth of brands and marketing for grocery products. Society has changed, and especially the customer's perception and value of time and hygiene has changed in the last centuries. Former types of markets without packaging as for example the *Mom-and-Pop-Stores* have nearly vanished, because they were not convenient enough for the mass of consumers.

However, it seems there is a slight trend back to the origins of grocery markets. *Zero Waste* is a movement towards this direction offering sustainable principles as reduce and reuse of resources by changing the lifestyle of consumers. By definition, it is not clear what should or could be the trigger to change the lifestyle of consumers. Regardless of this fact, several grocery markets opened recently in Europe avoiding packaging and using bulk containers to sell their groceries.

Certainly, packaging has reasonable advantages (protection, distribution, labeling), but also some disadvantages that are related to unsustainable waste management and unreflective consumer behavior (ecologic cost, food waste). Today, packaging for groceries is only thought in a linear direction from resource utilization to disposal of resources regardless of the ecologic consequences. Related to sustainable behavior a *Closed-Loop-Economy* is favored. In a *Closed-Loop-Economy* waste prevention is the measure with the highest priority. Waste prevention is related to *Precycling* (instead of recycling) and the sufficiency strategy, because the focus is on the change of human behavior to consume in a reasonable way and produce only what is really necessary. A *Zero Waste* grocery market integrates these sustainable principles at its core.

A *Zero Waste* grocery market could also solve some further challenges that emerged with modern supermarkets:

- The value loss of groceries in price and meaning. Solution by the support of the human senses (see, smell, taste) in a *Zero Waste* grocery market groceries reformulating their unique value.
- The increase of consumer confusion and stress, because of the overload of information. Solution by the decrease of this stress with the reduction of packaging and brand information and the re-orientation on the groceries itself.
- The loss of the customer experience by feeling shopping groceries as an unpleasant daily routine. Solution by the use of *Multisensory Enhancement* experienced when different sensations interact and thereby fit together in meaning.

In detail, the connection between *Zero Waste* and the customer experience is subject of this work. The hypothesis stated at the beginning of the thesis - *A grocery market based on Zero Waste can provide a better customer experience compared to ordinary grocery markets with packaged goods* - cannot be declared as true or false per se. In the context of the first research question this answer is explained in more detail as follows:

*I. Can a grocery market based on Zero Waste principles provide a better customer experience than an ordinary supermarket with packaged goods?* 

From the experts' perspective a grocery market based on *Zero Waste* principles is not only more sustainable than other markets, but can also provide a better experience for the customers, because all senses are addressed, the direct interaction with the groceries and the choice to select the right amount of groceries. But, within the interviews, especially during the constructed *Zero Waste* scenarios, many experts expressed feelings that this new way of shopping would not be that easy to handle for the mass consumer. Further, the new process is too long and too complicated in a world where time is getting less and less and at the same time people are striving for more convenience. However, most experts were sure about that a market focusing on sustainability as well as on the customer experience is both, realistic and desirable for the future.

As the Zero Waste philosophy guides people to change their lifestyle to a more sustainable behavior, design can be the trigger to support at the same time

consumer-satisfying and sustainable *Zero Waste* processes. This process of creating sustainable products, services and systems is the fusion of design and sustainability. Related to sustainable design is the design-led system change that focuses on the design of behavior-changing products that motivate people to adapt their behavior towards sustainable use. In this direction pointed the second research question of this work as follows:

# *II. How should a grocery market based on Zero Waste principles be designed to provide a better customer experience?*

The implementation of *Zero Waste* principles leads to a more sustainable grocery market, but is not per se designed for a better customer experience. Within the innovation workshop setting several conceptual approaches were identified by an interdisciplinary group of participants to increase the customer experience or to tackle known obstacles. These conceptual approaches in the form of prototypes were translated to general design principles for the product concept design as follows:

- Product information availability: The basic design principle is that certain product information plays a role at different stages of the grocery shopping process. Whereas some information is needed at the purchase stage (e.g. which product to choose), some information is only relevant at the after-sale stage (e.g. preparing of the ingredients). Equally, the form of the product information (digital, analogue) is dependent on stage of the process.
- Easy planning process: The basic design principle is the order by recipe. A recipe relies heavily on the exact amount of groceries by definition. At the same time, *Zero Waste* has its strength when the customer needs an exact amount of groceries. Further, easy planning with the support of digital technologies (app, online services) overcomes the time and inconvenience obstacles of a classical *Zero Waste* grocery shopping process.
- Experience and logistics area: The basic design principle is that the customer has no direct interaction with the logistic part (collecting groceries) of the grocery order. This decoupling of the experience and the logistic part as a concept enhances the *Zero Waste* experience, because the inconvenient elements (weighing, collecting, and waiting at the cash desk) are removed out of the process.

- Shopping bag and grocery containers: The basic design principle is a returnable system and a suitable carrying system for the grocery containers.
- Target groups and community building: The basic design principle is that there are different target groups interested in a *Zero Waste* grocery market. Many people are not very satisfied with today's supermarkets. At the same time, many people have not much time to organize their grocery shopping properly. Therefore, it makes sense to provide different shopping modes for different target groups.

The differentiation into different shopping modes makes obvious that depending on the selected mode - *Classic, Convenience* or *Comfort* - other customers or needs are targeted. The focus of the product concept design is the planned convenience shopping mode that consists generally of four steps: Select the recipe online and pay for it (e.g. via smart phone app), register at the market counter to pick up the recipe box and transport the box to the customer's home. Compared to the convenience mode the classic mode that has in total twelve steps that has to be accomplished by the customer.

The entire grocery shopping process is built on a closed circular system. In this new system, food is translated to *Food-As-A-Service*. With the process of combining different groceries in the right amount to a recipe and bundling this into a box, groceries are transformed to a service that adds value for the customer. The result is a convenient recipe box that targets people that want to save time (no collecting process, no waiting at the cash desk), but still have needs related to the quality and freshness of the meal itself. The product information can be retrieved in the context of *Food-As-A-Service* permanently via online services. Additionally offline product information (recipe, farmer, market and product information) accompanies the customer while transporting and cooking the recipe box. Nevertheless, the information is not destroyed, but returned to the market with the box within a reward-based system. A modular cardboard box that works as the carrying system and the glass containers fulfill the sustainability requirements. A returnable system for the box and the glasses makes the system even more sustainable avoiding waste within the entire lifecycle.

The customer experience is generated by the individual selection of recipes via the online service, the real-time shop experience by just picking up the box, the recipe

box with integrated information panels and serendipity effects while cooking the meal (information on the box). Additionally, the planned convenience shopping mode fits perfectly to the other modes (spontaneous, classic and comfort) that can be provided to the customer at the same time using the same infrastructure (market, box, online service).

In summary, it can be concluded that a sustainable solution as presented in this thesis has to be easily understandable for the consumer, should be integrated into everyday routine and has to be made available to allow alternative courses of action, which can be realized without high transaction costs (Brunner, 2005). Design is the key for sustainability, to unlock and change unsustainable routines and actions of consumers (Ehrenfeld, 2008). Therefore, the solution is to design behavior-changing products that motivate people to adapt their behavior towards sustainable use (Acaroglu, 2013). Finally, the product concept design fits to the notion of Hartmut Esslinger (2012) who stated that it is the task of a designer to replace today's wasteful consumption with meaningful usage and long-term enjoyment and further create human-centric and sustainable businesses and experiences for all people.

### 6.2 Future Research

In the context of this research the final product concept design including the online services, the *Holistic Box* and the new convenient *Zero Waste* grocery shopping process was not tested by end users or consumers. For future research usability tests with the prototypes presented in this thesis with real target groups are a potential field of interest. Further, another field of interest would be a quantitative study researching, if *Zero Waste* grocery markets implementing the model of this work reach a higher degree of customer experience compared to ordinary supermarkets with typical packaged goods.

### 6.3 Future Work

In the course of this work a startup with the name - *holis market* - was founded. The startup tries to implement the conceptual prototype presented in this thesis. Certainly, a further product development and improvement of the *Holistic Box* is the target of the next startup phases. In cooperation with a cardboard-furniture-designer

and manufacturer a final prototype is designed and manufactured based on the ideas of this master thesis. Finally, a completely new grocery shopping experience is planned in Linz (Austria) opening in the mid of 2015.

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## Appendix

All parts added in the appendix can be retrieved digital.

Contact: <a href="mailto:seher.franz@gmail.com">seher.franz@gmail.com</a>

- Part A: Interview: Consent Form
- Part B: Interview: Guide
- Part C: Interview: Zero Waste Definition & Mood
- Part D: Interview: Zero Waste Grocery Shopping Scenarios
- Part E: Interview: Future Food (Markets) Scenarios
- Part F: Interview: Transcripts
- Part G: Workshop: Invitation
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- Part I: Workshop: Quotes
- Part J: Workshop: Prototypes
- Part K: Workshop: Photos
- Part L: Design: Design Briefs & Research
- Part M: Design: Shopping Modes
- Part N: Design: Food-As-A-Service
- Part O: Design: Customer Journey
- Part P: Design: Prototypes
- Part Q: Design: Photos