The Supermarket of the Future

A Case study on the Transition towards Sustainable Packaging

MSc thesis

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Colophon

The Supermarket of the Future: A Case Study on the Transition towards Sustainable Packaging

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Examination date
13-12-2024

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Preface

When I first set out to explore what topic I would immerse myself in during the course of my master thesis, I had not expected to work on such a large-scale and topical matter. In fact, I did not envision myself on the sofa after a long day of work to be confronted by the topic I had just closed my laptop on, nor had I expected to be staring in the mirror every time I conducted an interview or wrote down one of the numerous insights that are described in this thesis. But I like to believe that those are some of the exact reasons why it has been so engaging to work on this topic. A master thesis is often referred to as the big finale of your studies, in which you are able to show the knowledge you have accumulated over some number of years, but most importantly the set of skills that you have developed. Moreover, it is the last academically driven learning experience before acquiring a paid learning position. The process that led to this thesis has fallen nothing short of that, which is why I am incredibly excited to show you what I have learned and worked on for the past year.

However, I would first like to express my gratitude towards those who have contributed to the thesis that lies before you. First of all, I would like to thank the Kennisinstituut Duurzaam Verpakken for hosting me and this research project. Starting from day one, you have always made me feel very welcomed. Your passion for the greater goal you are working towards has been contagious, and you are a club full of amazing people. Additionally, for the remainder of the week (and my studies) I was hosted by the Department of Design and Production & Management at the University of Twente. I would also like to thank you for your passion, the lessons you have taught me, giving me a glimpse into the academic world, but also for the necessary distractions here and there.

Next, I would like to thank all interview and workshop participants who contributed to this thesis by joining and participating in the sessions that were hosted in light of this research. Through you, I was given the ability to get a glimpse of the interesting world of the food packaging supply chain.

Friends, housemates, and family - thank you for your support, distraction, concern and advice when I needed it most, and for an unforgettable past few years. I am excited to see what the future will bring.

In particular, I would like to thank Bjorn and Petra. I could not have wished for any better supervisors than you. Your unwavering enthusiasm, understanding, invaluable feedback, and support allowed me to freely explore and learn and I believe you have provided me with the best learning experience I could possibly have had. For that, I am beyond thankful.

Last, yet everything but least, Lucas. Words fall short on how grateful I am for your endless support. Do bist de nochter oant myn Frysk wannear ik it sels efkes net bin.

Dagmar Tjalsma

29th of November, 2024

Abstract

More than one million tonnes of food waste are estimated to have been produced in the Netherlands during 2022, which corresponds to 59 kilograms of food waste per Dutch citizen. The environmental impact of food waste is significant and requires action. While the implementation of food packaging can address food waste, its existence currently has a negative environmental impact. Adapting and implementing sustainable packaging may offer a method to reduce food waste while mitigating its environmental impact.

This thesis aims to contribute to the sustainability transition of the food packaging industry by exploring how the Dutch food packaging supply chain can transition from contemporary food packaging to sustainable packaging by 2050. Given that most food purchased by Dutch consumers is bought at supermarkets, a case study is employed to investigate what role the supermarket of the future can assume to facilitate this transition.

The research first focusses on the current state of (sustainable) packaging and the food packaging supply chain – including Dutch supermarkets - through desk research and interviews with stakeholder parties. It identifies some crucial challenges the supply chain faces that hinder its transition to sustainable packaging, such as being limited by short-term perspectives and tunnel visioning. The case study continues by developing and employing a framework for the analysis and capturing of developments that may impact the supermarket of the future, the Dutch food retail industry, food, and packaging. These trends collectively form the basis for the construction of different scenarios to investigate the Dutch supermarket of 2050. Moreover, research findings highlight that the developed scenarios can also be used to address the previously mentioned challenges which the food packaging supply chain encounters during its transition to sustainable packaging. Subsequently, to evaluate the effectiveness of this tool, several workshops are hosted with food packaging supply chain parties and stakeholders.

The workshops showcased that scenarios can be effectively used as tools for the investigation of possible futures and as tools to address the short-term perspectives and tunnel visioning that limit supply chain parties and stakeholders. It has become apparent throughout the research that contemporary and future supermarkets can indeed contribute to the transition towards sustainable packaging. However, given that such a transition requires a systemic approach, other stakeholders can also play a pivotal role. Although willingness is present under some parties, they struggle to identify how they can engage in this particular transition.

The thesis is concluded with a synthesis of the valuable insights that were gained on what the transition of a system requires, resulting in a set of boundary conditions that can aid organisations to more effectively engage in transitions of systems.

Abbreviations

B2B	business-to-business
B2C	business-to-consumer
D2C	direct-to-consumer
EPR	extended producer responsibility
GHG	greenhouse gases
KET	key enabling technology *(nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics and advanced manufacturing technologies)*
LCA	life cycle assessment
KIDV	Kennisinstituut Duurzaam Verpakken *(Netherlands Institute for Sustainable Packaging)*
SDG	Sustainable Development Goal

Table of Contents

1. Introduction

This introductory chapter lays the foundation for the remainder of the thesis. First, the problem which is addressed during the research is explained to generate an understanding of why this particular research is performed. Next, the hosting organisation of the research is briefly introduced. Subsequently, the objectives of the research are presented along with the structure of the thesis. Finally, the scope of the research is described.

1.1 Problem Definition

In 2018, food production accounted for 26% of the global greenhouse gas (GHG) emissions, equalling approximately 13,7 billion metric tons of CO_2-equivalent. Almost a quarter of those GHG emissions, responsible for 3,3 billion metric tons of CO_2-equivalent, are caused by food wastage along the food supply chain [32]. In the Netherlands, an estimated one million tonnes of food is wasted yearly, corresponding to approximately 59 kilograms of food per capita per year [33].

Food wastage can partially be prevented by means of food packaging [34, 35], as one of the properties of such packaging is to protect its contents against the external environment which prolongs shelf-life [1, 35, 36]. Though packaging has many complimentary benefits, the production and disposal thereof require significant resources and in return contribute to pollution and emissions [37, 38]. Simultaneously, packaging is also seen to be partially responsible for food losses due to inefficiency of the packaging design [34, 35, 39]. Therefore, packaging is a direct and indirect contributing factor to GHG effects, such as global warming and climate change [35].

In 2019, the European Commission published the European Green Deal: a strategic framework aiming to advance Europe towards climate neutrality and a circular economy by 2050 [40], and thus soliciting a transition. In light of the growing attention for environmental sustainability, the food packaging industry in the Netherlands is increasing its efforts to reduce the environmental impact of their products and practices [41-43], albeit for different reasons. While progress has been made [44, 45], industry seems to be hitting a plateau at a moment when stalling is not just unacceptable, it is detrimental [46, 47]. As a result, a transition may be required to overcome this obstacle.

Little data is available on which channels or organisations hold the largest share of food packaging purchased by Dutch consumers. However, it is known that the majority of foodstuffs consumed by the Dutch is purchased at supermarkets [48, 49]. Consequently, it can be assumed that a large share of food packaging units available on the market are purchased by Dutch consumers at supermarkets. Therefore, in such a large and multifaceted issue, could the supermarket be a key player in the transition of the food packaging supply chain towards sustainability in relation to food packaging? And if so, what role could the supermarket assume in this transition?

1.2 Introduction Host

This research is hosted by the Kennisinstituut Duurzaam Verpakken (KIDV), which is also referred to in English as the Netherlands Institute for Sustainable Packaging. The KIDV was established in 2013 following the signing of the Raamovereenkomst Verpakkingen (Packaging Agreement) 2013-2022. This agreement called for the establishment of an independent knowledge institute consisting of scientists and representatives of the government, municipalities and the packaging industry [41]. As described in the Packaging Agreement, the main task of the knowledge institute is to set up a 'sustainability agenda' with concrete and clear objectives which carves out a path towards sustainable packaging [41]. Alongside the establishment of a sustainability agenda, the KIDV guides organisations during the transition towards sustainable packaging and the implementation thereof. The KIDV does so by providing professional trainings, personalised advice, tools and knowledge [50]. Furthermore, the institute actively and continuously fosters and expands knowledge on sustainable packaging by hosting learning communities and conducting research [50]. As of 2024, while maintaining its independence, the KIDV became part of the umbrella organisation Verpact, which finances and coordinates the collection and recycling of packaging waste in the Netherlands and aims to further increase the circularity of the packaging industry, including the food packaging supply chain [51, 52].

The KIDV has perceived an increase in demand and interest from industry in guidelines that support sustainable packaging. As a result, the KIDV is seeking to explore methods that assist industry organisations in the pursuit of what KIDV refers to as **intrinsic sustainable packaging**: *"packaging without any negative impact on mankind or the environment"* [53]. In order to achieve this, it may help to define the future of sustainable packaging.

1.3 Research Objectives and Structure

This thesis aims to contribute to the sustainability transition of the packaging industry, and in particular the food packaging industry. To achieve this, a case study is employed which focusses on the transition towards sustainable packaging by the food packaging supply chain. This supply chain can most likely follow various different directions or apply different methods to achieve sustainable packaging. However, this thesis set out to investigate a single direction given that the research had a limited timeframe. The 'supermarket of the future' is chosen as a starting point for the case study. The primary objective of the case study is to explore what this supermarket could do to support the food packaging supply chain in their journey towards sustainable packaging. Therefore, the main research question reads as follows:

"How can the supermarket of the future facilitate the transition of the food packaging supply chain towards sustainable packaging?"

By answering the main question, a statement can be made on how contemporary supermarkets can adapt to assume this facilitating role. However, this requires an understanding of what the future and particularly that of the supermarket might look like, what sustainable packaging entails and what a transition entails. Given that the main research question can be divided into four research domains, the following sub-questions are established per domain to support the main question:

Sustainability and packaging	Supermarkets
What is food packaging and why is it important?	What is the state of the art of supermarkets and the supermarket landscape?
What is sustainability within the domain of food packaging?	What is the relation between supermarkets and the food packaging supply chain?
How can sustainable packaging for foodstuffs be achieved?	What will the supermarket of the future entail?
Food packaging supply chain	**Future**
What is the food packaging supply chain and how does it operate?	What does the future entail?
What are the challenges that the food packaging supply chain faces in the transition towards sustainable packaging?	What is required to initiate and facilitate a transition towards a future?
	How can a transition be facilitated?

Table 1: The sub-questions which are covered in this research divided into their respective domains.

The food packaging supply chain is a system comprising of components, as will be shown in the thesis. Therefore, the case study on the transition of this supply chain to sustainable packaging can be regarded as a case study for the general transitions of systems (Figure 1). Subsequently, this thesis contributes to the transitions of systems in general by developing an understanding of what must precede system transitions for transitions to effectively occur through a proposal of boundary conditions.

Figure 1: The thesis involves a multi-layered research on systems.

Reading Guide

The thesis is divided into four parts. Part one, which encompasses Chapters 2, 3, and 4, expands on the problem definition by discussing the current state of the four research domains as presented on page 3. Therefore, part one develops an understanding of what is involved in the transition of the food packaging supply chain towards sustainable packaging.

Chapters 5 and 6, enveloped by part two, elaborate on the tools that have been developed to define possible futures of the supermarket. In Chapter 7, which forms part three, the resulting tools are tested on their functionality and effectiveness.

Parts one to three contribute to the answering of the main question, and lead to the synthesis of this thesis: part four. This part consists of Chapter 8, which discusses the findings originating from the research through the case study (i.e., the transition of the food packaging supply chain towards sustainable packaging) that are transferable to transitions in general.

It should be noted that a substantial amount of the information presented in this thesis was gathered by conducting exploratory interviews. More elaboration on these interviews, such as participant details and posed questions, can be found in Appendix A: Exploratory Interviews, page 100. It is specified in-text with the symbol [E] when information is derived from one or more of the exploratory interviews. Subsequently, if the information is participant-related, a number is added to the symbol (e.g., E2), which corresponds to the manner in which the participant details are presented in Appendix A.

1.4 Research scope

The quest of achieving absolute sustainability within the food packaging industry is undoubtedly longer than anyone with a right mind would wish for. Establishing a functioning and inherently sustainable packaging system will take considerable time and effort, and this thesis is only a small piece of that complex 'sustainable packaging' puzzle that is in the process of being laid down. As such, a scope has been set.

This thesis focusses on supermarket chains and its surrounding food packaging supply chain in the Netherlands. Due to time constraints, it is assumed that all entities and operations of this supply chain are located and executed in the Netherlands. It is acknowledged that in reality the food packaging supply chain and its operations are internationally interconnected and are often located outside of the Netherlands, which is of importance when discussing, researching and solving problems regarding sustainability. In addition to the geographical scope, the thesis also focusses on organisations within the food packaging supply chain that (predominantly) apply linear economy principles, as these organisations are often further removed from attaining sustainable packaging.

There are several terms with relation to the scope that are extensively used in this thesis. The following summation provides the definitions of these terms as applicable throughout this report and argumentation for the applied definition:

- **Food packaging:** in this research the focus is on the primary packaging for foodstuffs that are often but not always in direct contact with said foodstuffs. These food packaging are generally purchased and used by individual consumers and are commonly found in supermarkets in the Netherlands.
- **Food packaging supply chain:** the packaging supply chain in this context comprises all organisations in the Netherlands that are collectively engaged in the production, retail, and processing of packaging for foodstuffs. To increase readability, the term is often shortened to 'supply chain', which may subsequently be encountered throughout the report.
- **Supermarkets:** this research focusses on physical supermarket stores given that an estimated 97% of the Dutch population shops at physical stores, of which 17% shops at both physical and online supermarkets [54]. In general, supermarkets directly sell small product quantities (e.g., less than two kilograms or fewer than six identical products) to consumers. Private supermarkets constitute 0,1% of the market share (Figure 6, page 14) [5-26]. Moreover, private supermarkets are commonly not part of a larger, highly influential organisation within the food (packaging) industry. Therefore, private supermarkets are excluded from the scope as it is assumed that these supermarkets are unlikely to exert significant impact on the dominant parties within the food packaging supply chain to facilitate a transition.
- **Sustainability:** though it is commonly denoted that there are three pillars to sustainability (i.e., environmental, social and economic sustainability) [55, 56], this study primarily focusses on environmental sustainability as this pillar is deemed most relevant in relation to the problem described in Section 1.1. Therefore, social and economic sustainability are not taken into account.
- **Future:** in this research, the envisioned future is set at 2050, which aligns with the long-term objectives of the European Green Deal that the food packaging supply chain must adhere to [40].

PART 1 | Analysis

PROLOGUE

To answer the main research question of this thesis, first, a better understanding is required of what components are involved in the proposed transition towards sustainable packaging and what these factors entail. In this part, the following sub-questions will be researched and answered:

- What is food packaging and why is it important?
- What is sustainability within the domain of food packaging?
- What is the state of the art of supermarkets and the supermarket landscape?
- What is the food packaging supply chain and how does it operate?
- What is the relation between supermarkets and the food packaging supply chain?
- What are the challenges that the food packaging supply chain faces in the transition towards sustainable packaging?

Moreover, in this part of the thesis, the concept of the future will be investigated in order to answer the sub-questions as drafted in the domain ‘Future’ (page 3) during later parts of the thesis.

2. Packaging and Sustainability

The introductory chapter of this thesis describes the necessity of implementing sustainable packaging in an effort to combat food waste. The purpose of this chapter is to develop an understanding of food packaging in relation to sustainability. First and foremost, it is necessary to comprehend why sustainable packaging is a topic of interest. Therefore, the chapter first briefly discusses that the food packaging industry is facing a dilemma with regard to sustainability and what this dilemma entails. Next, the state of the art of food packaging and sustainability and their constituent elements is elaborated on, which intends to generate an understanding of the accompanying difficulty the packaging industry faces due to the dilemma. Subsequently, the chapter finishes by discussing the complexity inherent to sustainable packaging.

2.1 The Food Packaging Dilemma

Food waste is a large contributor to global emissions due to the globalisation of the food system and the large quantity of produced foodstuffs [35, 57, 58]. Most purchased foodstuffs are enveloped in packaging which are designed to protect, promote, transport, and make these foodstuffs more convenient for consumption, and so forth [1, 59]. Essentially, the majority of packaging functions can contribute to the prevention of food waste [60]. Therefore, packaging is often seen as indispensable [34, 61][E].

On average, consumers open seven packaging units per day [62]. The majority of packaging has no function after use, which generally leads to its disposal. It is estimated that 110 kilograms of food packaging waste per person in the Netherlands was generated in 2021 [53, 63]. Without interference a further 19% increase in packaging waste in European Union is predicted by 2030 [37]. Meanwhile, wastage of the packaged product often induces a higher environmental footprint than its corresponding packaging [34, 35, 64] and the environmental impact of the packaging system is small compared to the impact caused by the food system [2]. As a result, the packaging industry is confronted with what is referred to as the food packaging dilemma: packaging is seen as a useful tool to prevent the environmental impact caused by food wastage [34], but simultaneously the packaging industry faces pressure to improve sustainability of packaging [37], while, inter alia, balancing consumer expectations and adhering to laws and regulations [59, 65][E].

2.2 Packaging

According to Directive 94/62/EC of the European Parliament and Council of the European Union, ‘packaging’ are all products that are made of any material and are used to contain, protect, handle, deliver and present goods from producer to user or consumer [59]. However, packaging often fulfils many more different functions, such as providing information on its contents and the handling thereof, improving the ease of use, enhancing storage of the product, etcetera [1, 35, 66]. Although not always solely responsible, the product that is to be packaged commonly determines the function of a packaging [2]. Similarly, the purpose of a packaging often relies on the packaged product and its properties. For example, if the purpose is to facilitate a better user experience while retrieving milk from a packaging, the designer can opt to add a pouring spout to a beverage carton packaging. These examples on packaging dependencies provide only a few of the many dependencies that are inherent to packaging. Both interdependencies and intradependencies (Figure 2) complicate packaging design, thus typically causing (a change in) the design of a packaging to involve multiple trade-offs [67]. For

example, changing the colour of a regular cardboard box to white can affect the choice in materials and increase the cost and duration of production, which may require a trade-off between the purpose of the colour change and the involved costs.

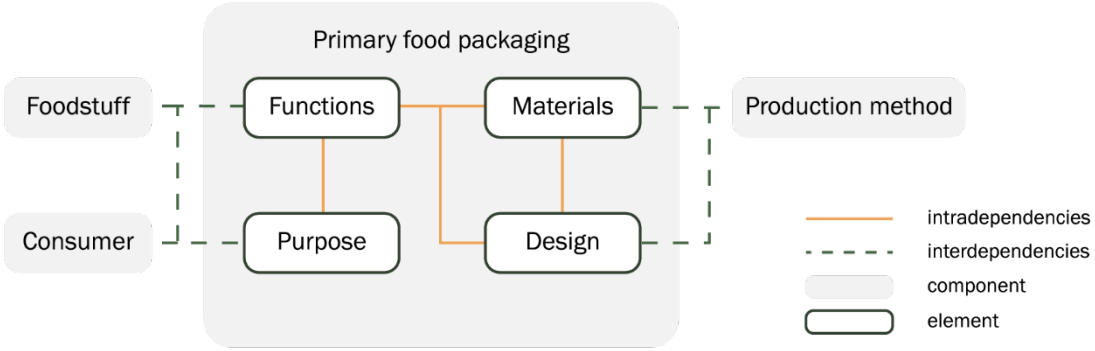


Figure 2: A simplified schematic exemplifying some possible intradependencies and interdependencies of primary food packaging.

The design, production, and processing of packaging involves more than the entity itself. It involves a system consisting of multiple actors, processes, relationships and components that are associated with the lifecycle of packaging. This implies that a change somewhere along the packaging system may translate to other elements within the packaging system (Figure 3). Additionally, given a regular life cycle of a packaging (e.g., excluding deviations such as production failure), packaging partially shares its life cycle with that of the packaged product (Figure 3) [67]. Decisions made in the packaging system can thus affect the packaged product lifecycle and its surrounding product system, and vice versa. Because packaging is generally mass-produced and thus decisions apply to large quantities of packaging, the impact of a seemingly minor change can be immense

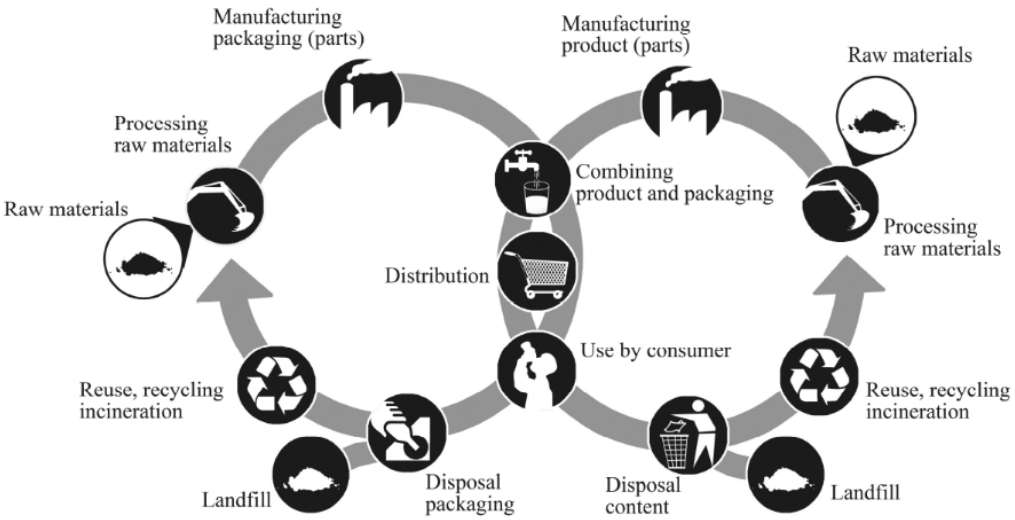


Figure 3: A simplified representation of the global product/packaging life cycle. Retrieved from [27].

In summary, there are different levels to packaging with a multitude of dependencies that often transcend packaging. Any change in a single packaging unit can affect different components, life cycles, systems, actors, and so forth, each with their own dependencies (Figure 4). The latter shows that many variables are involved in the realisation of a packaging. This makes the design and realisation of a packaging a complex process that involves many trade-offs.

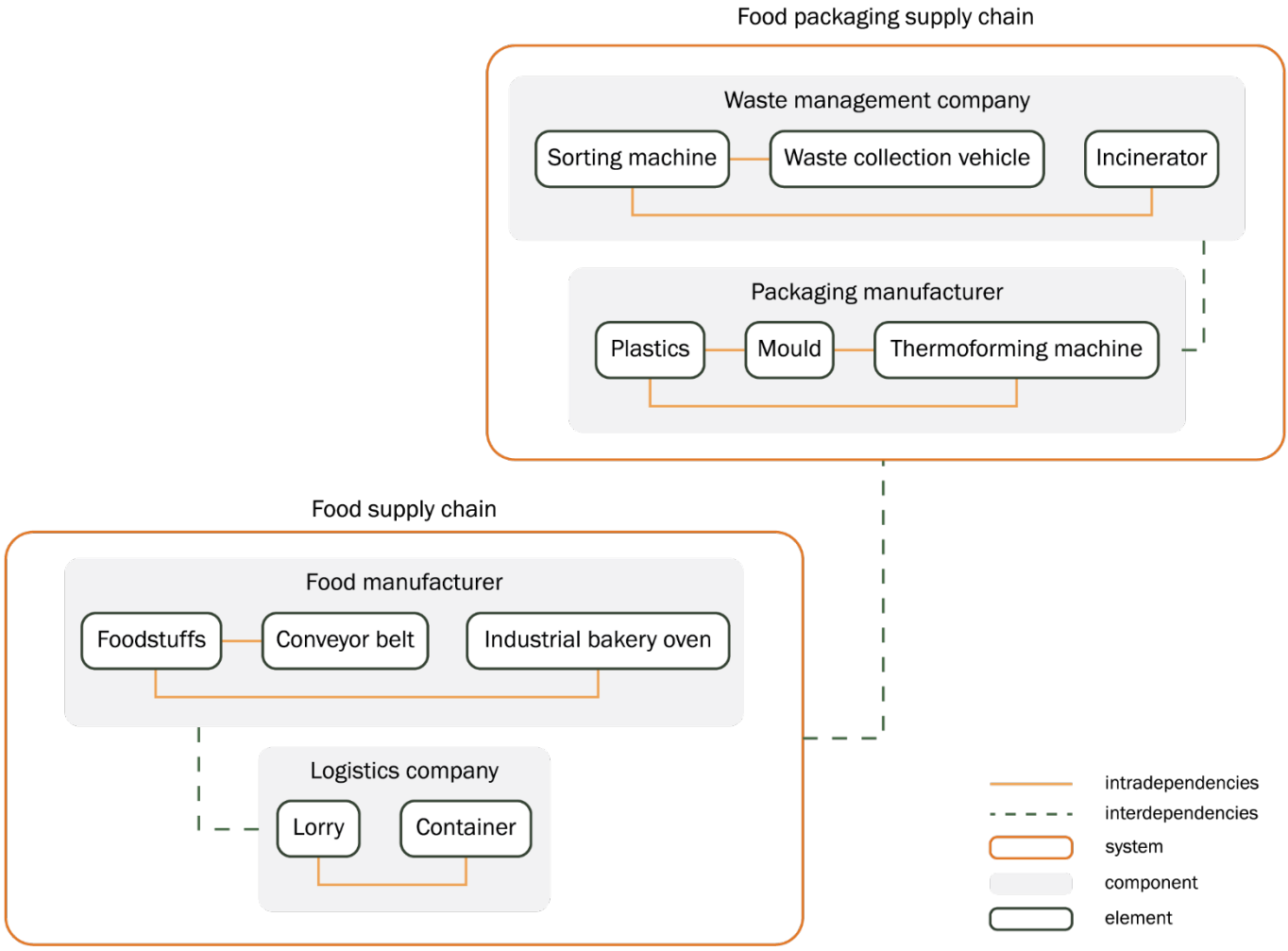


Figure 4: An exemplary schematic of intra- and interdependencies at a higher level.

2.3 “Sustainable Packaging”

The previous sections describe the inherent complexity of contemporary packaging, while also describing that the packaging industry is facing pressure to lower its environmental footprint by implementing sustainable packaging. What makes packaging, the verb *and* the noun, sustainable? To answer this question, first, an understanding of sustainability is required.

In 1987, the United Nations World Commission on Environment and Development famously defined sustainable development as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” [68]. Sustainability involves a balance between social equity, environmental quality, and economic prosperity [55, 56]. However, it is challenging to identify a single definition of ‘sustainability' which is universally applied [67][E]. Therefore, several methods and guidelines have been established to estimate the impact of certain practices, processes and

products, which are commonly used to interpret the level of sustainability. Examples include analysis and assessment methods (e.g., LCAs and IAMs), sustainability certificates (e.g., FSC, B Corp, Rainforest Alliance Certified [69-71]) and frameworks (e.g., Sustainable Development Goals, Circular Economy, Planetary Boundaries [56, 72, 73]). The 'R-strategies for circular economy' (Figure 5, page 11) is a framework frequently employed in the Netherlands to gain an indication of the environmental sustainability levels of products [28][E].

The interviews that were conducted as described in Appendix A: Exploratory Interviews (page 100) revealed that the perceived sustainability level of packaging depends on the employed definitions of sustainability and methods for its measurement. These subsequently depend on what is considered important by the parties who seek an indication of the sustainability level of their packaging. Therefore, sustainability can be considered both perspective-dependent as well as context-dependent. For example, if the level of sustainability is measured by the amount of recycled content used within a packaging (R8 in Figure 5), meat packaging would be unsustainable despite other efforts to reduce the packaging its environmental impact, for instance by employing strategies R1, R2 or R7, because meat is not allowed to be sold in impure materials due to current food safety regulations and guidelines (Appendix A.2 Participants, E2) [74, 75]. Furthermore, what may be considered 'sustainable' today, may not be considered sustainable in the future as the perception of sustainability changes over time [76].

In essence, discrepancies between these sustainability methodologies, frameworks, guidelines and definitions can oftentimes be observed, despite their shared objective of providing guidance to ultimately achieve sustainable development to a certain extent.

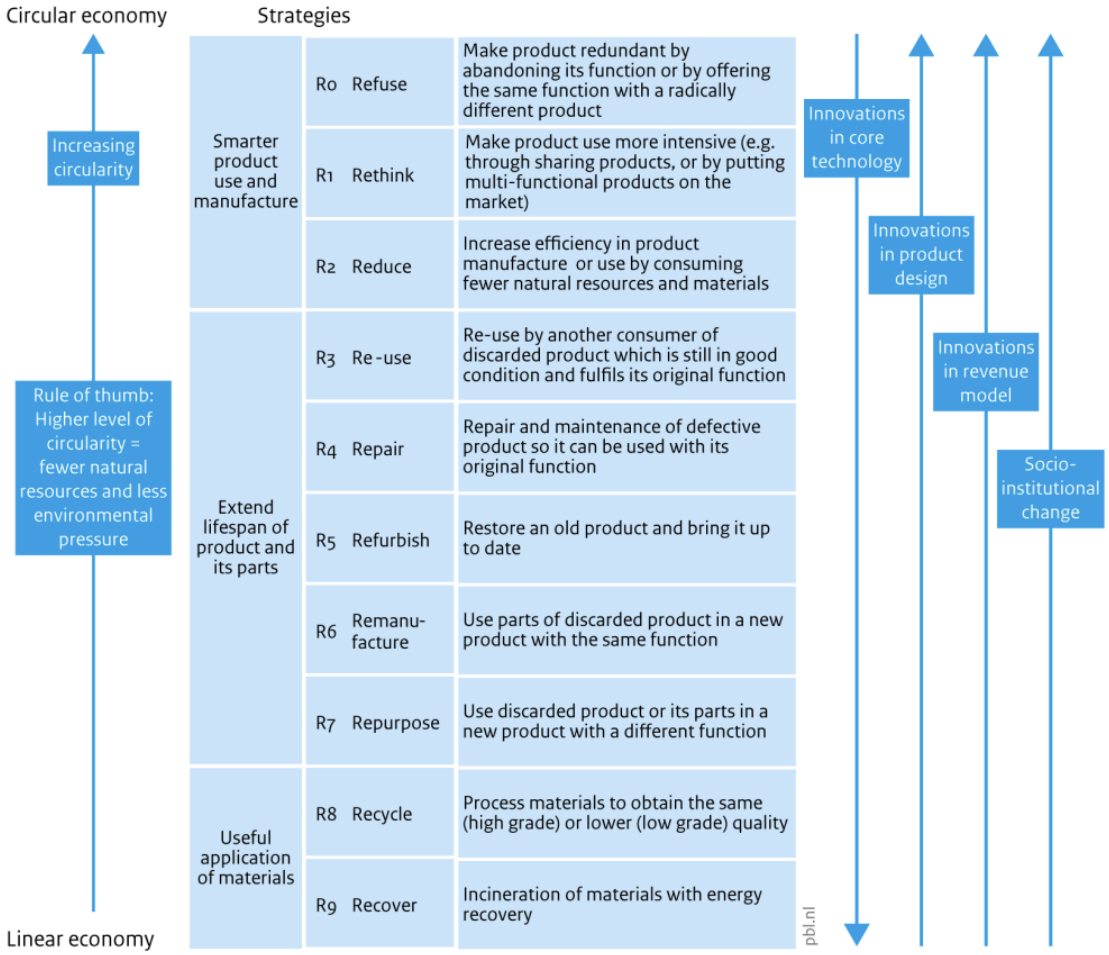


Figure 5: The 'R-framework' consisting of ten circularity strategies within the production chain, in order of priority. Retrieved from [28].

Research highlights the importance to implement systemic, interdisciplinary approaches to address sustainability-related challenges effectively [77, 78]. The alteration of an isolated element within a system to improve its sustainability does not inherently render the entire system sustainable. In contrast, it may reduce overall sustainability. For example, changing a plastic packaging to biodegradable paper packaging might necessitate adjustments from packaging manufacturers, such as acquiring new machinery to facilitate a different manufacturing method, or the investment in fossil-based energy due to an increase in energy demand. Therefore, the sustainability of an element can be affected by its dependencies, and vice versa. This example emphasises that systemic solutions are also required for food packaging that improve overall sustainability rather than focussing on isolated sustainability optimisations [79].

In addition to the ambiguity of sustainability, contemporary sustainable food packaging (*noun*) can be seen as a *contradictio in terminis* [79]. While packaging can contribute to overall sustainability by preventing food wastage, resources and energy are simultaneously required for its existence. At present, this mostly negatively impacts overall sustainability. Therefore, the transition to the concept of "sustainable packaging" may be better understood as the pursuit of the least environmental impact generated by preserving the functions of packaging, rather than an absolute ideal of sustainability [79]. This approach acknowledges the trade-offs present in sustainable packaging [80] and focusses on minimising harm while maximising utility.

Achieving sustainability in food packaging is not a one-size-fits-all endeavour. No single solution works universally across all food types (see Section 2.2, page 7), supply chains, or use cases [E]. Instead, the challenge lies in identifying the optimal balance for each context – an equilibrium where the overall impact is minimised while the functional requirements of a packaging are met. The pursuit of sustainable packaging involves evaluating multiple factors, including material selection, supply chain integration, and the environmental footprint of production and disposal processes. There is no "holy grail" for sustainable packaging; rather, it requires adaptive, context-specific solutions tailored to the unique needs of each scenario.

2.4 Conclusion

The objective of this chapter was to develop an understanding of packaging in relation to sustainability and what sustainable packaging entails. It has become evident that the food packaging industry is facing a dilemma on sustainability in which packaging is considered beneficial for its functions which can contribute to the prevention of food waste, while it is also regarded as detrimental due to its negative contribution to climate change. More sustainable packaging (*noun*) is widely pursued by the food packaging supply chain to reduce the negative environmental impact of packaging and to meet regulations and targets on sustainability. However, for a multitude of reasons, more sustainable packaging does not necessarily contribute to overall sustainability. Moreover, the food packaging supply chain risks facing the dilemma of having to choose between generating less food waste or not complying with imposed regulations and targets. This is a dilemma which must be avoided altogether. The food packaging supply chain must refrain from creating more sustainable packaging (*noun*) and must work towards sustainable packaging (*verb*) in which the packaging functions are preserved to avoid food waste.

3. Supermarkets and the Food Packaging Supply Chain

In the previous chapters, it is discussed that there is a need for the implementation of sustainable packaging for foodstuffs to eliminate food waste and the negative environmental impact of conventional packaging. Food, often enveloped by packaging, is primarily purchased at supermarkets.

The following chapter delves into the state of the art of supermarkets and the food packaging supply chain. It examines the nature of involved organisations, their interrelationships and challenges with relation to sustainable packaging. As a result, a statement can be made on if supermarkets can play a pivotal role in the transition towards sustainable packaging.

3.1 Contemporary Supermarkets

Before the introduction of the supermarket in the Netherlands, people shopped at multiple, separate stores to obtain their daily groceries because most stores only sold items from one single food category (e.g., milkman, greengrocer, cheesemonger, etc.) [81]. In grocery stores, customers had to notify a shop clerk about the products and quantity they intended to purchase. Shop clerks would subsequently collect and weigh the items and pack them in a paper bag for customers to take home [82]. 1946 marks the introduction of the first self-service store in the Netherlands after the concept had already been introduced and well-accepted in the United States [82, 83]. Counters and scales were traded for pre-packaged products and customers were allowed to collect groceries by themselves. Self-service stores became increasingly large and started to offer a broad range of products which included fresh produce. This led to the opening of what is considered the first Dutch supermarket in 1953 [82, 84].

Contemporary supermarkets, as part of the food industry, offer a wide variety of food and non-food products to a large and varied group of consumers with different food consumption needs and purchasing patterns [2, 81]. The supermarket is visited at least once per week by 94% of the Dutch population. However, most consumers visit the stores twice or three times per week [54]. Subsequently, supermarket chains are the most dominant retailers in the food service industry, being responsible for more than half of the food and drink turnover in the Netherlands in 2018 [48, 49]. As of January 2024, more than 6700 physical supermarkets could be found in the Netherlands [22]. This is a 56% increase compared to 2019 when the Netherlands hosted 4300 physical supermarkets [85]. Though the number of supermarkets in the Netherlands has shown an increase over the years, the number of different supermarket chains continues to decrease [26, 49]. Fifteen supermarket chains currently occupy most of the supermarket landscape with more than 4700 stores [5, 10-21, 23, 24, 26]. Collectively, these organisations account for 99,9% of the total market share within the supermarket sector (Figure 6) [5-9, 25].

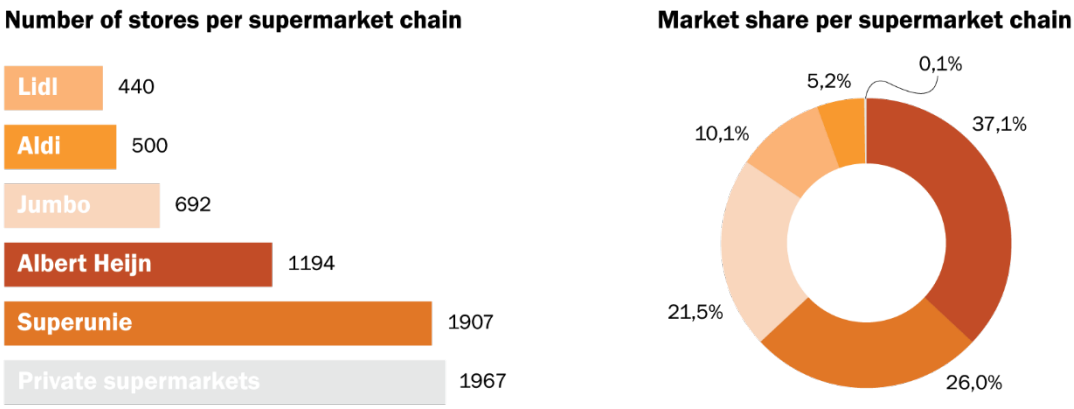


Figure 6: The number of physical stores per supermarket chain in the Netherlands and their respective market share. Superunie is the purchasing organisation of Plus, Boni, Boon's Mark Coop, Poeisz, Nettorama, DekaMarkt, Hoogvliet, Vomar, Spar and Dirk [4]. Based on [5-26].

Supermarket chains each have their own supermarket formula(s) that allow them to separate themselves from their competitors. A formula makes up part of the brand identity of a supermarket chain and partially determines the customer groups that are targeted. In general, a distinction can be made between two supermarket formulas [86][E6, E7]:

1. **Full-service:** as the name indicates, supermarket chains that use this formula focus on providing their customers with high quality service and products. This often translates into a large and diverse assortment of premium brands. Examples of full-service supermarket chains in the Netherlands include Albert Heijn and Jumbo.
2. **Discounter:** supermarket chains that apply this formula mostly target budget-conscious customers. 'Discounters' commonly offer a smaller selection of products with limited choice consisting mostly of private label or off-brand products. Example of discounter supermarket chains in the Netherlands include Aldi and Dirk van den Broek.

However, the formulas are not mutually exclusive. That is, there are discounters that offer premium brands and/or focus on high quality and service while maintaining a discounter identity [E6][86], and similarly there are also 'high-end' supermarket chains that offer inexpensive and/or off-brand products [87].

Though most supermarket chain branches comply to a main formula, some supermarket chains have branches that adhere to a sub-formula. Sub-formulas are store concepts that are aimed at serving a specific target group, product range, or market segment. For instance, in densely populated areas in the Netherlands you can often find city variants that are relatively small-sized, offer less products, have less variety than regular supermarkets, and mostly sell on-the-go products [88, 89]. A special type of branch are franchises, which are also individual stores operating under the auspices of a supermarket chain, though these stores are managed by an independent entrepreneur and often sell local foodstuffs [90][E].

Interviewees indicated that the food retail industry is highly competitive [49][E]. It can be argued that supermarket chains attempt to remain relevant, innovative and accessible to the best of their ability, to ensure *raison d'être*, attract (new) customers, gain market position and increase their competitiveness. Examples of competition measures include memberships and excessive discounts

[91]. Besides strong competition between supermarket chains, research shows that supermarkets have also started to compete with other food retail channels and foodservice-related organisations. For instance, most supermarkets nowadays have in-house bakeries, and some even have in-house butchers and cheesemongers to compete with speciality shops. Another example includes Jumbo who bought La Place in 2016 [92]. After its purchase, La Place restaurants were incorporated into a few Jumbo supermarkets to offer in-dining experiences to customers, thus competing with food service channels and simultaneously discerning Jumbo from competitor supermarket chains. These seemingly small deviations may drive consumers to shop at a certain supermarket chain or another, according to interviewees [E6, E7]. Moreover, these measures have partially caused supermarkets to become the important retailer they are today. Despite their current status, supermarkets are part of a larger system, known as the food packaging supply chain.

3.2 The Food Packaging Supply Chain

Supermarkets are often also referred to as retailers: they purchase products from parties and sell these products to the public. In a general sense, supermarkets can be found in the middle of the food packaging supply chain, as illustrated in Figure 7. This chain can be virtually split into two parts: the back and front of the supply chain. The front of the chain is predominantly, but not exclusively, responsible for the production of food packaging, whereas the back of the chain is mainly, but not exclusively, responsible for the processing of packaging waste. Supermarkets are involved with both sides of the supply chain [93][E].

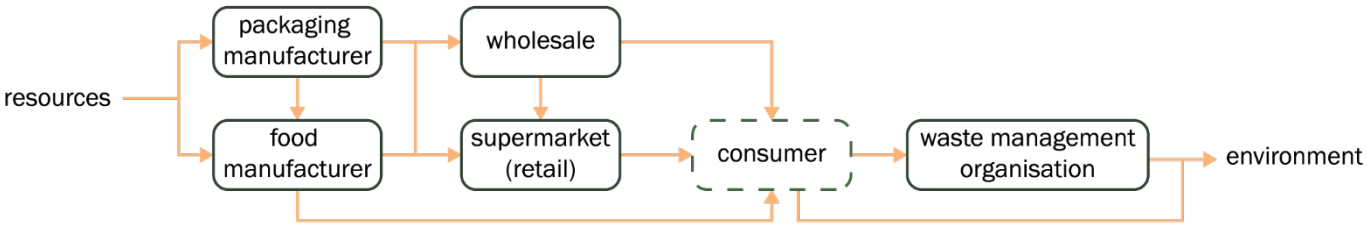


Figure 7: Simplified presentation of the predominantly linear food packaging supply chain. Transport is excluded from the schematic, given that their influence on the transition towards sustainable packaging is assumed to be limited due to their business focussing on the transport of products. The figure provides a generalised overview of linear economy packaging transportations between organisations. Based on [1, 2][E].

Figure 7 provides a general and simplified view of the food packaging supply chain and the movement of packaging (materials) between organisations. The food packaging supply chain consists of numerous varying organisations, which generally have different functions, interests, processes, resources, stakeholders, and so forth [E]. Many of these organisations are interconnected through supplier-client relationships, as noted by interview participants [E]. For instance, supermarkets source packaging and foodstuffs from producers, who in turn purchase products from manufacturers, who subsequently purchase resources from raw material suppliers. However, indirect relationships within the chain are also present. For instance, packaging waste management organisations, though not being direct clients of supermarkets or manufacturers, depend on upstream supply chain organisations for materials and designs to ensure their facilities can process packaging waste. Conversely, manufacturers depend on the services of packaging waste management organisations to comply with EPR [94]. Thus, upstream activities and decisions can influence the food packaging

supply chain downstream, and vice versa, regardless of the exact relation between the food packaging supply chain parties.

Furthermore, external stakeholders, such as logistics companies, governments, and trade associations, are influenced by activities and decisions within the food packaging supply chain [93][E]. However, this relationship is reciprocal as these stakeholders also shape the supply chain through, inter alia, regulations and industry standards. For example, consumers, as external stakeholders who act as clients rather than direct participants in the food packaging supply chain, influence decisions and activities through their purchasing habits and disposal behaviour, affecting for example end-of-life packaging management.

Internal stakeholders, such as employees, similarly impact and are impacted by decisions and activities within the supply chain. For example, employees can actively shape the outcomes through their roles and responsibilities [E]. In summary, the activities and decisions of the food packaging supply chain are accompanied by a high level of reliance.

Besides the aforementioned interdependencies, parties in the food packaging supply chain are facing several more challenges on the path to sustainable packaging, as revealed in the exploratory interviews. First of all, interview participants emphasised a strong desire to meet customer demands [E2-E4, E6], despite high volatility in customer demand [E2], oftentimes in fear of losing customers [E4, E6]. Participants also mentioned organisations are frequently being constrained in their visions and ambitions by current-day technology [E2] and legislation [E3, E4]. Furthermore, Participant E4 noted that *"There is a limited availability in factual data"*, further elaborating that the majority of organisations commonly abstain from uncertainties within decision-making to limit commercial risks [E4].

Interview participants highlighted that organisational changes generally require significant investments (e.g., financial means, time, effort), but that some organisations are reluctant to make new investments when it is unknown what it will yield and previous investments have yet to reach their initial value [E4, E5].

Furthermore, participants indicated that there is oftentimes limited collaboration between stakeholders of the food packaging supply chain, stating that "*there is simply not enough time to sit together with individual parties, so we mainly meet each other via trade organisations*" [E5] and "*if we collaborate, we mainly discuss current-day matters, not topics concerning the future*" [E3]. To complicate matters, there are parties that are willing to engage in sustainable packaging and those who are not. These unwilling parties include organisations as an entirety, for reasons such as losing the right to exist in a current format [E1], but also departments or colleagues within a single organisation for reasons such as *"we have done it like this for decades, [and colleagues state] why would we change?"* [E2]. The willingness of parties within the supply chain to adapt can be related to the Diffusion of Innovation Theory by Rogers [95] to illustrate the different perspectives, interests and current-states of these parties. This theory indicates that a (social) system can be divided into five different categories based on their willingness to adopt innovations [95]:

1. **Innovators**: generally deal with a high degree of uncertainty because of their early adoption of innovations and therefore must be able to absorb possible loss if the innovations fail or do not meet expectations.

2. **Early adopters**: are seen by Rogers as role models for the remaining categories given that they have the greatest degree of 'opinion leadership' within a system. By adopting innovations, they decrease uncertainty for the following categories.
3. **Early majority**: a group that seldom leads adoption of innovations but are relatively willing to adopt.
4. **Late majority**: often adopt innovations out of economic necessity and are generally sceptic with regard to the innovations.
5. **Laggards:** are suspicious of the innovations and rather resistant. This is often due to limited access to resources. Rogers states that this group, despite their hesitance, can generally benefit most from innovations.

Ultimately, the organisations within the food packaging supply chain can be categorised among these five categories [E]. Given the dependencies between organisations, the difference in a willingness to change can be counterproductive during a transition towards sustainable packaging.

3.3 The Role of Supermarkets in the Food Packaging Industry

Insights have been gathered on supermarkets, the food packaging supply chain, and their relationship. The following sub-section devotes additional space to some of the insights that were gathered regarding the role of supermarkets in the food packaging industry which aims to provide a better understanding of the state of the art of supermarkets and what role supermarkets may be able to adopt in the transition of the food packaging supply chain to sustainable packaging.

The majority of food purchased by Dutch consumers is bought at supermarkets [48]. Consequently, a large share of the food packaging units purchased by the Dutch population may also originate from supermarkets. This assumption was reinforced by Participant E6 (see Appendix A: Exploratory Interviews), who claimed that *"supermarkets are responsible for most food packaging and plastic packaging [in the Netherlands]"*. Nonetheless, all interview participants stated that supermarkets were not considered to hold a monopoly as alternative points-of-purchase for foodstuffs are available, and because supermarkets rely on other parties within the food packaging supply chain. Yet, they are considered to be highly influential and to wield significant power over other stakeholders within aforementioned supply chain. For example, participants E2 and E3 mentioned that supermarkets set requirements that organisations must adhere to. Participant E6 remarked that *"if supermarkets do not want to pay for a sustainable packaging [unit], it will not be found on shop shelves"* while Participant E11 noted that supermarkets are the largest among their clientele. Supermarkets are among the few organisations within the food packaging supply chain with direct consumer interaction, as noted by Participants E7 and E8. This grants them a unique position of influence, given that they can steer consumer purchase behaviour [49, 93]. Additionally, Participant E1 highlighted even though there are alternative points-of-purchase for foodstuffs, the amount is limited. This observation seems to align with the, albeit scarce, available data on stores and market share (Figure 6, page 14), as well as data on sales volumes. For instance, in 2017, supermarkets accounted for 87,8% of the volume share of fruits and vegetables in the Netherlands [96].

Meanwhile, Participants E1, E2 and E3 specified that other stakeholders such as premium brands also wielded significant power [49]. For instance, supermarkets rely on premium brands to attract consumers [E6] and on packaging manufacturers for high quality packaging [E6, E7, E11]. Moreover, supermarkets also rely on other parties their in-house knowledge on inter alia food and packaging [E3, E11]. Additionally, Participants E4 and E6 added that the majority of supermarket chains in the

Netherlands rely on Superunie, a purchasing organisation for foodstuffs [4]. In contrast, Participant E2 claimed that *"some premium brands pay to be on the shop shelves"*, which somewhat corresponded to the statement of Participant E1, who outlined that manufacturers are dependent on supermarkets to profile and sell their products. Participant E2 declared that regardless of the distribution of power within the supply chain, *"you simply have to keep up with the market"*. Subsequently, all participants indicated that each food packaging supply chain stakeholder had an important role within the sustainability transition and that all parties could exert some degree of influence [E].

3.4 Conclusion

This chapter aimed to explore the state of the art of supermarkets and the food packaging supply chain, focussing on their nature, interrelationships, and the challenges faced by the food packaging supply chain in the pursuit of sustainable packaging. Additionally, it examined the current role of supermarkets, providing insights to what role supermarkets may adopt to support this transition.

Contemporary supermarkets play a pivotal role within the food packaging supply chain, not only as the most dominant food retailers in the Netherlands, but also as intermediaries between producers and consumers. The supermarket landscape is dominated by several supermarket chains that are competitive beyond the retail industry. Moreover, supermarkets employ a multitude of methods to maintain their crucial position. As a result, supermarkets significantly impact the decision-making processes of other organisations within the supply chain, especially with regards to food packaging.

The food packaging supply chain comprises a multitude of diverse organisations that collectively ensure the production, retail and disposal of food packaging. Yet, these organisations face many challenges on the road to sustainable packaging, including a high level of complexity which is exacerbated by the dependencies inherent to the food packaging supply chain. Moreover, organisations within the food packaging supply chain are hindered by tunnel visioning which is driven by uncertainties and short-term objectives.

The next chapter will explore the concept of the future as to explore how tunnel visioning and how these uncertainties can be addressed.

4. The Future

Given that contemporary packaging practices contribute negatively to climate change, the research aims to investigate how sustainable packaging can be achieved in the future. In particular, it researches how the supermarket of the future can facilitate this. The objective is thus to move from the current state of packaging to a future where sustainable packaging is the norm.

In essence, there is currently a desire to respond to something that is not yet there, something that is unknown: it is unknown what the supermarket of the future entails, nor is it known what the future of sustainable packaging holds. Furthermore, it is unknown what the future in general, all-encompassing, involves. Yet, supply chain parties that are willing to pursue sustainable packaging have demonstrated a desire for informed decision-making (see Chapter 3).

In the following chapter, the concept of future is explored. Having learnt that food packaging supply chain parties often suffer from tunnel visioning and that there are most likely multiple ways to engage in sustainable packaging, it may be fallacious to focus on one future. Therefore, elaboration is given on the concept of multiple, alternative futures. Moreover, it is discussed how the future, oftentimes accompanied by uncertainty, can be addressed.

4.1 The Concept of 'Future(s)'

In vernacular speech people often refer to *the* future. This implies that there is only one future. However, in the field of futurology scientists generally speak of multiple or alternative futures [97-99]. In fact, futurologists state that to cope with uncertainties, organisations should try to acquire and explore various alternative futures rather than focussing on one visionary future [100]. According to Voros [97], seven types of alternative futures can be defined (Figure 8, page 21):

- **Potential:** all futures beyond the present moment.
- **Preposterous:** all futures that are considered to be absurd and impossible. According to Voros (2017), this alternative future is of high importance within the discipline of prospective thinking.
- **Possible:** those futures that might happen, based on knowledge that we might possess someday.
- **Plausible:** based on our understanding of how the world works, these futures could happen.
  Probable: usually based on current trends, these futures are inclined/likely to happen.
- **Preferable:** those futures that people would like ('should, ought') to happen.
- **Projected:** these futures are expected to happen as they have been predicted by means of extrapolation. In essence, they are a continuation of activities or occurrences from the past and the present.

The concepts can move from one alternative to another with the passing of time. Voros [97] notes that for the alternative futures, *"the descriptions are best considered not as rigidly separate categories, but rather as nested sets or nested classes of futures, with the progression down through the list moving from the broadest towards more narrow classes"* (Figure 8) [97]. Although the alternative futures can be discerned through nuanced differences, ultimately all futures amount to being a possibility [97].

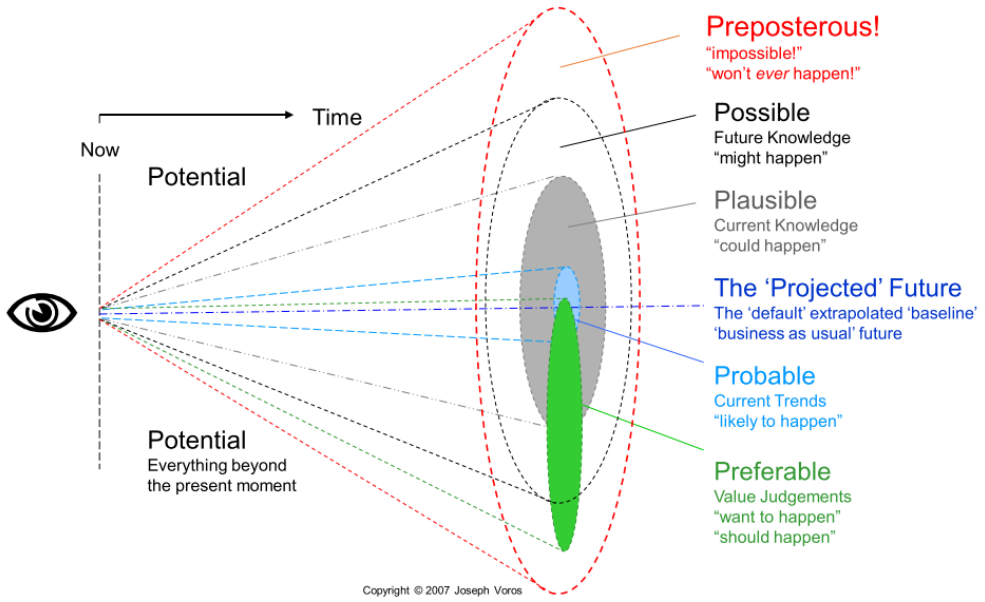


Figure 8: The Futures Cone depicting the seven alternative futures as proposed by Voros [97].

Though there are alternative futures, ultimately, it can be assumed that there is one true future – that being the future that becomes reality and transforms into the past. The "seven types of alternative futures" is only one of the many frameworks that illustrates the inherent complexity and ambiguity of the concept of future. Though various definitions and theoretical models have been established to manage possible futures, it remains impossible to know what the exact future *is* as it has yet to occur.

Fundamentally, the future is an unknown and therefore it is marked by uncertainty [31, 98, 101, 102]. However, humans have historically attempted to overcome this uncertainty by anticipating the future [101]. The anticipation of short-term futures is an everyday occurrence. Examples include the weather forecast ("Will it rain today?"), planning for deadlines ("Will I complete the project in time?") and setting daily routines ("At what time should I get up tomorrow?"). Such short-term futures are relatively manageable. However, as the time gap between the present and the future expands, the number of variables and associated uncertainties increases considerably [97]. Consequently, anticipation of long-term futures becomes increasingly challenging.

To better understand the different types of uncertainties in relation to alternative futures, use can be made of the Rumsfeld Matrix [30] in which (un)certainties are classified into four categories (Figure 9, page 22):

- **Known knowns:** elements that are known and understood (e.g., quantitative knowledge, experiential knowledge);
- **Unknown knowns:** elements that are known, yet not consciously acknowledged or utilised (e.g., unconscious habits, forgotten knowledge);
- **Known unknowns:** elements that are known to be absent, misunderstood or uncertain (e.g., research gap, the future);
- **Unknown unknowns:** unforeseeable and oftentimes disruptive elements, oftentimes referred to as Black Swans [103] (e.g., COVID-19, the rise of the Internet).

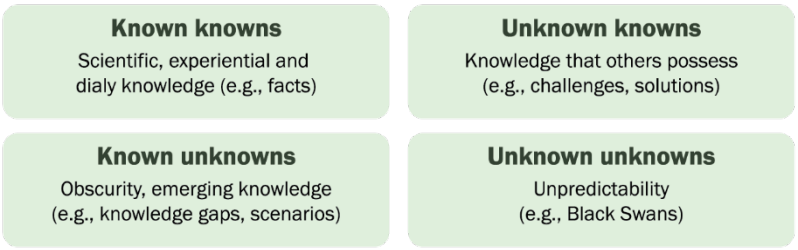


Figure 9: The different levels of (un)certainty according to the Rumsfeld Matrix. Adopted from [30, 31].

In the general sense, the future can be seen as a known unknown as it is acknowledged that the future exists, though it is unclear what the future withholds. One way to deal with this uncertainty is to interpret the future by means of *forecasting* and *foresighting* [31].

Forecasting is used when the future is somewhat certain and predictable. It relies on quantitative analysis to make data-driven predictions and estimates about futures. Forecasting is therefore generally objective and fact-based and often leads to one future option. Common examples of forecasting include the weather forecast and population forecasting [31, 104].

On the other hand, **foresighting** is applied when the future is uncertain and unpredictable. It involves a more exploratory approach to understand multiple potential futures using qualitative analysis. As foresighting does not necessarily rely on quantitative data, it can often be rather subjective. Ultimately, foresighting helps organisations to strategically think about long-term possibilities and uncertainties by means of anticipation [31, 102, 104, 105].

The future with relation to the scope of this thesis (i.e., sustainable packaging, supermarkets and the food packaging supply chain in 2050) is uncertain, as indicated by stakeholder parties during exploratory interviews (see Chapter 3)[E]. Given that the characteristics of foresighting align most with addressing this uncertainty, research on foresighting is continued in the next section.

4.2 Anticipating the Future

The previous section describes that there are different foresighting methods. Many researchers and organisations including Inayatullah [98], Slaughter [101], and Shell [106], have performed extensive research on different foresight methodologies, their applications and effectiveness, to name only a few. Given that the focus of this research is on exploring how a transition towards a certain future can be facilitated, it is beyond the scope of this research to perform similar thorough research on foresighting methodologies. Therefore, the methods will not be elaborately discussed but rather a short description is given on the principles of foresighting.

4.2.1 Foresighting

Foresighting is a methodology that helps to identify and anticipate forthcoming problems and opportunities which allows decision-makers to adapt to emerging situations. Moreover, foresighting allows the assessment of possible consequences of actions, decisions, etcetera. By addressing these problems before they occur, damage can be minimised. Simultaneously, the timely capitalisation on opportunities can maximise their benefits [98, 101, 102, 105]. More importantly, failing to apply

foresighting principles can have severe negative impacts [105]. According to Slaughter [101], the principle of foresight *"may provide a powerful stimulus for system change"*, because it moves the boundaries of contemporary perception [101]. A brief literature review on future thinking shows that foresight methodologies can generally be divided into several categories according to their purpose and functionalities [98, 107, 108]:

- To understand, identify and explore what precedes alternative futures by identifying drivers, relations, (in)direct consequences, and so forth. Methods and tools include Causal Layered Analysis [109] and the Futures Triangle [98].
- To create and define alternative futures. Methods and tools include Visioning [110] and Scenario Planning [102].
- To assess, understand, test and evaluate defined alternative futures. Methods include Wind Tunnelling [111], Cross-Impact Analysis [112], the Three Horizons Framework [113] and the Futures Wheel [114].
- To transform alternative futures into strategies or action plans. Methods include road mapping and Backcasting [115].

It must be noted that some methods or tools can be used for more than one of the aforementioned functionalities, as they often serve multiple purposes.

As indicated in the introduction to this section, the focus is on the exploration of how a transition towards a certain future can be facilitated. Therefore, the next sub-sections will elaborate on the elements that are involved in the construction of such an alternative future.

4.2.2 Trends

Futures often follow developments from the past, or, as some phrase it, "*the past and present push the future*" [98]. Such trends can be distinguished by their duration, impact, or the analytical level at which they exert influence (Figure 10) [31, 108, 116]. Trends with significant impact which have the capacity to transform systems and shape futures are commonly referred to as driving forces [31, 98, 108, 117].

Driving forces can embody any level of uncertainty as depicted in the Rumsfeld Matrix (Figure 9, page 22). However, when the objective is to address the uncertainties which accompany the future, it is most effective to focus on driving forces classified as 'known unknowns' [31]. These type of driving forces are known to have a significant impact, although it is unknown to what extent because their direction of change or pace of development are generally unknown [31, 98].

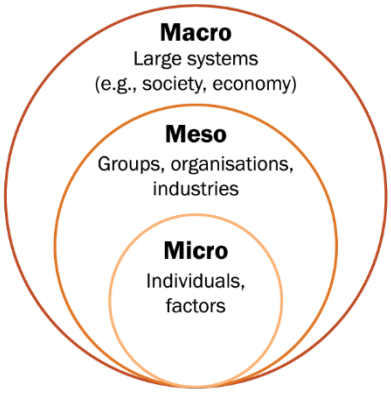


Figure 10: The different levels of environments in which trends can occur (i.e., analytical levels). Adopted from [3].

4.2.3 Scenarios

Essentially, scenarios are tools which enable the navigation and management of uncertainties by identifying and exploring potential futures (Figure 11) [31, 98, 100, 105]. Rather than predicting the future, scenarios offer a "window of opportunities", upon which the effects and implications can be reflected [100, 102]. Furthermore, scenarios are tools which support decision-making processes [31, 100, 102, 105], given that they can provide different and broader perspectives [100, 102], can support effective communication between parties as a dialogue tool [31], can oftentimes lead to new ideas and innovations [31, 102], and because of that may generate acceptance for strategic choices while supporting strategies [31, 100, 102].

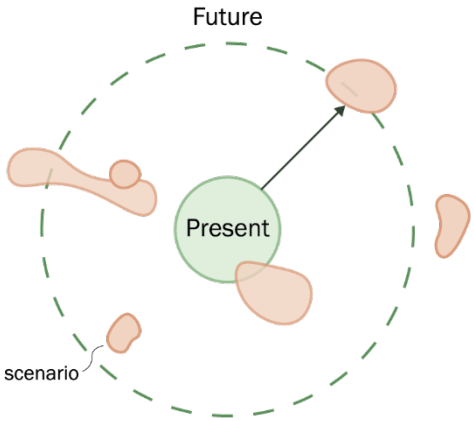


Figure 11: A simplified schematic of scenarios. Scenarios can take many shapes, can contain different directions of futures and may even overlap.

Scenario-making involves the generation of ideas and narratives without deeper analysis. Conversely, Scenario Planning involves the deeper analysis of past, current and potential future developments to develop broad and strategic futures which are able to support informed decision-making [105]. Within Scenario Planning, scenarios are best described as comprehensive descriptions of potential futures with an intelligible development trajectory, illustrating how that future emerged, based on a complex network of influence factors [31, 100]. According to Nekkers [31], well-constructed scenarios can be established by adhering to the following prerequisites:

- The scenario must be **radical**: it must outline a new world which deviates fundamentally from present-day reality.

    - E.g., the starting points must rely on something completely different than the dominant thinking of today and the scenario must encompass new future views.
- The scenario must be **plausible**: it must be imaginable that the envisioned reality can become reality within the given time period.
    - E.g., the scenario must not be science-fiction, it must be logically arranged from present to future.
- The scenario must be **relevant**: it must match the urgencies, interests, needs, wishes and fears of clients and must offer new insights to improve their decision-making process.
    - E.g., it must align with relevant issues, must be palpable, and it must not be dream or doom scenarios.

Nekkers [31] also states that scenarios must be equally radical, plausible, and relevant, and thus that the prerequisites should be met in comparable fashion.

To conduct Scenario Planning in order to develop scenarios, generally the following steps are involved [31, 98, 100, 102]:

1. Prepare the scenario project by determining why a scenario project is required, what the objective of the scenarios is (e.g., what will the scenarios be used for) and by defining the scope of the scenario(s) (e.g., time horizon, relevant topics, granularity). Furthermore, select a methodology for scenario development.
2. Explore trends and uncertainties by means of desk research, interviews, surveys, and other means to obtain information. Subsequently, determine the driving forces.
3. Construct the scenarios from the driving forces by means of the chosen methodology.

4.3 Conclusion

The objective of this chapter was to explore the concept of the future and to gain a better understanding of the uncertainty it oftentimes involves. It has become evident that there are multiple possible futures, and that all possible futures involve a different level of uncertainty. Reflecting upon the scope of the thesis, it can be concluded that there is no single definition of the future of supermarkets, the food packaging supply chain, or sustainable packaging.

Foresighting is a method commonly employed to address and navigate the uncertainty that accompanies possible yet unpredictable futures. Since the future is generally shaped by developments of the past, a foresighting methodology that can be employed is Scenario Planning. Scenario Planning involves the identification and analysis of impactful trends. These driving forces can subsequently be used for the development of scenarios. By employing this methodology, scenarios can be created which in turn can be used to address tunnel visioning and short-term perspectives by broadening perspectives and extending the focus of parties beyond their immediate concerns.

PART 2 | Shaping the Future

PROLOGUE

In Part 1 of this thesis, the current state of supermarkets, the food packaging supply chain and sustainable packaging has been discussed. However, the objective is to research how sustainable packaging can be attained by the food packaging supply chain through the supermarket of the future. Several challenges have been identified that could potentially hinder this transition, among which tunnel vision and short-term focus that are prevalent in supply chain parties, as well as the strong desire for informed decision-making. Part 1 showcased that by determining possible futures of the supermarket, supply chain parties may be able to overcome these challenges. Furthermore, by establishing 'the supermarket of the future', it can potentially be determined how it can facilitate a transition to sustainable packaging. Therefore, the following chapters describe the methodologies employed to develop a trend matrix and scenarios, which aid in envisioning the 'supermarket of the future'. As a result, the following sub-questions will be answered in Part 2:

What does the future entail?

What will the supermarket of the future entail?

5. Trend Matrix

Chapter 4 discusses that to define the future, the past and the present can be examined. Differences between the two and the developments that have occurred over time are analysed. These developments, otherwise known as trends, can afterwards be used to make a substantiated prediction of the future. However, numerous influential factors (i.e., driving forces) may shape these possible futures. To obtain an overview of these factors within the context of this research, a trend-matrix approach was applied. A trend matrix is a tool which supports trend analysis by visualising and categorising different trends within time periods and certain themes, otherwise known as trend mapping. Even though trend matrices are widely used within industry, no common methodology for the establishment of trend matrices could be found that fit the scope and subject of this research – that being a complex and multi-faceted issue concerning a system. Therefore, the trend matrix used in this research was designed by means of an iterative process. The end result can be found starting from page 39. This chapter describes how the trend analysis was conducted, the methodology used for the design of the trend matrix and the corresponding establishment of the design.

5.1 Methodology

The scope of the research as described in Section 1.4 was taken as a starting point for the trend analysis. Trends that have had, have or will have an impact on supermarkets, food packaging and the food packaging supply chain were gathered by means of desk-based research utilising online resources, reports and scientific literature. The DESTEP framework, a method that supports the examination of the macro-environment [118], was chosen to help identify relevant trends.

The DESTEP framework allows for the research and analysis of trends within six categories: Demography, Economy, Sociocultural, Technology, Ecology and Politics/Legal [118]. However, as a DESTEP-analysis solely focusses on the identification of developments in the macro-environment, it was assumed that the trend analysis would be insufficiently complete. Thus, three (sub-)categories were added: Food, Packaging, and Food Retail Industry, resulting in what will be further referred to as the DESTEP+ framework. More explanation on these three categories is given in Section 5.2. Trends that were identified during the analysis were subsequently categorised according to the DESTEP+ framework in what will be referred to as the ‘trend matrix’.

Timewise, the starting point for the trend analysis was set at 1953, which is when the first Dutch supermarket was opened [82, 84, 119], and the endpoint was set at 2050, according to the scope of the research (see Section 1.4). The overarching timeline of the trend matrix (from 1953 to 2050) was roughly divided into three time periods: the past (1953 – 2015), the present (2015 – 2030), and the future (2030 – 2050). The three time periods, as a combination forming the timeline, served as an indication of where to record different trends. At first, it was attempted to allot trends to specific time slots (e.g., 1971, 2008). However, some trends could not be appointed to specific time slots, nor could they be assigned to only one time period as the trends often transcended these. Therefore, trends were allocated much more fluidly. Thus, the trends stored in the trend matrix may sometimes be found across multiple time periods or in continuous timeslots, resembling some trends as perceived in reality.

The conceptual trend matrix filled with identified trends was reviewed during a meeting with approximately eight packaging (industry) experts from the KIDV. Their feedback on the trend matrix and the corresponding trends, oftentimes based on industry experience and knowledge, were considered and in some instances led to the fine-tuning of the trend matrix. The trend matrix that

was eventually established provides a complete overview of all trends gathered during the trend analysis and can be found in Section 5.3 Established Trend Matrix, page 39.

The methodology that has been utilised was partially based on the methodology as described by Schoemaker [102] and the scope and goal setting methodology corresponding to NEN-EN-ISO 14040:1998 [120]. Additionally, it emerged from an iterative approach involving trial-and-error. The methodology that ultimately has been applied to conduct a trend analysis and construct the trend matrix can be summarised as follows:

1. Define the focal issue, scope, subject, duration and granularity of the trend analysis.
    a. **Focal issue:** main problem, question or challenge to address and starting point of the research.
        Why is research being conducted?

    b. **Scope:** boundaries and extent of what is being addressed (e.g., geographical area, time frame, defined future).
        What are the boundaries of the research?

    c. **Subject:** topic, area or entity to be analysed (e.g., actor, central focussing point).
        What or who is researched? From which perspective is the research conducted?

    d. **Duration:** predetermine the duration of the analysis (i.e., define a deadline).
        How long will the research be conducted?

    e. **Granularity:** predetermine the granularity of information gathered during the analysis (e.g., monthly, yearly or decennial trends; analysed per unit or group).
        In what detail is the research conducted?

2. Choose one or multiple methods for trend analysis and trend documentation (e.g., expert interviews, literature review, DESTEP analysis).
    a. Additionally, to ensure the methods correspond to the entities named in step 1, adjust the method(s) to suit the predefined components of the trend analysis (e.g., define additional categories of influence).

3. Conduct the trend analysis and document trends.
    a. Find trends by reviewing suitable sources (e.g., annual reports, news articles, scientific journals).
    b. Document trends according to the chosen trend documentation methodology.
    c. Reassess step 1 and 2, correct trend analysis where necessary.
        E.g., does the methodology suit the scope? Has the scope been defined well enough? Does the granularity of trend identification suit the established duration of the analysis?

4. Review the trends that were gathered during the analysis.
    a. Gather feedback from experts on the topics that are analysed and the trends that have been captured.
    b. Adjust and recategorise where necessary (e.g., faulty or missing data and/or information).

5.2 Identified Trends

The following section presents the trends and developments that have been captured in the DESTEP+ framework by applying the methodology described in Section 5.1. Beforehand, the scopes of the trend analysis on the different categories are introduced by briefly describing what type of trends were considered relevant along with what the granularity of these trends is. For all categories, the reader can assume that the trend analysis has covered trends that affect at least the supermarket, food packaging, and the food packaging supply chain in the Netherlands, which corresponds to the scope set for the thesis (Section 1.4).

The identified trends are first concisely presented in the following sub-sections as independent developments per category, after which a collective overview is given of all trends, which consequently showcases the interdependent nature of the categories and the trends. The trends which were captured are considered significantly impactful and therefore relevant. However, many developments have taken place over the past 70 years and there is an inevitable inability to capture all relevant trends for reasons such as limited availability of resources and a limited timeframe for trend analysis. Yet, the trend matrix is deemed to sufficiently capture the main developments which, inter alia, influence supermarkets and food packaging.

5.2.1 Demography

Demography includes the statistical study of an area and the changes in its population during a particular period of time [121]. This category focusses on the demographic developments in the Netherlands. Topics include the age distribution of the population, number of inhabitants and distribution across the country, household composition, and educational level.

Demographic Trends

Around the 1950s, the average age of the Dutch public was 33 years. Only eight per cent of the population was above the age of 65 [122]. The Netherlands consisted of approximately 10 million people and population growth occurred due to natural growth and increasing migration [123]. In the 1960s, there were approximately 3,3 million private households, of which only half a million were single-person households [124]. During this period, people mainly worked in agriculture [125]. Leading up to the turn of the century, more people worked in industry [125]. Moreover, in 1993, the number of private households and single-person households had grown to 6,4 million and 2,0 million respectively [124]. Even though there was a growth in population nearing 2024, the natural growth had long before declined. Increasing migration has thus been the major contributor to population growth and accordingly, 2024 marked the milestone of 18 million inhabitants [123, 126]. By this year, the Netherlands consisted of 8,3 million private households of which 3,3 million single-person households [124]. The average age has increased to 42,4 years, with over 20% of the population being older than 65 years [122, 127]. Jobs are nowadays mainly in services [125] and the educational level is still increasing [125, 128-130].

Leading up to 2050, population growth is predicted due to increasing migration and due to a generally higher life expectancy in the Netherlands resulting in a lower death rate [123, 131, 132]. Additionally, fewer births are predicted, thus increasing the average age of the population [127, 132]. Furthermore, compared to 20-year-olds, 44,4% are predicted to be over 65 years old [127]. By then, the Netherlands will have 9,3 million private households and an increase in single-person households compared to 2024 [133, 134]. Ageing will increase in rural areas, as more young adults are expected

to move towards ‘de Randstad’ for job opportunities [134-136]. However, it must be noted that these predictions are based on the assumption that life will continue as usual. Demographic developments are highly dependent on Dutch and international economies, geopolitical circumstances and ecological events, among others [132].

5.2.2 Economy

Economic trends that have been captured include those that are known to have (had) a considerable impact on the Dutch economy and will continue to do so. This category is approached rather generally and roughly, as a general description of economic trends is assumed to be sufficient to generate an understanding of what significantly impacts the topics of interest.

Economic Trends

The Netherlands and the Dutch economy have been and remain very dependent on international developments due to a high share of imports and exports [125, 137]. Similarly, the gross domestic product has seen an increase in the Netherlands since the 1800s, except for during crises such as the two World Wars, the Great Depression, the Oil Crises during the 1970s, the 1980s Recession, the Credit Crisis from 2009 to 2014 and the Corona Pandemic [125]. There will be new crises in the future, yet it is unknown when and to what capacity (Black Swans) [103]. Nonetheless, the Netherlands has had and continues to have one of the most competitive economies in the world [138, 139], partially due to its high output of innovations and its status as a knowledge and service economy [125, 139]. The Dutch economy is regarded as a strong economy as it is relatively stable and has relatively low inflation rates [125].

The Dutch central government aspires and envisions an innovative, sustainable and strong Dutch economy for 2050 with widespread prosperity [140, 141]. Yet, this envisioned future trend theme cannot be directly adopted as certain: economies have a highly dynamic nature, are often globally interconnected, and are commonly typified as uncertain and unpredictable due to its many dependencies, such as the other macro-environmental categories described in this chapter [142].

5.2.3 Sociocultural

Any sociocultural trends that are strongly related to the Dutch their habits, behaviour, traditions and beliefs that affect food packaging, supermarket and food packaging supply chain operations are treated in this category [143]. Topics include habits and behaviours shown in grocery shopping as well as common beliefs and feelings typical to a particular time period. Additionally, a sub-category on the topic ‘Food’ is added to this section, which aims to provide a more comprehensive examination of food-related trends within a sociocultural context. These trends are often analysed at meso- and micro-levels and involve topics such as the shift in dietary preferences of the Dutch, consumption behaviour and lifestyle changes.

Sociocultural Trends

During the post-war period, people had little money to spend and were therefore rather frugal [144, 145]. Because of this frugality products had to be affordable and durable. Communities were very close due to the collective effort of restoring the country, due to a sense of unity succeeding the Allied victory and due to pillarisation within the Netherlands [144, 145]. Households were composed

with a clear distinction between the sexes. Men were regarded as the head of the home and worked extensive hours to generate an income while women worked extensive hours at home to take care of the household [144-147].

During the late 20th century, the differences between sexes began to blur as women increasingly entered the labour market [125]. This was possible as household chores became less labour and time-intensive, innovations allowed for family planning, societal ideologies began to change and the purchasing power of the Dutch increased [125, 144]. Conversely, as the overall working hours of a family increased, less time could be spent on household management [125, 144, 147]. Consumption patterns moved from conservatism and frugality to a culture of convenience and want instead of necessity, with excessive consumption and disposal as a result [93, 144, 147]. Succeeding a period of conservatism, requiring to be at the service of others at all times and widespread 'normalcy', the public mindset shifted to a state of individualism, liberalism and expressionism [144-146], which additionally contributed to the decrease in working hours [125].

Experts anticipate an even higher demand for convenience and flexibility in the future [148, 149]. Unlimited access to information may cause consumers to blindly trust unofficial sources and misinformation while it may also cause consumers to develop (a sense of) distrust towards official and endorsed information sourced.

Furthermore, experts assume that people will focus more on experiences, quality, health and sustainability [148, 150-152]. Despite these expectations, many future sociocultural developments cannot be anticipated as sociocultural trends appear unexpectedly and suddenly. Moreover, sociocultural developments are highly dependent on developments in all other macro-environmental categories.

Food-related Trends

After the Second World War, food was scarce and there was little variety – food was merely a means of survival. The Dutch diet consisted of locally available, seasonal, and (what was deemed) nutritionally dense foods, such as whole grains, vegetables, and dairy products [49, 147, 153]. As soon as food became more readily available, governments encouraged an increase in post-war calorie intake, and food scarcity transitioned into food abundance [81, 146] The cost of luxury foods like meat decreased, new exotic foods were introduced, and fresh foods became readily available, resulting in a modernisation of the Dutch cuisine [49, 81, 146, 147, 154].

The societal and industrial shift towards convenience and individualisation [49, 81, 148-150, 155] has resulted in the majority of present-day foods being (ultra-)processed and an extensive food offer, with the objectives of reducing preparation time and facilitating on-the-go consumption, inter alia [49, 81, 96, 154]. Over 75% of Dutch adults consume food at more than seven different moments during the day [81]. The Dutch generally regard food with little value [156] and as a consequence, food is wasted plentiful [57, 156, 157]. Furthermore, globalisation and overproduction of foodstuffs contribute to food wastage [81, 158]. Meanwhile, the knowledge on foods, human health, the environment and the relations between the topics has increased significantly. A corresponding growing societal awareness of prior consumption patterns such as over-purchasing, poor handling and excessive disposal of foodstuffs and their relations with the body and planet have prompted a transition towards sustainable, healthy and nutritional foods [39, 57, 81, 151, 155, 158-162].

Several directions for the future of food are generally discussed by experts, such as an increasing focus on healthy food and consumption thereof (e.g., less sugar, salt, and fats, an increase in

nutritional value and a decrease in quantity) [146, 150, 151, 163], highly individualised diets that are person-specific [161], new foods stemming from new food sources and production methods (e.g., sea farming, undiscovered exotic foods, insects, cultured meat, vertical farming) [150, 164], and an increasing focus on sustainable foods (e.g., local, protein transition) [81, 150, 162]. The future of food is however highly dependent on technological, sociocultural, economic and ecological developments, such as new food production methods, consumer acceptance, purchasing power and extreme weather. Therefore, the future of food is difficult to predict and is often assumed.

5.2.4 Technology

The technological developments that affect packaging, supermarkets and the packaging supply chain generally correspond with the development of industry as a whole, which aligns with the Industrial Revolutions (Figure 12) [165]. Although the Industrial Revolutions are commonly denoted by distinct time periods, their characteristic technological advancements oftentimes transcend these. For instance, the First Industrial Revolution (c. 1780s – 1840s) is typified by the large-scale implementation of mechanisation and steam power, which are technological concepts that are still in use today. Similarly, automation and cyber-physical systems are technological concepts expected to be utilised in the future [152, 164, 166].

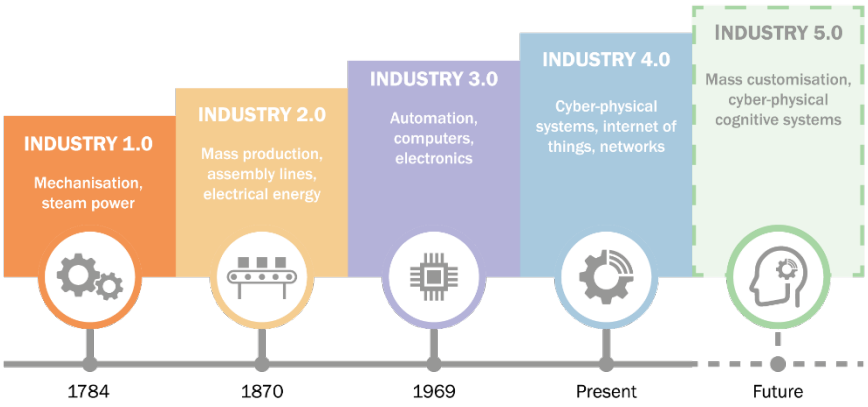


Figure 12: A simplified overview of the Industrial Revolutions and the year in which they are generally considered to have begun. Note that the technologies characteristic for the different Revolutions are not limited to that Industrial Revolution. Adopted from [29].

The development of industry has had a profound impact on the trends of other categories within the trend matrix, as will be shown in Section 5.2.8. This section is used to elaborate on some distinct technological applications, processes, frameworks and concepts that have had considerable impact and are expected to be of significant influence.

Considering the focus of this research, additional attention is paid to the topic of packaging, which has been designated a sub-category. This sub-category consists of a generalised description of packaging trends, which includes packaging material trends, the evolution of packaging purposes and functionalities over time, and trends that among others further impact the production, use and disposal of packaging as well as food consumption.

Technological Trends

The Dutch government actively promoted industrialisation, and while automation and assembly lines were present in industry well before the Second World War, Dutch post-war industry fully committed to automation and mass production [167]. Consequently, the Netherlands witnessed a considerable

increase in manufacturing capacity and productivity around the 1960s. Scientification facilitated further innovation and induced computer-aided automation in the 1970s [167].

After the war, the reconstruction of the Dutch infrastructure led to wide-scale household electrification. Current-day household samples like gas stoves, refrigerators, freezers, and microwaves became more widespread during the late 20th century [81, 144, 147].

Some of the household appliances that were introduced to the general public before and during the 20th century have since been succeeded by optimised versions or advanced adaptations (e.g., electric hobs, air fryers, food processors, boiling water taps). Other contemporary technologies that are widely adopted in industry and society or are expected to become increasingly common include wearables, mixed reality devices and artificial intelligence [156, 168]. Remarkably, such technologies have oftentimes been introduced many decades before. For instance, artificial intelligence was introduced in the early 20th century but has recently experienced considerable advancements and has gained increased popularity [169].

Retail industry experts expect many technologies to be developed and implemented that will significantly affect consumers and the food and packaging industry. For instance, they predict the future to encompass 'smart industries', in which they expect advanced sensors, robotics and automation to drive manufacturing processes and product development [135, 148, 152]. They also anticipate a strong reliance of industry on data [135, 148]. Furthermore, KETs and NBIC technologies are foreseen to introduce new materials, new products, and new food production technologies, but are also expected to improve currently existing manufacturing and waste management processes, and so forth [170]. Moreover, some expect the future to entail the "industrialisation of home cooking". For instance, the additive manufacturing of food products at home is anticipated [164]. Furthermore, retail industry experts expect further enhancement of convenience and consumer experience through improved industry processes, technological appliances or other innovations. For instance, they describe faster and automated delivery services utilising drones, kitchen robots fully responsible for meal preparation, nanotechnology enhancing the senses through molecular gastronomy, the forecast of consumer demand by employing artificial intelligence, and so forth [152, 164].

As is the case with many other trend matrix categories, the future of technology is uncertain. It is difficult to predetermine the course of development of technologies or technological concepts. Technologies may be fully developed within two years after two iterations, but it is also possible for a concept to remain in its early stages of development for several decades, and it reaches full maturity in several centuries following countless iterations [171]. Furthermore, history has proven that technologies can be unexpectedly revived through different applications or the (accidental) discovery of new purposes for them (e.g., microwave oven, Teflon, Artificial Sweetener). Additionally, it should be noted that technological innovation cannot (always) be pushed – it frequently unexpectedly occurs. As a result, it is challenging to anticipate the impact of new technological concepts.

Trends in Packaging

Even though metal, paperboard and plastic packaging had been invented and used well before the 1900s, and likewise important packaging methods such as pasteurisation and canning [93, 172, 173], these packaging materials and methods became more widespread post-1940s. The Second World War contributed to the improvement of preservation and logistics, and the development of new packaging materials, such as aluminium foil and plastic film [93]. Several new packaging materials, types and production methods followed in the late 20th century, such as the materials OPP, PE, PET,

and the methods coextrusion technology, enabling multi-layered packaging, vacuum packaging and aseptic packaging [93, 174]. Furthermore, packaging materials became increasingly tailored for specific applications [93, 153]. Following widespread application and adaptation, as well as high technological productivity, some materials, such as plastics, became inexpensive [93].

At present, the overall packaging quantity has severely increased over the years and is predicted to continue to increase. Similarly, the amount of and demand for single packaging units has increased [81, 96, 153]. On the contrary, the amount of material per packaging unit has decreased [153]. Other packaging-related trends of today are intelligent packaging [35], more sustainable packaging (e.g., recyclable, reusable, new packaging concepts) [85, 96, 151, 175] and packaging with a higher value as perceived by consumers.

Experts foresee that in the future, sustainable packaging will have become widespread (e.g., biodegradable, fully recyclable, reusable, compostable, packaging-free, less material use, etc.) [85, 93, 96, 151] but also expect smart packaging to be significantly influential [93]. Moreover, new packaging methods and materials are expected to arise [170].

5.2.5 Ecology

The category of 'ecology' encompasses trends pertaining to the natural environment, including climate and weather patterns, the availability of natural resources and the growing awareness of environmental issues. This section provides a generalised overview of ecological trends with occasional highlights of events that are considered highly important and sometimes disruptive.

Even though the scope as discussed in Section 1.4 implies a focus on developments in the Netherlands, environmental developments often align with global developments. Therefore, this section may discuss more globally applicable developments than other categories.

Ecological Trends

Global and Dutch emission levels in the Netherlands rose significantly after the Second World War [47, 176]. By the 1960s, some of the first observations of excessive plastic waste were reported [177]. Per the 1970s, carbon dioxide emission levels in the Netherlands had notably increased [47]. These developments, among others, contributed to a growing overall awareness of the environmental impact of industrial practices and societal behaviours. Subsequently, this may have led to an increase in the establishment of environmental interest groups and organisations [178, 179]. In the 1980s, research led to the discovery of a hole in the ozone layer which confirmed and highlighted the serious consequences of human activity on the environment [180]. Other critical events during the 1980s include carbon dioxide levels in the Netherlands reaching a peak height [47] and the founding of the Intergovernmental Panel on Climate Change [181].

Carbon dioxide emission levels in the Netherlands increased between 1970 and 2020, but have since seen an overall decline [47, 182]. Meanwhile, the implications of global pollution are becoming more prominent [46, 183, 184]. Research on the relationship between the environment and human activities has significantly increased, and this research has contributed to the expansion of environmental knowledge [185]. Furthermore, generally, the public seems to become more concerned with climate change [186, 187]. For instance, a growing awareness of plastic and a growth in disapproving attitude towards the use of plastics has been observed [156, 188]. However, simultaneously, there is a growing trend of environmental fatigue [189].

Researchers predict that climate change events such as extreme weather will occur with greater frequency and intensity [46]. As the consequences of pollution increase, it is likely that public awareness and concern will grow along. This awareness may drive the widespread adoption of circular economy principles and foster collaboration among industry parties [41, 151, 190]. However, experts are hesitant of these developments due to the possible increase of environmental opposition. They also believe that the decline of greenhouse emissions will come to a halt if our way of living is not changed completely [46].

5.2.6 Political and Legal

Politics and legal measures often cover many different disciplines. However, the section attempts to provide a substantiated yet general overview of legislative measures and political events that have had and will have a significant impact on the topics covered in the scope (see Section 1.4). Examples include legislative measures on sustainability, the retail industry, packaging, and regulations that affect consumer behaviour.

Political and Legal Trends

The 1970s are seen as the period in which the Dutch political landscape began to seriously discuss the reduction of (packaging) waste and the categorisation of packaging materials [191]. As a result, the first Dutch memorandum was published in the 1980s which discusses the prevention and reuse of waste materials [191]. In the same decade, the European Union included packaging in an issued directive for the first time [192].

By the 1990s, the European Union introduced a directive dedicated to packaging and packaging waste [59]. In that same period, the Netherlands introduced legislative measures and agreements on packaging, waste and environmental management [191, 193].

In the following years, both the European Union and the Netherlands increasingly refined their regulatory framework by introducing agreements, legislative measures and action plans on the prevention and management of (packaging) waste and packaging, but also on what packaging must comply with to ensure, inter alia, consumer safety [41, 193-197]. A notable observed trend in recent years has been the growing emphasis on environmental sustainability [40, 196, 197].

Up until recently, retailers experienced strong governmental interference in their operations [49, 82]. For example, up until well in the 1970s, supermarkets were not allowed to sell bread [82]. Some interference in retail operations is currently still being exerted, including the allowed trading hours for physical stores [135]. Interference on other topics within the food industry has grown throughout the years. An example includes food safety and quality as exemplified by the Dutch Commodities Act, which was introduced in the early 20th century and has been expanded numerous times since [146, 198]. Similarly, governmental interference concerning societal food consumption has been present since at least the 1940s and seems to be increasing [199].

Beyond the food industry, there has been a noticeable increase in legislation focussed on (consumer) safety and health, the integration of technology and corporate responsibility [75, 200-202]

The fluctuating nature of politics causes the political and legal future to be somewhat uncertain. It can be assumed that a majority of the laws and regulations in force today will remain in force for at least the short-term future. Furthermore, there will likely be governmental interference, yet it is unknown in what manner and to what extent.

5.2.7 Food Retail Industry

Although many trends in the food retail industry correspond with macro-environmental developments identified in other categories within this chapter, this category was specifically established to emphasise some of the trends that have occurred within the food retail industry that have influenced supermarkets, and which are anticipated to shape future supermarkets.

Trends within the Food Retail Industry

In the 1940s, approximately 40.000 grocers could be found in the Netherlands [83]. In the following decades, the number of grocers decreased while the number of supermarkets increased [22, 83]. Self-service was introduced [82, 83], supermarkets began to expand their offer [82, 203], and the size of supermarkets increased significantly [82, 146]. An increase in focus on efficiency followed [150, 161]. Merges of supermarket chains over the years caused a significant decline in fragmentation within the market [26, 49].

At present time, fifteen supermarket chains make up most of the supermarket landscape [5-9, 25], turning the market into an oligopoly [149]. Yet, speciality shops, similar to grocers in the past, are returning to the market in great numbers [204, 205]. In response, supermarket chains are adopting multiple and varying formulas, often experimenting with and copying concepts from speciality shops (e.g., fresh fish on ice, in-store bakeries, cheesemongers and butchers) [152], hosting franchises [161] or experimenting and implementing new retail concepts (e.g., E-commerce, flash-channels, sushi-bars, in-store restaurants) [148, 204]. As a result, there is an increase in points of sale [49]. Meanwhile, the product offer continues to expand because of more products, private label products and the capitalisation on demand for niche products [49, 206]. Moreover, an increasing focus on customer service and experiences is observed as the ‘customer is king’ mentality is gaining more support [93, 135]. The COVID pandemic catapulted the retail industry into a digital transition [207], which caused automated store concepts including self-scanning, self-check-out terminals and automated micro-stores to establish themselves [152].

For the future of retail, experts expect further technology integration which will likely change currently defining aspects of the food retail industry, such as customer experiences and logistics [152, 164, 208]. Moreover, as a result, the retail industry is assumed to operate as a 24-hour economy [135]. Along with further technology integration, new business models are assumed to arise and current niche retail concepts are suspected to become integral [152, 205]. Yet, some predict that physical supermarkets will never cease to exist [207], unbeknownst in what manner. For instance, some predict staff-less and automated convenience stores [152, 161, 164].

The non-food sector is expected to enter the food retail industry and compete with currently existing and prominent food retail organisations [209]. Retailers are expected to focus more on (cost) efficiency, convenience, growth and digitalisation [152, 161, 205]. Additionally, an increased emphasis on sustainability is expected, such as sustainability as a sales aspect and an effort to reduce food and packaging waste [49, 141, 161].

5.2.8 Collective overview

The following section provides a relatively concise and collective overview of the trends from all the categories per time period as defined in Section 5.1. Note that in reality the trends oftentimes surpass the time period.

The Past (1953 – 2015)

After the Second World War, the Netherlands and its 10 million inhabitants collectively focussed on the reconstruction of its economy, industry, and society. During the 1950s and 1960s, men typically worked long hours in agriculture or industry, while women managed the household. Wartime shortages and post-war scarcity encouraged the use of durable goods, including reusable packaging. Technological advancements introduced halfway through the 20th Century boosted industry productivity and changed consumer habits as products became more readily available. During the late 20th Century, household appliances such as refrigerators and microwaves reduced the time for meal preparation, which allowed more women to enter the workforce and as a consequence changed traditional gender roles.

Meanwhile, technological advancements also changed the retail industry. New materials, food technologies and an increased productivity level allowed for the retail industry to expand its offer with new, oftentimes exotic foodstuffs. Whereas products became less expensive, a disposal culture emerged. In the late 20th Century, the environmental consequences of increased industrial productivity and general disposal culture became apparent, which resulted in the first regulations on environmental sustainability and an increase in awareness.

Economically, the Netherlands established a strong position in global trade by means of agricultural and industrial innovation. Economic stability allowed consumerism to grow as Dutch citizens were able to spend more money. Following the secularisation and a post-war mentality, individualism increased which also shaped purchase behaviours.

Following the turn-of-the-century, society has increasingly been shaped by technological advancements and globalisation. Full-time availability of products has paved the way for convenience. Meanwhile, the environmental consequences as a partial result of this convenience have become more apparent, and an increase in awareness and addressing of sustainability can be observed as a result.

The Present (2015 – 2030)

Accelerated technological integration and heightened awareness of sustainability challenges are prominent developments within the present time. The Netherlands has nearly reached 18 million inhabitants as a result of post-war population growth driven by natural birth and migration. Household dynamics continue to shift, with an increase in single-person households driven by individualism, urbanisation and a national increasing level in education.

The food retail industry has accommodated this continuous shift by expanding its product offer and embracing automation and digitalisation. Self-check-out systems, automated micro-stores and e-commerce platforms have emerged and redefine the customer shopping experience. The COVID-19 pandemic accelerated this digital transformation of retail, causing new supermarket formulas to emerge to meet changing consumer expectations.

Sustainability became a key focus of societal and regulatory efforts. Public concern about waste and pollution, particularly plastic waste, drove demand for greener products and practices. Governments responded with stricter legislation promoting circular economy principles and encouraging industry to adopt recyclable and biodegradable materials. These policies influenced packaging trends, with an increasing emphasis on reducing material usage and creating reusable or compostable options.

Health consciousness emerged as a key socio-cultural trend, fuelled by widespread access to information. This, among others, resulted in personalised diets, alternative proteins (e.g. cultured meat, plant-based options) and minimally processed foods. However, the demand for convenience remained strong, highlighting the ongoing tension between environmental responsibility and consumer habits. Technological innovations, such as smart packaging and AI-driven personalisation, offered potential solutions to balance these competing priorities.

Technological integration extended beyond retail and food production. Smart appliances, wearables and artificial intelligence became an integral part of everyday life, shaping how consumers interacted with products and services. These advances enabled greater efficiency in supply chains and personalised consumer experiences.

The Future (2030 – 2050)

The Netherlands is predicted to reach a population of approximately 20 million inhabitants, driven by further migration and an increase in life expectancy. Meanwhile, it is expected that the retail industry will undergo significant changes driven by further technological advancements such as Industry 4.0 and 5.0 technologies. Society is expected to continue to be driven by convenience, although an increased environmental awareness, focus on health and dislike for several technological advancements may cause a countertrend in which

5.3 Established Trend Matrix

This section presents the trend matrix framework with captured trends as described in the previous sections. The trends are placed along the timeframe of the framework according to their perceived actuality and most distinct period of impact. Note that in reality, trends are much less rigid than may be perceived while viewing the established trend matrix.

Within the trend matrix, a distinction has been made between several types of trends, as will become evident while viewing the contents of the framework. Figure 13 elaborates on how these trends can be identified and what they entail.

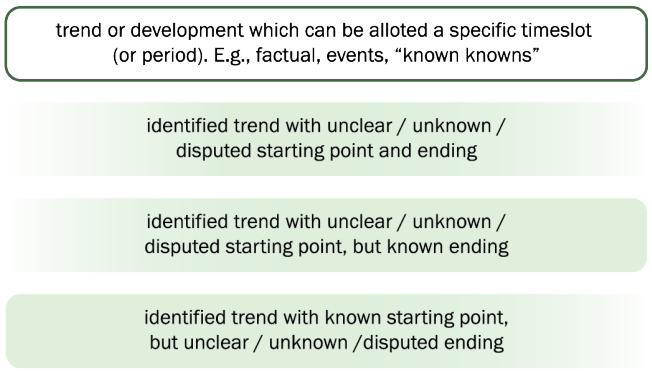
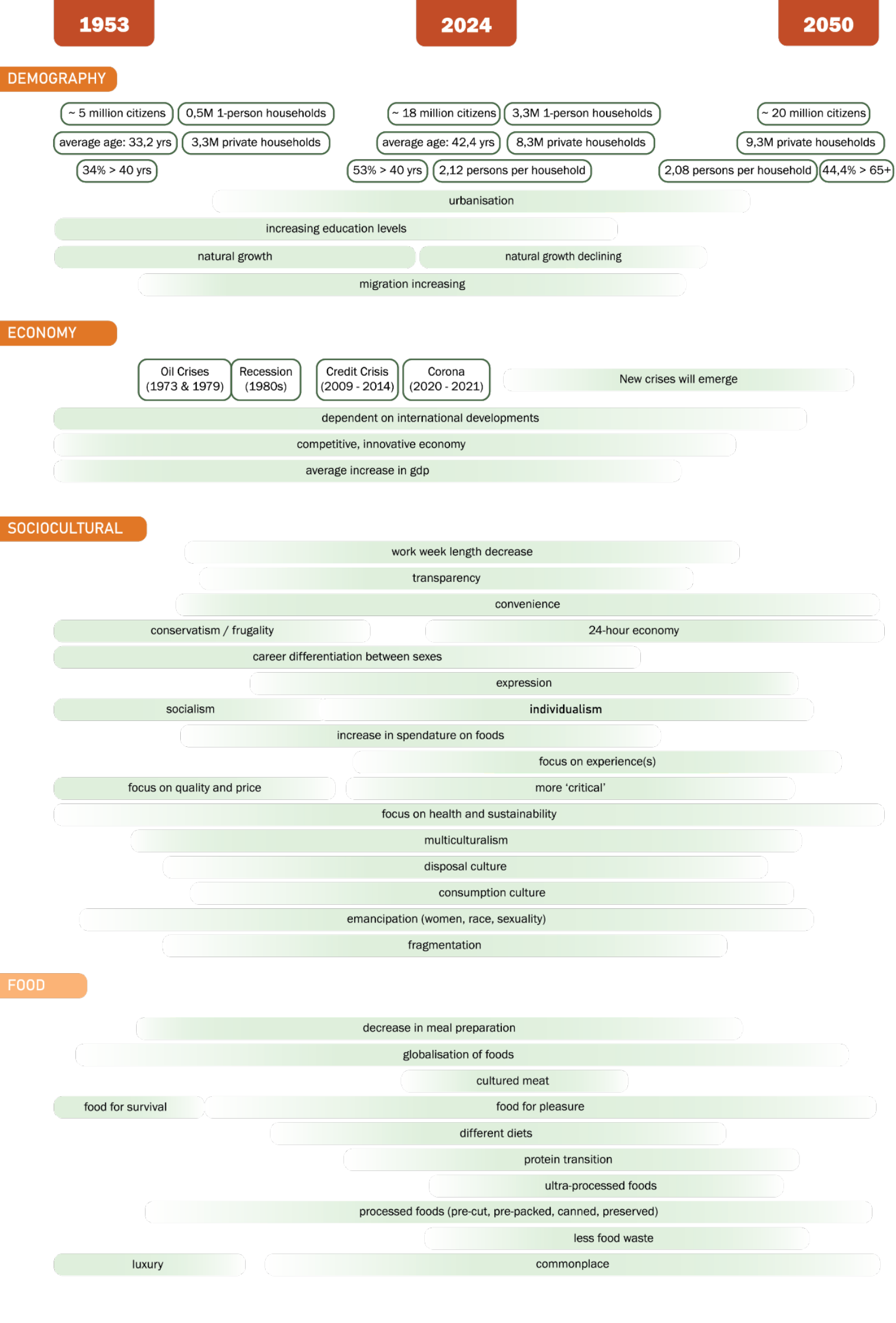


Figure 13: A depiction of how the different trends within the trend matrix can be identified with additional elaboration on the type of trends.


1953
2024
2050
DEMOGRAPHY
~ 5 million citizens
0,5M 1-person households
average age: 33,2 yrs
3,3M private households
34% > 40 yrs
~ 18 million citizens
3,3M 1-person households
average age: 42,4 yrs
8,3M private households
53% > 40 yrs
2,12 persons per household
~ 20 million citizens
9,3M private households
2,08 persons per household
44,4% > 65+
urbanisation
increasing education levels
natural growth
natural growth declining
migration increasing
ECONOMY
Oil Crises (1973 & 1979)
Recession (1980s)
Credit Crisis (2009 - 2014)
Corona (2020 - 2021)
New crises will emerge
dependent on international developments
competitive, innovative economy
average increase in gdp
SOCIOCULTURAL
work week length decrease
transparency
convenience
conservatism / frugality
24-hour economy
career differentiation between sexes
expression
socialism
individualism
increase in spendature on foods
focus on experience(s)
focus on quality and price
more 'critical'
focus on health and sustainability
multiculturalism
disposal culture
consumption culture
emancipation (women, race, sexuality)
fragmentation
FOOD
decrease in meal preparation
globalisation of foods
cultured meat
food for survival
food for pleasure
different diets
protein transition
ultra-processed foods
processed foods (pre-cut, pre-packed, canned, preserved)
less food waste
luxury
commonplace

daily groceries

ready-to-eat, convenience and on-the-go

increase caloric intake

local

local

healthy foods (less sugar, salt, fats, fresh)

seasonal

slow food

scarcity

abundance

unlimited choice

functional foods (superfoods)

fresh foods

new foods (algaes, seaweeds, insects)

exotic foods

biological foods

TECHNOLOGICAL

technological developments following Industrial Revolutions

household electrification

refrigerators

microwaves

supermarket freezers

smartphones **and** mobile applications

wearables

AR, VR & MR

artificial intelligence

new materials

new waste management technologi**es** / processes

smart industry

data-driven

KETs

NBIC technologies

new food technologies

advanced manufacturing

PACKAGING

plastic packaging

variation in packaging materials

packaging for branding

sustainable packaging

packaging for mass consumption

packaging for safety and health

active packaging

packaging for convenience

packaging for experience

inclusive packaging

compostable

intelligent packaging

recyclable

reusable

reusable

packaging-free

packaging-free

increase packaging units

decrease packaging material

environmentally concious packaging

ECOLOGICAL

observation plastic debris (1960s)

publication Planetary Boundaries (2009)

European Green Deal (2019 - 2050)

ozone layer awareness (1980s)

Paris Climate Agreement (2015)

peak Dutch CO2-output (1980)

increasing environmental fatigue

founding IPCC (1989)

increase in circular economy

increase CO2-emissions Dutch economy (> 1970)

decrease CO2-emissions Dutch economy (> 2010)

increase pollution and impact

increased understanding human-nature relationship

increase environmental activism groups

increased effects climate change

growing awareness

POLITICAL/LEGAL

start discussion on waste reduction (NL) (1970s)

first memorandum (NL) on prevention and reuse of waste materials (1980s)

first law on packaging and environment (EU) (1980s)

more detailed laws on packaging (EU) (1990s)

first packaging laws and agreements (NL) (1990s)

anticipated increase in laws and legislative measures on:

corporate responsibility and reporting;
safety and health;
sustainability, circular economy, etc.;
technology and innovation

increased governmental interference in industry

increase in laws on (sustainable) packaging, circular economy, environmental management

RETAIL INDUSTRY

decrease in specialty shops (> 1953)

introduction self-service

increasing no. different supermarket formulas

specialty shops return

expanding offer

increasing focus on service and experience

increasingly monotonous market (oligopoly)

increased integration smart industry

increasing focus on efficiency

new business models

non-food entering food sector

increase in corporate transparency, responsibility and accountability

increasing focus on quality

increase in collaboration

adoption of circular economy and sustainable principles

market fragmentation

1953 **2024** **2050**

5.4 Conclusion

The objective of this chapter was to conduct a trend analysis to identify influential and impactful past, present and future developments and to establish a trend matrix which provides a coherent and concise overview of these trends.

A trend analysis and matrix methodology has been developed to identify and capture various trends at different analytical levels, which can be used for trend analyses concerning systems. The conducted trend analysis has shown that many of the identified trends are related, even if corresponding to different categories, and often follow one or multiple previous developments, showcasing the causal relationship most often prevalent between different types of trends. Furthermore, trends commonly surpass the categories of a trend matrix or trend mapping methodology, and often cannot be assigned to a specific time. Following the conducted trend analysis, it can be concluded that some trends can be anticipated whereas others cannot.

To develop possible futures, the identified trends can subsequently be used for the construction of scenarios, which will described in the following chapter.

6. Scenarios

Chapter 5 describes the establishment of a trend analysis and mapping methodology which is subsequently applied to collect trends related to the issue presented in this thesis. In this chapter, these trends are used to develop possible futures through scenarios. First, the chapter discusses how the driving forces (i.e., future-shaping trends) were selected from the numerous collected trends and developments. The chapter subsequently explains the method that was employed to construct scenarios on the supermarket of the future, after which the developed scenarios are briefly presented.

6.1 Driving Forces

In Chapter 4 it has been established that Scenario Planning provides a structured manner to conceptualise and explore alternative futures. Moreover, it describes that an effective method for constructing scenarios involves the selection of the most critical driving forces which will form the foundation for the scenarios. In the following section, elaboration is given on the process of determining these driving forces which could subsequently be used for the development of scenarios.

Several methods to select and identify the driving forces were employed through an iterative approach. For instance, labelling and categorisation of the trends (e.g., according to their duration or analytical level of impact), the positioning of trends in an uncertainty-importance matrix, and linearly ranking trends on personally perceived uncertainty are methods that have been attempted. However, these methods often seemed too perspective-dependent or generalised for the number of collected trends and the complexity that is involved given that many trends could not be processed according to the aforementioned methodologies. Since trends are required to be relevant (see Section 4.2.2), the driving forces were selected after another evaluation of the trend matrix with four employees of the KIDV, the host organisation of the research, who are regarded as packaging (industry) experts. The experts were shown the completed trend matrix and were requested to answer the following questions:

- Which trends are you missing in this overview?
- Which trends do you think are the most uncertain trends in this overview?
- Which trends within this overview do you think will be most important in the shaping of the future?

The answers were compared among each other and also with the trend assessment of the author of this thesis. This resulted in the general trend theme ranking as shown in Table 2. Note that although some trend themes are perceived as ‘most certain’, in general, all trend themes are considered uncertain.

Least certain

Timing of events: when does what happen?
Climate events
(Global) Political developments & economic repercussions
Societal & consumer mindset and values
Development & increase in/of new technologies
Rate of change
Degree of political involvement & law implementation
Migration patterns

Resource security
Industry development & innovation
Liveability of (certain areas) of the Netherlands
Economic independence of Europe and the Netherlands
Most certain

Table 2: Ranking of uncertainty of global trend themes following the assessment of the four experts and the author.

Next, for some of the trends, overarching themes were found by looking at the correlations between the trends in different categories and time periods. For example, the trends of an increase in flash-channels, processed foods and increasing focus on efficiency share the commonality of 'convenience'. Subsequently, the most important trends or trend themes were identified together with one of the packaging (industry) experts. The identification of these driving forces was predominantly based on experience, developmental trajectories of the past and personal assessment of the possible future impact and relevancy. Counterparts were determined by means of idea generation to establish driving force paradoxes, which aligns with the extremities that Nekkers [31] proposes should be used to construct scenarios. This resulted in the paradoxes as presented in Table 3. Note that although the driving forces within a paradox are considered opposites, they are not necessarily mutually exclusive, especially in reality. The defined paradoxes as presented formed the selection of driving forces that could be used for scenario development.

Automation	Experience
Local	National
Urbanisation	Ruralisation
Data-driven	Aversion data sharing
An economy of meaning (environmental considerations)	Capitalism (economic considerations)
Industry is lagging (more legislative measures)	Industry is leading (fewer legislative measures)
Technocracy	Naturocracy
Mass production (one-size-fits-all)	Personalisation (all-sizes-fits-one)
Slow-living / quality-living	24-hour economy / efficiency
Risk-avoidance / safety	Risk-taking / boldness
Autonomy	Heteronomy
Convenience (e.g., processed foods)	Effort (e.g., pure/natural foods)
Chain management	Individual link
Material globalisation	Material scarcity / localisation
Environmental fatigue / neglect	Environmental activism / awareness

Table 3: The determined driving force paradoxes (i.e. extremities) which collectively form the selection of driving forces.

6.2 Scenario Development

The previous section provides elaboration on the driving forces that have been identified which can be used to construct scenarios with. The objective of the scenarios was to shape futures as well as the supermarket of the future to provide an answer to the main question of this thesis. Moreover,

the scenarios were developed as a means to reduce the short-term vision experienced by food packaging supply chain parties. This section outlines how the scenarios were constructed.

The scenario development, similar to the establishment of the driving forces, also involved an iterative approach. First, several methods were experimented with to establish a first draft of scenarios (Figure 14):

- **Categorisation**: selecting and coupling as many driving forces as possible based on correlation that seem to fit a certain theme. All driving forces within a theme are used to create scenarios.
- **Matrices:** establishing a matrix in which two sets of driving force paradoxes are placed perpendicularly, resulting in four quadrants which each consist of two driving forces. A single quadrant can subsequently be used to create a scenario.
- **Random combinations:** selecting four different driving forces by using an online random generator tool [210]. These four driving forces are used to create scenarios.
- **Brainstorming:** establishing scenarios based on one driving force, further developing them by means of idea generation.

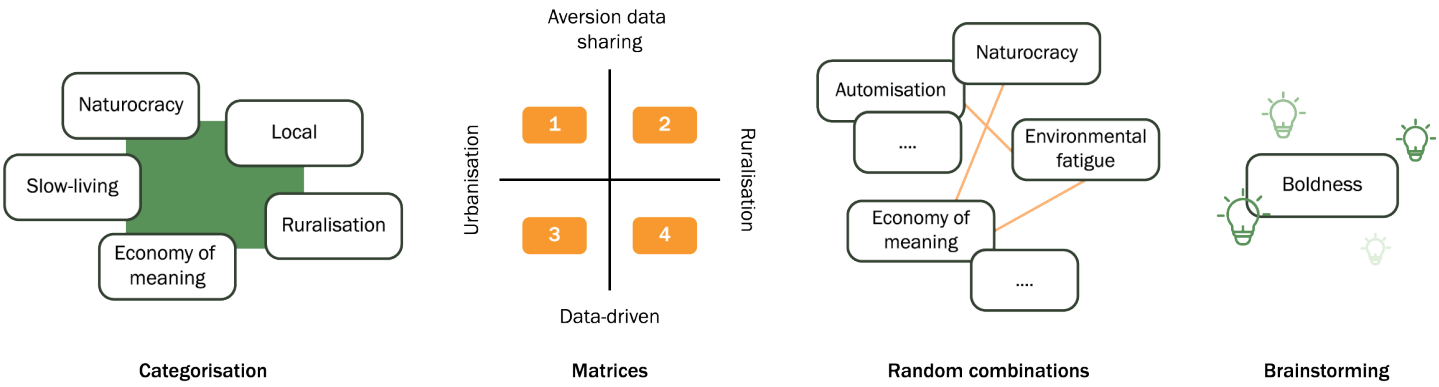


Figure 14: Visualisation of the four methods used to create the first draft of scenarios.

The first draft of scenarios using these four methods was evaluated with the supervisors of this thesis on coherence, plausibility, relevancy, and radicality. Given that the matrices-methodology resulted in scenarios that best met the requirements for scenarios as described in Section 4.2.2 and provided a substantiated foundation for the scenarios, this method was chosen to develop the final scenarios.

The matrices, in which two sets of paradoxes are perpendicularly placed, provide four quadrants. These four quadrants comprise two driving forces each which can be utilised to establish scenarios. It had been found that in nearly all attempts to create the first drafts of scenarios from the matrices-method, one of the quadrants would have driving forces that were too contradicting which hampered the development of scenarios. Subsequently, it also became evident that sometimes there was a combination of driving forces (i.e., a quadrant) that would result in a scenario that was a continuation of "business-as-usual". The aim was to create scenarios that were as different as possible from the current state of affairs to adhere to the requirement of radicality and to ensure an alternative future (see Section 4.2.2). Therefore, these "business-as-usual" quadrants were not utilised during the development of scenarios.

Ultimately, it was decided to create a total of four scenarios because of the time necessary to establish them and due to the limited time available that could be spent on the construction of the scenarios. The scenarios were established using two matrices consisting of four driving force paradoxes. These two matrices were chosen following the first draft of scenarios, capitalising on some of the scenarios that had already been constructed and during which it became clear what driving force paradoxes resulted in scenario drafts that met the requirements for scenarios (see Section 4.2.2).

One of the driving forces within a matrix was chosen based on the level of radicality it was assumed to provide to a scenario. The perceived 'most radical' driving force was subsequently crossed with the remaining paradox of the corresponding matrix, resulting in two pairs of opposing scenarios which still shared some commonality between the individual pairs. The goal of this scenario development method was to ensure that the correlations and differences between the scenarios could be evaluated more easily than was assumed would be possible with four scenarios without any correlation. As a result, the scenarios were developed from the 'radical' driving forces and driving force paradoxes as shown in Figure 15.

Figure 15: The driving force-paradox matrices which have been used for the development of scenarios A, B, C and D.

The development of the final scenarios involved an iterative process, in which definition was given by means of idea generation. The scenarios were drawn up from imaginative developments at macro-level that would provide a plausible cause which resulted in plausible effects at micro-level. This top-down approach had previously been perceived during the first draft of scenarios to require less effort and time than a bottom-up approach (e.g., from micro-trends to macro-level developments). Examples of macro-level developments include ecological-related occurrences such as extreme weather for a prolonged time. Micro-level effects include the definition of the supermarket of the future, foods and specific technologies. To assist the idea generation and to ensure logical cause-effects, ChatGPT [211] was used to strengthen the scenarios.

Given that the objective of the research was to explore how the supermarket of the future can facilitate the transition of the food packaging supply chain towards sustainable packaging, no definition is given to the food packaging supply chain within the scenarios. During the development of the scenarios, the idea emerged to review the scenarios with stakeholder parties of the food packaging supply chain, to evaluate the effectiveness of the scenarios as a tool to instigate long-term thinking and to remove stakeholder parties from their current manner of thinking. Therefore, no definition was given to food packaging within the scenarios, as this forced stakeholder parties to think about sustainable packaging for themselves, rather than copying what is presented to them. The implementation of the idea is discussed in more detail in Chapter 7 '*Workshops*'.

6.3 Summary of Scenarios

The following section provides a summary of the scenarios that were developed as described in the previous section. A complete view of the original scenarios can be found in Appendix C: Scenarios.

5.3.1 Scenario A (Local x Environmental Awareness)

Food production in the Netherlands has been organised locally to ensure self-reliance as a result of extreme weather and floodings in Europe, which had caused a strain on the national food supply. The societal awareness on climate change and sustainability is high, and policy measures are focussed on climate change mitigation and adaptation. The Dutch food supply system has been entirely localised to guarantee independence and self-reliance.

Citizens have spread across the country and live in self-sustaining communities, which each has a single supermarket that sources their product offer from within a 50-kilometer radius. Supermarkets are equipped with cultivation areas where customers can directly harvest fresh vegetables, fruits and herbs through subscription-based business models.

The Dutch food production has significantly increased in efficiency and yields harvests superior to traditional food production methods as a result of strong national investment in green technologies such as vertical farming and hydroponics, which is supported by automated systems and advanced data analytics.

5.3.2 Scenario B (International x Environmental Awareness)

The growing impact of climate change has heightened societal awareness of unsustainable practices. As a result, consumers, businesses and policymakers prioritise sustainability in their decisions. Dutch and European policies prioritise sustainability by stimulating green and circular initiatives through subsidies and penalties for lagging parties. Investments in technology have driven breakthroughs in energy efficiency and sustainability. Meanwhile, global food systems are being restructured to minimise ecological footprints while remaining globally interconnected.

Customisable meal boxes, which contain processed foodstuffs, are nowadays our main source of food. The meal boxes are produced daily in supermarkets, and data exchange between supermarkets and customers enables the synchronisation of demand and supply while enabling delivery and pick-up opportunities with automated systems for efficiency.

Physical supermarkets have evolved into experiential hubs, which offer in-dining experiences in automated and robotised restaurants. Moreover, consumers can learn about sustainability, the food system and food technologies in immersive exhibits. This transformation aligns with consumer demands for transparency.

5.3.3 Scenario C (Decrease in Legislative Measures x Chain Management)

The combination of resource scarcity, international tensions, and large-scale material consumption led to a virgin resource crisis in which material prices rose to unprecedented levels. This compelled governments and industries to innovate and focus on closing material loops. The Dutch government eased regulations and invested in recycling infrastructure, which enabled businesses to develop circular economy practices. Collaboration between industries and research institutions accelerated

technological advancements such as alternative materials and more effective and efficient recycling systems.

The impact of international tensions and growing material prices could be felt in all layers of society, which resulted in a shift in consumption patterns to more circular behaviour. Because of a general increased focus on circular economy, supermarkets embraced their central societal role by establishing collection hubs for packaging waste. Advanced machines efficiently sort any packaging waste in bulk. Consumers are subscribed to supermarkets to be able to deposit packaging waste, and in return receive personalised discounts that can be spent in those supermarkets.

5.3.4 Scenario D (Increase in Legislative Measures x Chain Management)

Worldwide, countries faced devastating climate effects which disrupted production and transport of raw materials, intensifying the pressure on resources. Combined with stockpiling and consumption as usual, this led to severe resource shortages. The European Union pushed various ambitious targets on sustainability to combat climate effects, resource shortages, and to strengthen their economic position in relation to other global superpowers. To meet these targets, the Dutch government implemented strict legislation focussing on sustainability, public health, and circular economy. Businesses must take full responsibility for the entire life cycle of the products they market, report to government, and are required to be fully transparent to avoid hefty financial penalties. This stimulated technological advancements such as real-time monitoring of material flows and resulted in a large part of the population blindly trusting the safety of products. Meanwhile, there is a part of the population which demands comprehensive information for informed decision-making.

Supermarkets comply with laws through automated hybrid refill and return-on-the-go systems which allow customers to use reusable packaging. Reusable packaging is cleaned and refilled on-site. Self-service kiosk with augmented reality provide personalised shopping experiences, which offer detailed product information tailored to consumer preferences and dietary needs.

6.4 Conclusion

The purpose of this chapter was to elaborate on the process of scenario development as performed during this research. First, the chapter discusses that there are various methods to identify and select driving forces. The selection of driving forces can be challenging as the trends need to be assessed on importance, impact and uncertainty. These assessments are oftentimes perspective-dependent which can significantly influence the outcome of the eventual scenarios and their effectiveness as tools. Therefore, when scenarios are created for systems in which many different factors and influences apply, the determination of driving forces in a group setting can broaden the horizon and enhance the relevancy of the scenarios by considering varying perspectives. Consequently, this may strengthen the foundation of the scenarios that are to be developed.

Secondly, the chapter discusses several methodologies that can be employed for the development of the scenarios which is followed by the construction of four scenarios utilising a matrix-methodology, providing substantiated visions of possible long-term futures. The chapter is concluded with summaries on the four scenarios.

The effectiveness of the scenarios as tools for broader and extended thinking will be examined in the next chapter.

PART 3 | Tool Assessment

PROLOGUE

During the second part of this thesis, insights have been gathered on how possible futures can be developed. Consequently, four scenarios were generated which each describe a different macro-environmental future and supermarket corresponding to that particular future. These scenarios can serve as tools to address the challenges that food packaging supply chain parties are facing in the transition to sustainable packaging. However, the effectiveness of the scenarios as tools is still unclear and moreover, it is unclear how these tools can be employed.

Part 3 investigates the effectiveness of the scenarios within the case study as presented in this thesis as tools to address the challenges faced by the food packaging supply chain. Their effectiveness is evaluated through various workshops with supply chain organisations and stakeholders of this supply chain. In doing so, the workshops are designed to simultaneously research the following sub-question:

> What is required to initiate and facilitate a transition towards a future?

7. Workshops

Chapter 3 describes that the food packaging supply chain is currently facing several challenges in the pursuit of sustainable packaging. These challenges include being impaired by a short-term perspective and tunnel visioning. Does presenting a long-term vision assist in encouraging the food packaging supply chain to adopt a more forward-looking approach and avoid tunnel visioning? The scenarios that were designed as outlined in Chapter 6 were tested and evaluated through workshops with stakeholder parties as a means to examine this question, given that the workshops also provided the opportunity to examine stakeholder parties their perspectives on what is required to transition. The following chapter discusses how these workshops were set up, what type of participants were involved and how they were gathered, and what the results of the workshops were.

7.1 Participants

Participants for the workshops were recruited via email using contact information obtained through a personal network. Furthermore, following a call on LinkedIn, participants could self-register. To partake in the workshops all prospective participants had to meet the following requirements:

The participant is employed by an organisation that is part of the food packaging supply chain in the Netherlands as previously depicted in Section 3.2 (Figure 7, page 15) **OR**

The participant is employed by an organisation that influences the design of food packaging or the configuration or processes of the food packaging supply chain (e.g., consultancy, governmental body) **AND**

The participant must possess a basic knowledge level of the processes, packaging and operations within the food packaging supply chain and subsequently has worked or still works with these aspects **AND**

The participant must possess sufficient knowledge on their employing organisation and its processes and products and/or services.

Sixty individuals from forty-five different companies were contacted. From this group, thirty-six individuals were interested in joining the workshops. Ultimately, nineteen individuals employed by sixteen different organisations participated in a total of eight workshops, the details of whom can be found in Table 4.

Participant	Role	Type of Organisation	Size of Organisation[212]
W1	Quality Manager	Food Retail	Large
W2	Product Manager	Waste Management	Large
W3	Project Manager	Municipality	Large
W4	Owner	Food Production	Small
W5	Advisor	Waste Management	Large
W6	Change Manager	County	Large
W7	Policy Advisor	Municipality	Large

W8	Owner	Waste Management	Small
W9	Project Manager	Packaging Production	Medium
W10	Sustainability Manager	Food Production	Large
W11	Policy Advisor	Trade association	Large
W12	Product Manager	Food Production	Medium
W13	Policy Officer	Ministry	Large
W14	Packaging Innovation Manager	Food Production	Large
W15	Commercial Director	Packaging Production	Large
W16	Owner	Packaging Production	Medium
W17	Quality Manager	Packaging Production	Medium
W18	Strategic Marketing Manager	Packaging Production	Large
W19	Technical Director	Packaging Production	Large

Table 4: Additional information on the workshop participants.

7.2 Structure of the Workshops

The workshops were hosted online and recorded via Microsoft Teams. Beforehand, participants were requested to look at two scenarios which had been sent in advance. Table 3 depicts the participants and treated scenarios per workshop session. The scenarios were allocated to participants at random, though it was ensured that there was alternation between the workshops (e.g., avoiding sequences and patterns such as AB-AB-AB or CD-CD-CD). The purpose of this alternation was to ensure that any expected improvements to the workshop process would not significantly impact the data resulting from the workshops. The scenarios that were used have been described previously in Chapter '6 *Scenarios*' and can be found in Appendix C: Scenarios.

First, the goal for the workshops was to review two scenarios equally elaborately within one and a half hour. However, during the first workshop it became clear that this goal was too optimistic timewise. As the goal of the workshops was to discover the effect of the scenarios as a tool, it was opted to review one scenario more elaborately and compare it very briefly with the second scenario treated during a session. Therefore, during the other workshops the participants spent 45 to 60 minutes on one scenario, while the other scenario was reviewed within 15 to 25 minutes and only on questions 5 to 8. Two scenarios were reviewed while using a workspace during the first three sessions. The workspace will be further explained below. For the remaining sessions, the first scenario of the session was reviewed while using the workspace, whereas the second scenario was covered verbally – this saved time and thus rushing through the first scenario could be avoided more.

The workshops were arranged to last one and a half hours, though depending on the availability of participants the actual duration of the held workshops differs, as can be seen in Table 3. About 15 minutes were spent on a short introduction of the participants, host and research, the structure of the workshop and the workspace, a short summary of the scenarios treated during a session, as well as the closure of a workshop session.

Workshop session	1	2	3	4	5	6	7	8
Participants	W1 W2	W3 W4 W5	W6 W7	W8 W9 W10	W11 W12	W13 W14 W15*	W16 W17	W18 W19
Scenarios	A B	A B	C D	D C	B A	D C	All scenarios	B A
Duration workshop	~ 60 min	~ 75 min	~ 60 min	~ 75 min	~ 75 min	~ 75 min	~ 50 min	~ 75 min

Table 5: Overview of the participants and scenarios per workshop, and the approximate duration of the workshop sessions.
* This participant left the session after approximately 45 minutes.

As can be seen in Table 3, workshop number 7 differs from the other sessions. This is because both participants were employed by the same organisation, and they indicated that they were only available for 30 minutes. At the time this workshop was seen as valuable as prior to the session only three workshops had been hosted with no other sessions being successfully scheduled, in addition to the workshop period coming to an end. Therefore, little data had been captured and workshop session seven was scheduled.

All participants evaluated the scenarios in a prebuilt workspace in Miro, which is a digital platform that facilitates distributed collaboration [213]. Participants were asked to familiarise themselves with the workspace beforehand by viewing it and filling in parts of the workspace (e.g., designated fields asking for their name, function, what packaging their organisation dealt with, and a short introduction of their organisation). The respective Miro workspace formats with additional elaboration can be found in Appendix D: Workshops. In the workspace, participants answered a list of questions one-by-one by noting down their thoughts and responses to the questions in post-its within fields adhering to the questions. The questions were first covered individually, after which the questions and individual answers were addressed and discussed collectively. This method was used to first capture the participants their initial reactions to the questions, subsequently capture if these reactions diverged after discussion with others, and lastly to investigate in what manner the reactions had changed. The purpose of this method was to gauge not only what effect the scenarios would have but also what discussion or collaboration with other parties with assumably different perspectives would have. The questions treated during the workshops can be found in Table 4.

To accommodate the little time available during workshop session seven, a slightly different set-up was used compared to the regular workshop sessions. Instead of working on two scenarios, Participants W16 and W17 reviewed all scenarios. However, they only answered questions 5 to 8. Additionally, the participants reviewed all scenarios on how radical, plausible and relevant they seemed. The latter was also done by the remaining participants following their sessions, which will be discussed in section 7.3.2 Follow-up, page 61. Along with the alternative set-up of workshop session seven, an alternative workspace format was used which can also be viewed in Appendix D: Workshops, along with elaboration.

1. What are the implications of this scenario on the packaging supply chain? What would the packaging supply chain look like?

2. What are the implications of this scenario on your organisation? What would your organisation look like?

3. Which packaging functions are most important in this scenario?

4. Sustainable packaging solutions for food products in this scenario look like this …
5. In what time frame will we get this done?
6. What are the impediments on or what could hinder the road towards this future vision?
7. What are the possibilities on or what could improve the road towards this future vision?
8. What is your reaction to this scenario?

Table 6: The questions covered during the workshops.

Table 6 covers the questions which were answered during the workshops. For question 3 (*Which packaging functions are most important in this scenario?*), the packaging functions that can be found in Table 7 had to be ranked from 1 (most important) to 5 (least important). Additionally, participants were given the option to add another packaging function if they ought something to be missing. Participants were asked to elaborate on their answers in a different text box. The purpose of the ranking was to obtain a better understanding of the interests of the different participants and their organisations, as well as gain a better understanding of their answers to the questions, and in particular the answer to question 4 (*What do sustainable packaging solutions for food products look like in this scenario?*).

To encompass/enclose/contain the contents, the packaged product

To facilitate transport, storage and transhipment of the packaging-product combination

To protect from environment or to protect the product or packaging-product combination

To inform

To facilitate end-use, consumption and disposal

Table 7: The packaging functions that were to be ranked for questions 3. Adopted from ten Klooster, et al. [1].

As for question 5 (*In what time frame will we get this done?*), one or multiple pins had to be placed on a timeline ranging from 2024 to 2050 (Figure 16). Participants were free to place any number of pins on any location, including none or on the right side of '2050'. These two options were not announced explicitly during explanation of the task to gauge the initial response of participants. Furthermore, participants were asked to elaborate on their answers by attaching post-its with explanations to the different pins that they had placed across the timeline, or besides the timeline if they had not placed any.

Figure 16: The timeline used for question 5 treated during the workshops.

Finally, for question 8 (*What is your reaction to this scenario?*), participants were requested to give an indication of their reaction to the addressed scenario by encircling one or two figurines that best matched their reactions (Figure 17). The figurines used for question 8 leave considerable room for interpretation, thus participants were again asked to elaborate on their answers by noting down the reasoning behind their choice of figurine(s).

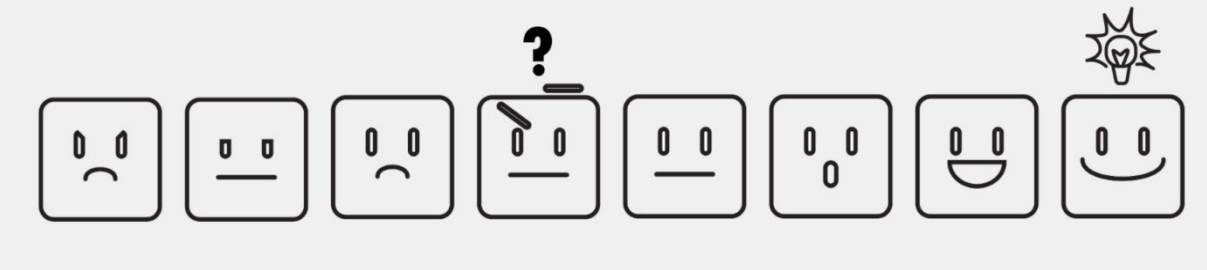


Figure 17: Figurines used as an indication of participants their reactions towards the scenarios during the workshops.

7.3 Workshop Results

During the workshops, the answers of participants to the posed questions were recorded on post-its notes in the digital workspace, after which these answers were discussed collectively. This data was afterwards evaluated, along with observational notes (e.g., participants their reactions, the flow of discussions, the answering process, etc.) and transcripts. Responses of participants were compared per workshop session and across all sessions to identify similarities and differences. The following section presents insights derived from these analyses. Given the large and highly variable dataset, only the most significant and important findings are discussed (e.g., key observations, significant patterns and notable divergences).

7.3.1 Workshop results and Insights

All participants actively engaged in the workshops and demonstrated considerable thought with regard to the scenarios and questions posed. Within the participants their ability, all questions received responses, regardless of personal attitudes towards the scenarios or the perceived difficulty of questions. A few participants openly referred to some questions as challenging (e.g., questions 1 to 5 and 7), while others required additional time to think or struggled to provide answers and thus demonstrating a similar view. The perceived difficulty was especially evident for questions 1 and 2.

Instead of identifying the impact on specific parts of the packaging supply chain, other types of organisations, or providing a definition, most participants respond with rather global implications when questioned about the implications of scenarios on the food packaging supply chain (e.g., *"fine-*

grained logistics" [W1, W2], *"less choice"* [W1 – W5], and *"other packaging types"* [W6, W14]). Similarly, the second question – *'What are the implications of this scenario on your organisation? What would your organisation look like?'* – was oftentimes met with general, undefined responses (e.g., *"Very different, this will undermine our business model"* [W8] and *"More inefficiencies"* [W1]). It seems that participants find it challenging to define uncertainties.

Additionally, the question on the implications on participants their own organisation raised many questions marks (e.g., *"[Implement] reusable packaging?"* [W9], *"Depends: what will our responsibility be?"* [W11], *"More revenue loss?"* [W5]). These self-composed questions were oftentimes left unanswered, but sometimes participants used these questions as a starting point to expand on their answers (e.g., *"Based on reusable packaging, food safety may be at risk. This requires sharpening of laws and regulations"* [W10]). This occasionally resulted in critical thinking (e.g., *"Why clean the packaging at supermarkets and not at home? Who will be the owner of the packaging?"* [W8] and *"If the focus is on fresh produce, how will consumers shop for other products?"* [W12]). Likewise, some participants demonstrated a problem-solving approach (e.g., *"Our products are unlikely to come in meal boxes, so we will have to find other PoS. Maybe we can deliver on-demand, or we package in bulk"* [W12]).

Contrary to an initial hypothesis of disagreements and debates, participants in all workshop sessions were generally in agreement and hardly contradicted one another, even if explicitly prompted to voice opposing views or raise questions on the already established input. Instead, participants expanded on the previously shared input by adding insights or generating new ideas. However, their initial answers differed greatly, even the answers from participants with similar backgrounds.

It Is observed that most participants hardly adopt a holistic view (e.g., *"I can only tell something about the resource cycle"* [W8]). Additionally, participants mostly view the scenarios from a current-day perspective based on their experiences and feelings, and project current-day reality on what potential futures could look like (e.g., *"Small-scale, so more expensive for consumers"* [W4] and *"Return systems and collection points fall short, which is going to cause mess on the streets and frustration among consumers"* [W6]). Therefore, described ideas were generally conventional and participants largely felt that some elements would not be or ever become possible. Moreover, scenarios that consist of elements which are yet a contemporary reality were commonly regarded as unrealistic. Simultaneously this caused the scenarios to be perceived as more radical.

For question 3 (*Which packaging functions are most important in this scenario?*), input from seventeen participants was gathered as this question was not covered during workshop session seven. Scenario A received five answers, scenario B received four answers, whereas two answers were given for scenario C and scenario D obtained six answers. Table 8 (page 58) depicts the average ranking scores per function per scenario while Table 9 (page 59) presents the rankings given by participants per scenario and organisation type.

	Scenario A	Scenario B	Scenario C	Scenario D	Avg.
To encompass/enclose/contain…	4,00	2,33	2,00	2,60	2,73
To facilitate transport, storage…	3,00	1,75	2,00	2,33	2,27
To protect from environment or…	3,60	2,00	3,50	1,67	2,69
To inform	2,00	3,75	3,00	4,50	3,31
To facilitate end-use, consumption…	2,20	4,75	4,50	4,00	3,86

Table 8: Average ranking score received per scenario on the five different functions as displayed in Table 7. Scale ranging from most important (1) to least important (5). The perceived average of most and least important function is highlighted, with the highlight of most important being dark-coloured and the highlight of least important being light-coloured.

Among the seventeen participants who answered question 3, only two provided matching rankings: Participant W11 (scenario B) and Participant W13 (scenario D). No identical rankings were given by participants within the same scenario group. In fact, all rankings varied greatly, with only two participants from the same organisation type (W10 and W14, food production) providing somewhat similar rankings for the same scenario. Notably, there were five duos that share an organisation type who also reviewed the same scenario, though not during the same session.

Table 7 shows that employees from organisations involved in food production consider the function *'to protect from environment or to protect the product or packaging-product combination'* most important and the function of *'to facilitate transport, storage and transhipment of the packaging-product combination'* second-most important, both across two different scenarios. Table 7 shows that employees from packaging production companies ranked the function *'to facilitate end-use, consumption and disposal'* least important across two scenarios. Two participants opted to rank the functions *"marketing"* (W10) and *"reuse of the packaging"* (W18) instead of *'to encompass/enclose/contain the contents, the packaged products'*.

	To encompass…	To facilitate transport…	To protect from…	To inform…	To facilitate end-use…	Other
Food retail						
W1	4	2	3	2	3	-
Food production						
W4	5	4	1	3	2	-
W10	-	2	1	5	4	3
W14	4	2	1	5	3	-
W12	1	2	4	3	5	-
Governmental						
W3	3	4	5	2	1	-
W6	1	3	2	4	5	-
W7	3	1	5	2	4	-
W13	3	2	1	5	4	-
Waste management						
W2	3	2	5	1	4	-
W5	5	3	4	2	1	-
W8	2	3	1	5	4	-
Trade organisation						

W11	3	2	1	5	4	-
Packaging production						
W9	1	2	5	3	4	-
W15	2	3	1	4	5	-
W18	-	2	1	3	5	4
W19	3	1	2	4	5	

Table 9: Overview depicting the rankings given by all participants per scenario according to organisation type. The scenario that participants ranked is indicated by the colours green (scenario A), orange (scenario B), blue (scenario C) and red (scenario D).

In short, Table 8 and Table 9 show that the interests regarding packaging functions differ greatly between scenarios, participants and organisation types, but that some common ground can be found as well.

When participants were questioned about what they considered sustainable packaging solutions within the scenarios that they treated, many similar responses were obtained regardless of the varying scenarios. The most frequently mentioned were solutions that are reusable, followed suit by solutions that are well recyclable. All descriptions of sustainable packaging solutions that were given align with definitions that are well-known today. Looking at the R-framework for circular strategies (Figure 5, page 11), only two participants surpassed the R-step of reuse by answering *"No packaging"* [W7] and *"Force product groups to do things differently, e.g. detergent can no longer be sold as a liquid per 2040"* [W15]. For scenarios A, B and C, mostly reuse was mentioned. For scenario D, mostly recycling was mentioned. However, many other definitions, terms and descriptions were given, examples including *"monomaterials"*, *"standardisation"*, and *"content easily adaptable conform the consumer wish"*.

During question 5, participants reviewed the plausibility of scenarios with pins on a timeline. Five participants ought scenarios or certain parts thereof to be impossible to take place before 2050, but the remaining participants indicated that the scenarios were (largely) achievable before 2050. For rationale, participants referred to objectives which they thought could be met, such as specific percentages in terms of recyclability, reuse, and standardisation, but they also discussed what would prevent any earlier achievement of the (elements of the) scenarios, like lobby by industry, scalability, and political and technical developments.

A clear distinction was visible between participants with extensive experience in interdisciplinarity due to their current role or background, and those primarily focussed on their own organisation or without a background involving interdisciplinarity. The former group of participants demonstrated a broader understanding of the packaging supply chain and involved parties, providing more detailed and comprehensive responses compared to the latter group of participants. Nonetheless, both groups displayed that in general, participants quickly recognise the difficulties en route to a future vision, with opportunities often left unmentioned or hardly highlighted. Yet, when participants were specifically requested to generate input for both, no significant difference in the quantity of obstacles versus opportunities was noted across the workshops, nor was any scenario particularly associated with a higher quantity of one over the other. Nonetheless, participants their willingness to pursue a scenario or the elements thereof tend to be driven by the difficulties, which were also described with slightly greater detail and definition.

Several themes were seen as most obstructive and counterproductive in the pursue of the scenarios. Participants are wary of the current efficiency of the packaging system and its components, particularly in logistics and manufacturing, and the potential inefficiencies that may arise from adopting a proposed future. Moreover, they highlighted that the highly economically driven current-state of the packaging industry and thus the potential lack of financial advantages generated by adopting a scenario set-up may be detrimental, as well as the lack of urgency among key players (e.g., consumers, industry parties, government). Participants often highlighted that consumer behaviour and preferences were counterproductive to sustainability efforts, amplifying that countertrends and countermovements diminish sustainability efforts. Additionally, participants warned for these trends and movements to potentially reverse any currently obtained progress. Active legislative measures of today were seen as a restrictive, and participants expressed concerns about the potential limiting nature of any future legislative measures. Similarly, participants frequently mentioned food safety requirements, with discussion surrounding how established standards could be met in the future. Finally, participants discussed the uncertainty surrounding the practical implementation of new strategies, systems, and products within both current and potential future systems.

In contrast, several topics were viewed as highly supportive and conducive to achieving the scenarios, of which some are viewed as opportunity-generating elements on this path. Key supportive factors included an increased emphasis on sustainability. Elements such as a severe decrease in packaging quantities, uniformity, equal opportunities for all, improved health outcomes and a strong reduction in food waste contribute to the overall definition of sustainability, according to participants. As opposed to the obstructive nature, participants also saw value in countertrends, countermovements, laws and regulations – stating that they could support the advancement of sustainability. Additionally, greater awareness and knowledge concerning food and packaging production and sustainability spanning consumers, industry and governmental entities were seen as advantageous and critical enablers. Furthermore, meeting consumer expectations while encouraging and challenging more sustainable behaviours and fostering collaboration across industry parties were also highlighted as important possibilities stemming from the realisation of the scenarios. Finally, participants suggested that meeting elements sketched in the scenarios may result in higher efficiency than current systems and processes could generate.

The reaction of participants on the different scenarios differed, though once again common ground could be found. The scenarios were generally perceived as interesting, although participants were not always confident in the realism of the scenario nor if the scenarios should be pursued (e.g., *"Nice thought, but not realistic nor desirable"* [W1] and *"Interesting view, yet again with some question marks"* [W3]). With respect to the answers, participants mostly rated the scenario as the ultimate goal.

A majority of the participants reported both positive and negative aspects of the scenarios (e.g., *"There are many chances and possible ways to get [to the scenario], but how it works in practice is still tricky"* [W5], *"Nice scenario which stimulates innovation, but I also see risks like monopolies and consumers choosing convenience"* [W7] and *"Big challenge with many dependencies. However, there is a very clear urgency that we are working on"* [W10]). Most participants therefore expressed a mixture of feelings which consisted of doubt, excitement and curiosity. Furthermore, even though some scenarios were seen as unobtainable or undesirable, participants noted that some elements may be beneficial or favourable (e.g., *"Sounds as ultimately disadvantageous. Elements are good, but the total scenario is counterproductive"* [W2] and *"[The scenario] does not seem realistic [due to its decentralisation], but elements (like reuse of secondary packaging) are possibly achievable"* [W14]).

7.3.2 Follow-up

After the workshops had finished, participants were sent a follow-up via Google Forms to evaluate both the workshop and the scenarios. The goal of the follow-up was to gather more insights with regard to how participants had experienced the workshops and scenarios. Moreover, the goal was to find out whether participants reflected differently on the workshops and the scenarios after letting them sink in for a while or after discussing them with others. The forms that were used for the follow-up can be found in Appendix D: Workshops, including the posed questions and answer formats.

Follow-up Results and Insights

Of the 17 individuals who participated in the 'normal' workshops, 13 people filled in the follow-up. Eight responses were obtained on the follow-up for scenarios A and B, and five responses were obtained for scenarios C and D. An overview of the questions that participants were asked during the follow-up and the format of answers can be found in Appendix C: Workshops.

The participants were asked how they had perceived the scenarios (Figure 18, page 62). Some participants answered this question by noting down two answers, indicating they were in between answers. Given the differing number of total answers per scenario, the data is interpreted relatively. In summary, scenario A was seen as the most radical. In terms of plausibility, scenario B scored the highest overall. All except for scenario C were mostly considered relevant, although scenario B scored the highest on this topic.

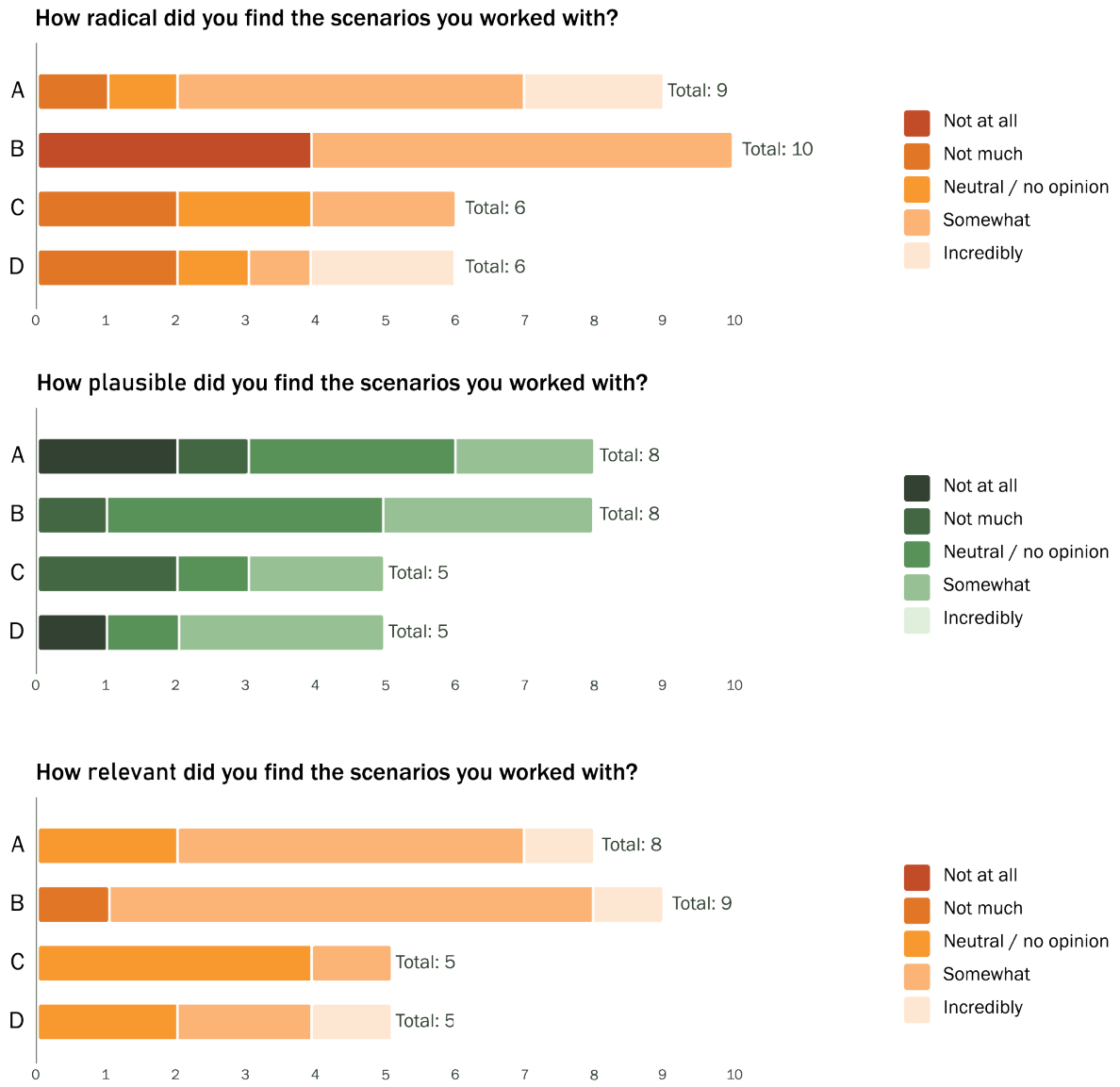


Figure 18: An overview of how the scenarios were perceived by participants who responded to the follow-up.

In total, five participants indicated that they had discussed either the scenarios, the workshops or both with colleagues after the workshops. Eight participants indicated that they did not discuss the scenarios nor the workshops with colleagues, but three participants were planning on doing so.

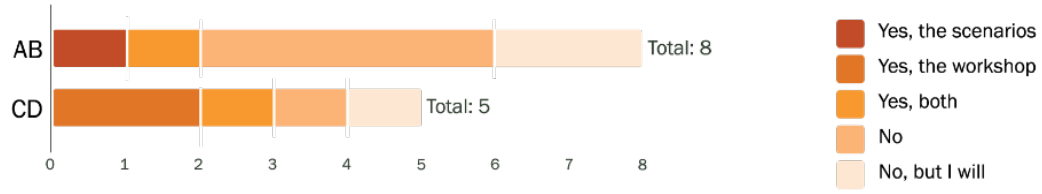


Figure 19: Answers per workshop scenario group on the question *"Did you discuss the scenarios and/or workshop with colleagues afterwards?"*

Nine participants indicated that working with the scenarios was a positive and interesting manner of thinking about the future, expanding perspectives and stimulating a long-term view. Some indicated that the scenarios evoked curiosity on what the next steps would be in the transition to such future visions, and others expressed that it made them realise the complexity of the situation once again (i.e., packaging industry transition towards sustainability). Three of the participants only discussed the content of the scenarios in their answers, namely stating what they thought of the scenarios (e.g., *"I am enthusiastic about scenario A"*) and that they wondered if the scenarios would become reality (e.g., *"Scenario B feels like a far utopian future"*). One participant did not particularly like the scenarios, stating that it *"Made me think of my student time. Little connection with the current starting position"*. This same participant found both scenarios that they worked on radical, plausible and relevant.

> ***"[The scenarios] stimulated thinking about the future in a more general sense, thus not as subject- and material-specific as we normally do. It broadens the perspective".*** **[W18]**
>
> ***"The more extreme sketch does broaden your train of thought, which is nice".*** **[W1]**

For workshop group 'scenarios A and B', two people indicated that they had gained new insights and/or ideas from the scenarios, whereas one participant stated that they had gained new insights and/or ideas from the workshops (Figure 20). Four participants mentioned that they had not generated any. One participant noted *"Not specifically insights or ideas, but I am taking along new input"*. For workshop group 'scenarios C and D', three participants indicated that they had not generated any new insights nor ideas, whereas one did due to the workshop. One participant crossed both the options "Yes, due to the scenarios", "No", and "Other", mentioning that the insights and/or ideas were gained from discussion with other participants.

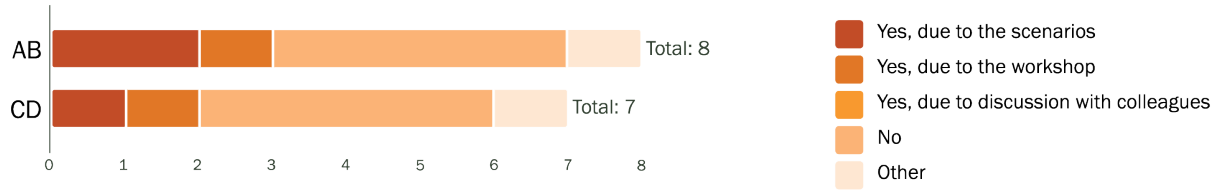


Figure 20: Answers per workshop scenario group on the question *"Have you gained any new insights/ideas since the workshop?"*

> ***"I did not necessarily gain any new [insights or ideas], but it became clear that people view the future differently".*** **[W9]**

When the participants were asked what new insights or ideas they had developed, seven participants answered they had not generated any which matches the results shown in Figure 20. Two participants answered they had generated new insights because of the workshops due to the opinions of others, which differed from theirs, though not stating the content of these new insights. One participant indicated something similar, revealing that they had obtained *"Clarity that people view the future differently"*. Two participants discussed having learned about one of the trends that was discussed in the scenarios, and one participant stated that *"Working with scenarios is effective"*.

Two participants declared that they did not think the scenarios could help their organisations in any way, of which one participant had previously said they had not developed any new insights or ideas, stating that *"As an organisation, we are further removed from the scenarios and are [a following party] in this"*. The other participant was the same individual that did not seem to value the scenarios. They did however answer that the workshop had provided new insights. The remaining participants spoke of the scenarios potentially helping their organisations due to an increase in awareness and disrupting thinking patterns, which might aid the receptiveness towards new ideas and solutions, as indicated by the participants themselves. Furthermore, participants stated that the scenarios would aid in *"sharpening"* policy development and would induce reflection (e.g., *"How does your company relate to [the proposed visions]?"*).

> ***"I suggested to colleagues to organise a similar workshop internally to get insights and ideas on how people see the future of our company by means of scenarios like in the workshop".*** **[W9]**

When asked specifically about the workshop, the process and the overall contents of the workshops, all participants expressed they had experienced the workshops positively. According to the participants, the workshops were well-structured and organised. Both the content and the digital platform were also well-received, apart from some skill-related hiccups. However, they commented that there was too little time to cover both scenarios and that at times the workshops felt rather rushed, whereas participants would have liked to discuss scenarios, questions and their respective answers more in-depth. Moreover, some participants revealed that they had hoped for more concrete insights from specific stakeholder parties and had hoped for more networking opportunities.

Seven participants indicated they had no expectations prior to the workshops, though most were pleasantly surprised by different aspects of the sessions (e.g., the scenarios, the workspace, learning from others). The remaining six participants announced that the workshop had met their expectations, not stating what these expectations were exactly. Participants reiterated that they enjoyed looking beyond their own perspectives by working on the scenarios and partaking in the joint discussions. On the other hand, two participants found the scenarios too rigorous and complex due to the extreme natures and due to the many components of the scenarios.

Participants were questioned on what they found most and least valuable about the workshops. Six participants indicated that the discussion and contact with other participants was most valuable, along with other participants being employed by a different company type and them thinking differently. Moreover, four participants specifically answered that they most appreciated actively applying a different way of thinking (e.g., *"out-of-the-box thinking"*). Three participants considered the lack of time for more elaborate interaction and for discussion about the topics to be least valuable. Two participants mentioned that it was a shame that not all or more supply chain perspectives were present during individual workshops. One person mentioned that the sessions lacked new insights, and another found that the discussion was oftentimes random.

> ***"[The scenario] is interesting for your train of thought but there is not much practical use to it".*** **[W1]**

> ***"Still seems complicated to see one of the scenarios become reality".*** **[W12]**

7.4 Conclusions

The objective of this chapter was to evaluate the effectiveness of scenarios as tools to address the short-term focus and tunnel visioning prevalent in food packaging supply chain parties. The effectiveness of these tools has been evaluated through a workshop with food packaging supply chain organisations and stakeholders. Simultaneously, the workshop was used as a means to uncover what is required to transition. Although many conclusions can be drawn from the workshop sessions and follow-ups, the most important conclusions will be described below.

First of all, the workshops confirmed that stakeholder parties have the tendency to fall victim to short-term thinking and tunnel visioning. The scenarios are indeed effective tools to compel stakeholder parties to abandon these thinking patterns by considering alternative viewpoints. The combination of scenarios and workshops provides a broader and extended perspective and instigates systemic reflection that allows stakeholder parties to generate new ideas. The simultaneous collaboration with other parties allows for the formulation of more widely applicable strategies and products.

Next, it has become evident that the employees of supply chain stakeholders generally adopt a double role as a food packaging industry professional and consumer. This adds bias to the decision-making process on strategies, activities and practices within the food packaging supply chain, and thus also to its transition towards sustainable packaging. Although participants are able to provide answers to the questions during the workshops, these answers remain general. As a result, the uncertainties associated with long-term futures remain unaddressed. This is likely to cause decisions regarding long-term futures to be based on personal experiences, expectations and “gut feeling”.

Finally, although workshop participants are in agreement on broad lines, they generally diverge on details. Parties generally adopt an all-or-nothing attitude, which complicates matters such as tunnel visioning.

The conclusions following the scenarios, workshops, and follow-ups, as well as all previous parts of the thesis provide valuable insights that seem to be more broadly applicable. This will be discussed in the last part of the thesis.

PART 4 | Synthesis

PROLOGUE

In the previous parts of the thesis, an understanding has been created of what is involved in the transition of the food packaging supply chain towards sustainable packaging if it is facilitated by the supermarket of the future. While the research primarily addresses the components of this specific case study, insights were gained from this case study that can contribute to a deeper understanding of systemic transitions. Therefore, the following part provides a synthesis of these insights.

The following part attempts to answer the following sub-question:

How can a transition be facilitated?

8. System Transitions

In previous parts of the thesis, many insights were collected on what seems to be necessary before the transition of the food packaging supply chain to sustainable packaging. A distinction can be made within these insights between two types of insights: case study-specific insights and insights that can be translated to the transitions of systems in general. Case-study-specific insights include those that are solely applicable to the transition of the food packaging supply chain towards sustainable packaging, as facilitated by supermarkets.

This chapter elaborates on the insights that were gained over the duration of this research through desk research, interviews, workshops and which are thought to apply to the transitions of systems in general. These insights are subsequently used as the foundation for a proposal of eight boundary conditions on system transitions. Based on these insights, it is believed that the meeting of these conditions will positively contribute to effectively commencing the transition of a system. The originating chapters of the insights are referred to where possible.

Shared Visions and Objectives

The answers of interviewees (see Appendix A: Exploratory Interviews*)* and insights from Chapter 3 revealed that many organisations have varying interests, as they fulfil different functions, sell different products, serve different customers, have different partnerships, and so forth. Furthermore, interview and workshop participants (see Chapter 7) demonstrated that people and the organisations they represent are generally focussed on details, as is described in Section 3.2. For instance, organisations are commonly required to meet legislation and overarching targets set by governments or trade associations, which oftentimes require a specific percentage to be achieved, such as the amount of recycled content which must be used for the production of new packaging [85, 214]. One can assume that people and organisations try to hold one another accountable to collectively meet these requirements. However, organisations, products and processes can be very dissimilar and may never be able to achieve these targets due to the nature of their product or service (Chapters 2 and 3). Therefore, such requirements may be counterproductive if they are too generalised, as demonstrated by the example of recycled content in meat packaging (Section 2.2, page 7).

One-size-fits-all solutions are effective in towing along ‘laggards’ and perhaps ‘late adopters’ [95], but often prove disadvantageous for innovators, early adopters and early majority as discussed by interview and workshop participants (see Chapter 7). Forcing organisations to meet requirements that they are fundamentally unable to meet may negatively impact the overarching objective. It may be better to find common ground and differences between organisations, products and processes, and cope with these by accommodating and balancing them in such a way that overall targets can be met as a system, even though individual entities may not align with the set targets. In conclusion, parties need to focus on ***shared visions and objectives*** during transitions (Figure 21), rather than individual and one-size-fits-all objectives (Figure 22).

Figure 21: Different parties are involved in a game of archery during which they each are allowed to shoot one arrow. Party A, who has decades of archery experience, is aiming to score a bullseye. Party B, significantly less experienced with only two years of practise, is aiming to score at least five points. Party C, who is completely new to archery, is happy with any points as long as they are hitting the target. In this analogy, the shared objective is to hit the target with an arrow.

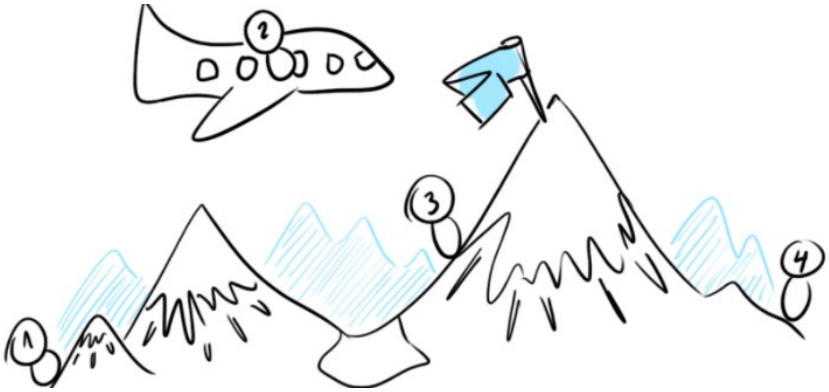


Figure 22: Even though parties may share an objective or vision, their starting point, path towards the objective or vision, available resources and knowledge in order to reach the objective or vision may differ greatly.

Guidance

Workshop participants expressed that guidance played a crucial role in the workshop process (see Section 7.3). They expressed this for the facilitation of the workshops themselves, but more importantly, they voiced that guidance effectively assisted participants in maintaining focus on the global topic of interest, preventing a relapse into tunnel visioning. For example, during discussions, participants often fixated on details such as the precise definitions of terms (Workshop 3) or specific elements of scenarios (Workshop 4). In such instances, it helped participants to be reminded to focus on the broader picture. This observation suggests that in the transitions of systems – processes with inherently more elements and details than the workshops that were hosted – such **guidance** can help stakeholders navigate multifaceted and complex challenges without deviating from the core objective for which a transition is necessitated.

Guidance, or guiding parties, are proposed to not be part of the executive part of the transitioning system to avoid developing short-term and tunnel vision themselves. Furthermore, guides must safeguard the overarching goal at all times to ensure that transitioning parties do not engage in counterproductive activities. In addition, guides must actively monitor the transition and its progress by means of milestones, for instance. By doing so, guides can provide timely interventions if stakeholders deviate from the intended objectives or if challenges emerge that threaten the success of the transitions.

Support

Participants of the conducted interviews and workshops emphasised that individual organisations have limited capacity to drive significant change unless they possess substantial resources or create outcomes so valuable that others are motivated to emulate them. Moreover, some voiced that all organisations need to contribute to effectively engage in a system transition. System transitions typically involve an interconnected network of actors (see Section 3.2). Although it may seem favourable to have all parties align on the need and willingness for change, it does not inherently result in the failure of a system transition when one party abandons the collective pursuit. Instead, transformative changes likely require sufficient **support** to reach a tipping point and catalyse a systemic transition. This support may depend on the strategic involvement of highly influential factors rather than the number of participating parties [215]. The exact impact or number of parties, actions or events required to reach this tipping point remains unknown. Nevertheless, it is likely not every party and component, nor even a majority, is required to initiate a transition, contrasting the beliefs of some of the interview and workshop participants.

Iterative Process

As time progresses and parties continue to work on a transition, new information, knowledge, technologies and other resources will likely become available, as observed during the identification and collection of trends (see Chapter 5). These eventualities may positively or negatively impact the transition process and its progress. To assess the effectiveness of the process and the general progress of the transition as well as the impact of these eventualities, frequent reflection and evaluation are required. Subsequentially, periodic adjustments must be made when circumstances necessitate.

Transitioning parties need to reflect on and evaluate their activities and processes to, for instance, ensure alignment with the objective that necessitates a transition and to prevent tunnel visioning (Chapter 7). However, the active reflection and evaluation of the overall transition may be a more suitable additional role for guiding parties, given that they already actively focus on the monitoring and achievement of the overarching objective. Consequently, the guides should periodically evaluate whether the vision and overall strategy still meet the overarching objective (e.g., is the goal still being pursued, are the generally applied strategies in line with the achievement of the main objective, are there any crucial knowledge gaps, etc.). Transitioning parties could be actively involved as it can foster a sense of ownership and responsibility and provide an incentive for collaboration and reflection.

Collaboration

Complex system transitions generally involve multiple parties (see Chapter 3). A recurring theme during the interviews and workshops was the belief that **collaboration** is essential to achieve systemic objectives effectively. Although participants discussed different partnerships depending on their organisational type, they unanimously emphasised the importance of knowledge exchange and mutual support (see Section 7.3). A combination of efforts may result in greater impact not solely because of joint resources (e.g., partners, financial means, workforce) but also by a potential increase in reach (e.g., shared client base) [49]. Furthermore, as described in Section 7.3, collaboration also allows for the expansion of perspectives, the generation of new ideas, and the gaining of insights that can be used to adapt strategies and support decision-making.

Growth Mindset

During the workshops, it was sometimes observed that participants were persistent in their perception of what they deemed achievable, and if a future or strategy was deemed unachievable, participants voiced reluctance to engage in it (see Chapter 7). This persistence reflected a static mindset, which can limit the willingness to explore unconventional or uncertain pathways. However, system transitions, inherently complex and dynamic processes, often require significant shifts in attitudes and behaviours to adapt to new norms, practices, and innovations (see Chapter 5).

Parties that are resistant to change and are unwilling to learn along the way are assumed to hinder the effective launch of a transition due to the systemic approach and adaptation required for system transitions (see Chapters 2, 3, 7). Therefore, parties must adopt or learn to apply a **growth mindset**. A growth mindset involves flexibility, adaptiveness, and receptiveness to feedback [216]. In essence, it is thought that parties must be willing to embrace uncertainties instead of eliminating uncertainties altogether. Attempting to eliminate uncertainties could lead to short-term thinking and tunnel visioning, restricting innovation and change (see Chapters 3 and 7). A solution-oriented approach may best reflect a growth mindset, in which a standstill is avoided by actively applying learnings, fostering adaptability while simultaneously focussing on progress.

Finally, a willingness to learn effectively requires the overcoming of fear of failure. In the context of systems transitions, failure is often an unavoidable part of the process due to the complexity and uncertainty involved. However, failure may provide critical feedback when reflected upon, which can be used for adaptation to achieve long-term success.

Intrinsic Motivation

Transitioning parties driven by external motivators, such as legislative measures, financial or social gain, may be inclined to abort the pursuit of a transition when the external motivator is omitted (see Chapters 3 and 7). Given that the transition of a system involves a long-term process and much resources due to their complexity, intrinsic motivation - defined as *"the doing of an activity for its inherent satisfaction rather than for some separable consequence"* [217] - may be necessary to ensure progress. Intrinsic motivation has been linked to be a significant predictor of risk-taking behaviour. Intrinsically motivated individuals show an increased willingness to engage in risk-taking activities [218].

All parties that have been spoken over the duration of the research, including interview and workshop participants as well as industry experts, demonstrated varying degrees of motivation to participate in the transition to sustainable packaging. Some parties candidly expressed an eagerness to gain insights that could ultimately improve their market position, whereas others revealed a deeply embedded and personal commitment to advance and achieve sustainability. Drawing on the diffusion model established by Rogers [95], some type of motivation is required to catalyse change. **Intrinsic motivation** is assumed to be particularly valuable for its generally strong durability and resilience.

Perseverance

Systemic transitions involve the transition from dominant regimes during a long-term process [219, 220]. The challenges and complexities faced by the food packaging supply chain, as described in Chapters 2 and 3, have persisted for an extended period. It is generally unknown how much time, effort and other resources the change of such dominant regimes and the overcoming of such challenges require (see Chapters 3 and 7). Moreover, it is likely parties will face many emerging

challenges hindering transition progress, such as the application of ineffective strategies, active resistance from other parties, or unsuccessful innovation projects that require recalibration. Therefore, the transition of a system may require significant **perseverance** from involved parties.

Chapter Conclusion

This chapter set out to synthesise the insights that were gained throughout the thesis that are assumed to apply to system transitions beyond the case study of the research. Consequently, the purpose of this chapter was to contribute to the general understanding of what can support effective transitions within complex systems. A set of eight boundary conditions on system transitions has been proposed as a result. These conditions are intended to serve as guiding principles, that, when met, are hypothesised to positively influence the launch of systemic transitions.

Conclusion

The research aimed to explore how the Dutch supermarket of 2050 could facilitate the transition of the Dutch food packaging supply chain to sustainable packaging of foodstuffs. In doing so, it is concluded that the food packaging industry should strive for sustainable packaging to prevent food waste, focussing on the functions of packaging rather than the packaging as an entity itself.

Given the pivotal role of contemporary supermarkets and their central position in the food packaging supply chain, it is concluded that the supermarket can assume an important role in the aforementioned transition. To explore how the supermarket of the future can facilitate the transition to sustainable packaging, a trend-matrix and analysis methodology was developed and applied to discover trends that could shape the future. These trends have been used to construct four scenarios, which were subsequently employed during workshops with food packaging supply chain stakeholders. The insights gained following the trajectory of this research have contributed to a set of eight boundary conditions that are proposed to precede systems transitions.

In order to facilitate the transition of the Dutch food packaging supply chain towards sustainable packaging, the contemporary Dutch supermarket should determine which of the proposed boundary conditions they can meet and subsequently how these conditions can be met. Furthermore, the contemporary supermarket should determine what the supermarket of 2050 entails, so that it can actively shape this supermarket of the future, which, in turn, can facilitate the transition from a possible future of sustainable packaging to a projected future of sustainable packaging.

Discussion and Recommendations

Many different components have been covered during this research. In the following chapter, the most important components of the research are reflected upon and evaluated. Additionally, several recommendations for future research are proposed.

General Discussion and Recommendations

First of all, the research that was conducted involved an explorative and iterative top-down approach in which several components remained undefined and unexplored. This provided an opportunity to focus on systems transitions beyond the employed case study. As a result, despite the scope of the research, it is presumed that the findings and results, such as the proposed boundary conditions, can be applied to other domains, industries, and systems that are at the forefront of a transition. Yet, it must be noted that due to the encompassing nature of the research, some findings may not apply to every situation, stakeholder, or system.

The majority of the findings that are used to establish the proposed boundary conditions for system transitions are predominantly based on qualitative data, which provide valuable but nuanced insights into the topic. The inclusion of quantitative data could further substantiate and strengthen the claims and statements of the research. Furthermore, given that the boundary conditions were established following a single case study, the findings of the research will be, to a certain extent, prone to bias.

Therefore, further research is required to determine the validity of the boundary conditions in addition to refinement of the boundary conditions. For example, varying case studies on different system transitions can be employed to investigate whether the boundary conditions are indeed generally applicable. Moreover, if the boundary conditions are validated it should be investigated to what extent the boundary conditions must be met to effectively commence transitions, in what manner, if the conditions are future-proof and if the conditions follow a specific orderliness.

Additionally, research is required on the translation of theory on system transitions into practice: how can parties be activated to engage in transitions and how can effective long-term commitment to transitions among parties be ensured while their organisations maintain relevancy, fulfil their role, and meet short-term objectives?

Since system transitions concern a vast network of actors, it is recommended to research how additional value can be created in addition to the value of the intended purpose of a transition, as the research clarified that many parties may only be motivated extrinsically. Although it is assumed that this issue is eventually self-resolved given that industry organisations that do not adopt will ultimately disband due to, for example, not meeting customer demand, it is believed that involving these parties in the transitions can actually accelerate and support the transitions at hand.

By breaking down a complex, systemic problem into smaller pieces by for instance applying a case study, the systemic problem and the involved complexity can become more manageable. This can contribute to the process of solving it. Additionally, applying various case studies can show which factors significantly influence the systemic problem, which can subsequently be addressed.

Discussion and Recommendations on the Case Study

As described in Section 1.4, the case study has focussed on the environmental pillar of sustainable development. However, sustainable development, as described by the Brundtland Committee [68],

also concerns economic and social development. Future research on systems transitions should consider all three pillars as the pillars are interlinked and thus can significantly influence one another. Moreover, involving the remaining two pillars in future research may provide valuable insights regarding the proposed boundary conditions and their independence with respect to environmental sustainability.

Future and contemporary supermarkets can assume an important and impactful role in the transition towards sustainable packaging due to their dominant position in the food retail market and their central role in the food packaging supply chain. However, the food packaging supply chain consists of numerous parties and involves various stakeholders that can collectively and individually significantly contribute to the transition. Subsequently, it is recommended to further investigate how and to what extent these parties could contribute to the transition within the case study. Additionally, to translate this and future research into practice, it is recommended to investigate transition management, strategies and other practical tools that can be applied to effectively instigate and facilitate a transition. A recommended starting point is the question *"How can a strategy be determined from long-term visions and futures, and subsequently be applied to effectively instigate a transition?"*.

Furthermore, as discussed throughout the thesis, there are more possible directions in which climate change, sustainable packaging, food waste and likely systems transitions can be addressed. It is recommended that these possible directions are further researched from different disciplines and in different manners. In doing so, it is advised to look beyond the status quo and anticipate and research possible consequences of practices and research.

One of the drivers to investigate sustainable packaging is the desire to maintain the packaging functions to prevent food waste. The implementation of sustainable packaging can contribute to the prevention of food waste. However, there are more means to address food waste. These means should be investigated alongside sustainable packaging, and thus a systems approach should be applied.

Trend Matrix and Scenarios

As described in Section 5.2, it is likely that some relevant and important trends may not have been captured in the trend matrix. This is inherent to trend analyses for several reasons. First of all, trend analyses are oftentimes subjective. The executor of a trend analysis ultimately decides which trends are captured. This may or may not align with the view of others. Additionally, the perspective of the executor may be limited and information on trends and developments may be unavailable at the time of the analysis. This can result in subjects and topics remaining untouched. Finally, a trend analysis is inherently incomplete given that new trends may have emerged by the time the analysis has finished. For instance, within the timeframe in which this research has been conducted, a shift in the Dutch political landscape occurred which might have large consequences for trend matrix categories such as Ecology and Economy. Therefore, even though a trend analysis can form a well-founded foundation for scenario generation, it is important to view the results of a trend analysis as a somewhat subjective snapshot of time and not as an all-encompassing truth.

The trend matrix framework as described and shown in Chapter 5 has captured numerous past, current and future trends. Trends that occurred in the past and trends that are known to currently transpire are relatively certain. However, future trends, even if predicted by means of and supported by data, are uncertain to some degree. Therefore, it is important to note that scenarios are not predictions of the future. The scenarios as developed in this thesis are educated guesses of what the future may or may not entail used to inter alia support reflection, communication, and decision-

making. Moreover, there are no wrong or right scenarios following that all futures are possible. Thus, when employing scenarios, one should focus on the utilisation of the scenarios rather than the correctness of the scenarios.

Yet, some scenarios may be more plausible than others. Additionally, scenarios can differ greatly in their effectiveness as tools. The effectiveness of a scenario depends on its purpose, the circumstances under which it is employed, and the manner in which it has been developed.

Nekkers describes that scenarios must be relevant, plausible and radical [31]. However, this depends on the purpose of the scenarios and their application context. For example, it was observed during an external workshop on the future of packaging that the workshop-specific scenarios were perceived by participants as too radical. Consequently, participants voiced that the scenarios lost all plausibility. Nonetheless, the scenarios still served their function as a dialogue tool given that participants engaged in discussion on their differing perceptions of the scenarios. Furthermore, given that the aforementioned requirements and scenarios can be viewed and perceived differently, they are considerably perspective-dependent. Consequently, it may be challenging to meet the scenario requirements at all times. Nevertheless, the scenario requirements described by Nekkers serve as helpful guidelines during the construction of scenarios as they provide an indication of the effectiveness of the scenarios prior to application.

The scenarios as designed in Chapter 6 were constructed by building on the trends captured in Chapter 5. This methodology has somewhat limited the exploration of possible futures in a sense that radical and relevant ideas could not be freely integrated into the scenarios, since there had to be a clear connection between causes and effects to achieve plausibility. Therefore, the long-term visions as depicted in the current scenarios may be limited to some extent. However, this is regarded as inherent to the employed methodology. Furthermore, while comprehensive cause-and-effect relationships are required to ensure plausibility within a scenario, they can be counterproductive if the target audience finds the cause-and-effect relationship to be implausible.

The scenario development methodology and workshops developed and employed during this research are thought to be tools that can be applied by the KIDV, especially in further exploring how a transition to sustainable packaging (for all types of products and industries) can be pursued. In doing so, if a new trend matrix must be established, it is recommended to apply a time limit for the trend analysis and to utilise in-house expertise. Additionally, the methodologies are also believed to be applicable within their own (umbrella) organisation, for instance for the further development, implementation or evaluation of visions or strategies.

Finally, it is thought that the organisation suits the role as a guiding party. After all, the KIDV currently meets some of the conditions set for ‘guiding parties’, as described in Chapter 8. However, a challenge lies ahead: currently, industry parties frequently question how more sustainable packaging (*noun*) can be obtained in the near future and as a result often focus more on optimisation rather than seeking to adopt sustainable packaging (*verb*) in the long-term. It must be researched how the KIDV and similar (potential) guiding parties can navigate this role as guidance while avoiding the pitfall of being caught in short-termism and tunnel visioning themselves.

References

[1] R. ten Klooster, J. M. Dirken, F. Lox, and A. A. Schilperoord, *Zakboek Verpakkingen*. Reed Business bv (in Dutch), 2008, p. 894.

[2] J. M. Kooijman, "Environmental Assessment of Food Packaging: Impact and Improvement," *Packaging Technology and Science,* vol. 7, pp. 111-121, 1994. [Online]. Available: https://doi.org/10.1002/pts.2770070302.

[3] "Micro meso macro." managementmoellensite.nl. https://managementmodellensite.nl/micro-meso-macro/ (accessed.

[4] "Home- Superunie." Superunie. https://www.superunie.nl/ (accessed 2024).

[5] "Over ons | Jumbo." Jumbo. https://www.jumbo.com/nieuws/over-ons-bedrijf (accessed 2024).

[6] "Marktaandelen door 2 brillen bekeken- Hoe groot is Albert Heijn en hoe klein Lidl?" Foodlog. https://www.foodlog.nl/gespot/2024-01-18/ (accessed 2024).

[7] G. Lommen. "Marktaandelen: Plus, Jumbo, Poeisz, Aldi, AH..." Food Personality. https://www.foodpersonality.nl/branche-cijfers/branche-cijfers/18375/marktaandelen-plus-jumbo-poiesz-aldi-ah- (accessed 2024).

[8] "Retail Insiders | Supermarkten." Retail Insiders. https://www.retailinsiders.nl/branches/levensmiddelenzaken/supermarkten/ (accessed 2024).

[9] "Marktaandelen- Distrifood." Distrifood. https://www.distrifood.nl/food-data/marktaandelen (accessed 2024).

[10] "Albert Heijn." Albert Heijn. https://www.ah.nl/winkels (accessed 2024).

[11] "Over Hoogvliet- Hoogvliet supermarkten." Hoogvliet. https://www.hoogvliet.com/over-hoogvliet (accessed 2024).

[12] "Winkels | DekaMarkt." DekaMarkt. https://www.dekamarkt.nl/winkels (accessed 2024).

[13] "SPAR | de winkel voor dagelijks gemak, je vindt het bij SPAR." SPAR. (accessed 2024).
[14] "Coop: Zo kan 't ook! | Coop." Coop. https://www.coop.nl/supermarkt (accessed 2024).
[15] "Supermarkten in het Noorden | Poeisz Supermarkten." Poeisz Supermarkten. https://www.poiesz-supermarkten.nl/onze-winkels (accessed 2024).
[16] "PLUS Holding | PLUS." Plus. https://www.plus.nl/organisatie/over-ons/plus-retail (accessed 2024).
[17] "Onze winkels | Boni supermarkt." Boni. https://bonisupermarkt.nl/onze-winkels (accessed 2024).
[18] "Dirk winkels | Dirk." Dirk. https://www.dirk.nl/winkels (accessed 2024).
[19] "Vomar Voordeelmarkt | Bekijk alle winkels." Vomar. https://www.vomar.nl/winkels (accessed 2024).
[20] "Over ALDI- Geschiedenis en praktische informatie." ALDI. (accessed 2024).
[21] "Boon's Markt- Het kan wèl!" Boon's Markt. https://www.boonsmarkt.nl/ (accessed 2024).
[22] "Meer winkels in 2024." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/nieuws/2024/18/meer-winkels-in-2024 (accessed 03-09-2024, 2024).
[23] "Supermarktketens Nettorama en Boni fuseren." NOS. https://nos.nl/artikel/2484558-supermarktketens-nettorama-en-boni-fuseren (accessed 2024).
[24] "Dit is Lidl- Lidl Nederland." Lidl. https://corporate.lidl.nl/geschiedenis (accessed 2024).
[25] D. van Loon. "NielsenIQ: marktaandelen supermarkten 2023." Food Personality. https://www.foodpersonality.nl/branche-cijfers/branche-cijfers/18357/nielseniq-marktaandelen-supermarkten-2023 (accessed 2024).
[26] "Supermarktketens Nettorama en Boni fuseren," in *NOS*, ed, 2023.

[27] J. de Lange, E. Oude Luttikhuis, R. ten Klooster, and D. Lutters, "Towards integrating sustainability in the development of product/packaging combinations," 2013.
[28] J. Potting, M. Hekkert, E. Worrell, and A. Hanemaaijer, "Circulaire Economie: Innovatie Meten in de Keten," Planbureau voor de Leefomgeving, Den Haag, 2016.
[29] L. J. Pronk, "The design of a roadmap for the integration of remote support into a production environment," MSc, Design, Production and Management, University of Twente, Enschede, 2023.
[30] D. Rumsfeld, "Department of Defense News Briefing," ed: U.S. Department of Defense, 2002.
[31] J. Nekkers, *Wijzer in de Toekomst*. Amsterdam: Business Contact, 2020.
[32] J. Poore and T. Nemecek, "Reducing food's environmental impacts through producers and consumers," *Science of the Total Environment,* vol. 360, no. 6392, pp. 987-992, 01-06-2018 2018, doi: 10.1126/science.aag0216.
[33] "Food Waste Index Report 2024," in "Think Eat Save: Tracking Progress to Halve Global Food Waste," 2024. [Online]. Available: https://wedocs.unep.org/20.500.11822/45230
[34] H. Williams and F. Wikström, "Environmental impact of packaging and food losses in a life cycle perspective: a comparative analysis of five food items," *Journal of Cleaner Production,* vol. 19, no. 1, pp. 43-48, 2011, doi: 10.1016/j.jclepro.2010.08.008.
[35] B. Wohner, E. Pauer, V. Heinrich, and M. Tacker, "Packaging-Related Food Losses and Waste: An Overview of Drivers and Issues," *Sustainability,* vol. 11, no. 264, pp. 1-15, 2019, doi: https://doi.org/10.3390/su11010264.
[36] K. Verghese, H. Lewis, S. Lockrey, and H. Williams, "Packaging's Role in Minimizing Food Loss and Waste Across the Supply Chain," *Packaging Technology and Science,* vol. 28, no. 7, pp. 603-620, 2015, doi: 10.1002/pts.2127.
[37] (2022). *European Green Deal: Putting an end to wasteful packaging, boosting reuse and recycling*. [Online] Available:

https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7155
[38] "Visual Feature | Beat Plastic Pollution." United Nations Environment Programme. https://www.unep.org/interactives/beat-plastic-pollution/ (accessed 07-01-2024, 2024).
[39] F. Wikström and H. Williams, "Packaging and Food Waste Behavior," in *Food Science*: Elsevier, 2017, pp. 1-4.
[40] (2019). *The European Green Deal*. [Online] Available: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF
[41] "Raamovereenkomst Verpakkingen 2013-2022," 27-06-2012 2013.
[42] "Handvest Circulair en duurzaam verpakken," Den Haag. Accessed: 08-01-2024.
[43] (2020) Duurzaam verpakken in de supermarkt. 1-30.
[44] P. Hammingh, M. Abels-van Overveld, D. Blomjous, and E. al., "Klimaat- en Energieverkenning 2024," Den Haag, 2024.
[45] "Toelichting op het Verslagleggingsformulier: Resultaat Verpakkingen 2023," Leidschendam, 18-07-2024 2024.
[46] W. J. Ripple *et al.*, "The 2024 state of the climate report: Perilous times on planet earth," *BioScience,* pp. 1-13https://doi.org/10.1093/biosci/biae087, 2024, doi: https://doi.org/10.1093/biosci/biae087.
[47] "Efficiënt gebruik van materialen niet genoeg voor verminderen CO2-uitstoot." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/nieuws/2023/47/efficient-gebruik-van-materialen-niet-genoeg-voor-verminderen-co2-uitstoot (accessed 11-04-2024, 2024).
[48] H. A. B. van der Meulen and P. Berkhout, "Food Economic Report 2019 of the Netherlands: Summary," Wageningen Economic Research, Den Haag, 01-2020 2019, vol. 2023. [Online]. Available: https://edepot.wur.nl/512109
[49] H. Westhoek *et al.*, "De Macht van het Menu: Opgaven en kansen voor duurzaam en gezond voedsel," Den Haag, 2013.

[50] "Diensten- KIDV." KIDV. https://kidv.nl/diensten (accessed 2024).
[51] "Wij Zijn Verpact | Verpact." Verpact. https://www.verpact.nl/nl/wij-zijn-verpact?_gl=1*1xstgft*_up*MQ..*_ga*MzMyNjMxODE1LjE3MzEwNzc2Mjc.*_ga_WLP0FL9EKR*MTczMTA3NzYyNi4xLjAuMTczMTA3NzYyNi4wLjAuMA.. (accessed 08-11-2024, 2024).
[52] "In één organisatie met de naam 'Verpact' klaar voor de toekomst | Verpact." Verpact. https://www.verpact.nl/nl/actueel/blog-een-organisatie-met-de-naam-verpact-klaar-voor-de-toekomst (accessed 08-11-2024, 2024).
[53] C. Bruijnes, H. Diepenmaat, R. ten Klooster, J. P. van Soest, G. Langeveld, and V. Balk, *The State of Sustainable Packaging*. KIDV, 2020, pp. 1-171.
[54] "Consumentenonderzoek 2023," 09-2023 2023.
[55] J. Elkington, *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. Capstone Publishing Ltd, 1999, p. 424.
[56] "THE 17 GOALS | Sustainable Development." United Nations Department of Economic and Social Affairs. https://sdgs.un.org/goals (accessed 2024).
[57] "Food Waste." European Commission. https://food.ec.europa.eu/food-safety/food-waste_en (accessed.
[58] FAO, "Agricultural production statistics 2000-2022," in "Analytical briefs," Rome, 2022. [Online]. Available: https://openknowledge.fao.org/server/api/core/bitstreams/fba4ef43-422c-4d73-886e-3016ff47df52/content
[59] *European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste*, 1994.
[60] H. Williams, F. Wikström, T. Otterbring, M. Löfgren, and A. Gustafsson, "Reasons for household food waste with special attention to packaging," *Journal of Cleaner Production,* vol. 24, pp. 141-148, 2011, doi: 10.1016/j.jclepro.2011.11.044.
[61] H. Williams, F. Wikström, and M. Löfgren, "A life cycle perspective on environmental effects of customer focused packaging development," *Journal of Cleaner Production,* vol. 16,

pp. 853-859, 2008. [Online]. Available: doi:10.1016/j.jclepro.2007.05.006.
[62] R. ten Klooster, *Verpakking buitenstebinnen*. 2007, p. 68.
[63] "Packaging waste by waste management operations." Eurostat. https://ec.europa.eu/eurostat/databrowser/view/env_waspac/default/table?lang=en (accessed.
[64] S. Otto, M. Strenger, A. Maier-Nöth, and M. Schmid, "Food packaging and sustainability – Consumer perception vs. correlated scientific facts: A review," *Journal of Cleaner Production,* vol. 298, 2021, doi: 10.1016/j.jclepro.2021.126733.
[65] "Alle doppen verplicht aan de fles: goed voor het milieu, maar wel irritant." NOS. https://nos.nl/artikel/2525664-alle-doppen-verplicht-aan-de-fles-goed-voor-het-milieu-maar-wel-irritant (accessed 2024).
[66] H. Williams, A. Lindström, J. Trischler, F. Wikström, and Z. Rowe, "Avoiding food becoming waste in households – The role of packaging in consumers' practices across different food categories," *Journal of Cleaner Production,* vol. 265, 2020, doi: 10.1016/j.jclepro.2020.121775.
[67] B. de Koeijer, J. de Lange, and R. Wever, "Desired, Perceived, and Achieved Sustainability: Trade-Offs in Strategic and Operational Packaging Development," *Sustainability,* vol. 9, no. 10, 2017, doi: 10.3390/su9101923.
[68] "Our Common Future," World Commission on Environment and Development, Nairobi, 10-1987 1987. [Online]. Available: https://digitallibrary.un.org/record/139811?v=pdf
[69] "What the FSC Labels Mean | Forest Stewardship Council." Forest Stewardship Council. https://fsc.org/en/what-the-fsc-labels-mean (accessed 2024).
[70] "B Corp Certification demonstrates a company's entire social and environmental impact." B Corporation. https://www.bcorporation.net/en-us/certification/ (accessed 2024).
[71] "What Does "Rainforest Alliance Certified" Mean? | Rainforest Alliance." Rainforest Alliance. https://www.rainforest-

alliance.org/what-does-rainforest-alliance-certified-mean/ (accessed 2024).
[72] "Planetary boundaries- Stockholm Resilience Centre." Stockholm University. https://www.stockholmresilience.org/research/planetary-boundaries.html (accessed 2024).
[73] "The circular economy in detail." Ellen MacArthur Foundation. https://www.ellenmacarthurfoundation.org/the-circular-economy-in-detail-deep-dive (accessed 07-02-2024, 2024).
[74] *Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food,* E. Union 10/2011, 2011.
[75] *Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC,* E. Union 1935/2004, 2004.
[76] A. A. Leiserowitz, R. W. Kates, and T. M. Parris, "Sustainability Values, Attitudes, and Behaviors: A Review of Multinational and Global Trends," *Annual Review of Environment and Resources,* vol. 31, p. 37, 2006, doi: https://doi.org/10.1146/annurev.energy.31.102505.133552.
[77] J. Lui *et al.*, "Systems integration for global sustainability," *Science,* vol. 347, no. 6225, p. 9, 2015, doi: http://dx.doi.org/10.1126/science.1258832.
[78] F. W. Geels, "The multi-level perspective on sustainability transitions: Responses to seven criticisms," *Environmental Innovation and Societal Transitions,* vol. 1, no. 1, pp. 24-40, 2011, doi: 10.1016/j.eist.2011.02.002.
[79] "Packaging in the Sustainability Agenda: A Guide for Corporate Decision Makers," Brussels, 2009.
[80] D. X. Sumter, I. Oskam, K. Poldner, and A. F. Zuidberg, "Well packaged: Tradeoffs in sustainable food packaging design," presented at the Product Lifetimes And The Environment, Espoo, 2023.

[81] M. Geurts, A. M. van Bakel, C. T. M. van Rossum, E. de Boer, and M. C. Ocké, "Food consumption in the Netherlands and its determinants: Background report to 'What's on our plate? Safe, healthy and sustainable diets in the Netherlands'," 2017.
[82] ed: Kruideniers Museum Utrecht, n.d.
[83] "De historie van de Nederlandse supermarkten." Alle Supermarkten. https://www.allesupermarkten.com/informatie/historie-nederlandse-supermarkten/ (accessed?, 2023).
[84] "Dirk van den Broek, van boerenzoon tot supermarktmagnaat." Gemeente Amsterdam. (accessed 13-03-2024, 2024).
[85] "Brancheplan Duurzaam Verpakken 2019-2022," 2019.
[86] I. Geyskens, B. Deleersnyder, M. G. Dekimpe, and D. Lin, "Do consumers benefit from national-brand listings by hard discounters?," *Journal of the Academy of Marketing Science,* vol. 52, 97, pp. 97-118, 2024, doi: 10.1007/s11747-023-00937-3.
[87] "Huismerken bezig aan opmars in de supermarktschappen." NOS. https://nos.nl/artikel/2488170-huismerken-bezig-aan-opmars-in-de-supermarktschappen (accessed 19-02-2024, 2024).
[88] "Alles over Albert Heijn | Albert Heijn." Albert Heijn. https://www.ah.nl/over-ah (accessed 13-03-2024, 2024).
[89] "SPAR city | Je vindt ze in binnensteden door heel Nederland." SPAR. https://www.spar.nl/city/ (accessed 13-03-2024, 2024).
[90] "Jumbo franchise- Hoe start ik een Jumbo Franchise." Jumbo. https://nl.jobs.jumbo.com/nl/contact/franchise/ (accessed 2024).
[91] M. Stikkelorum. "Twee grote supermarktketens verlagen de prijzen; volgt de rest?" NOS. https://nos.nl/artikel/2196136-twee-grote-supermarktketens-verlagen-de-prijzen-volgt-de-rest (accessed 2024).
[92] "Voorgenomen besluit: La Place verder als zelfstandige organisatie." La Place. https://www.laplace.com/foodstories/voorgenomen-besluit-la-

place-verder-als-zelfstandige-organisatie (accessed 16-10-2024, 03-06-2024).
[93] O. Ağlargöz and F. Ağlargöz, "Towards a Packaging-Free Society: A Historical Journey of Institutionalization and the Way Forward," in *The Future of Consumption: How Technology, Sustainability, and Wellbeing will Transform Retail and Customer Experience*, K. Bäckström, C. Egan-Wyer, and E. Samsioe Eds.: Palgrave Macmillan, 2023, p. 397.
[94] "Uitgebreide producentenverantwoordelijkheid (UPV) verpakkingen." Inspectie Leefomgeving en Transport. https://www.ilent.nl/onderwerpen/producentenverantwoordelijkheid/upv-verpakkingen (accessed 22-11-2024, 2024).
[95] E. M. Rogers, *Diffusion of Innovations*, 3 ed. New York: The Free Press, 1962, p. 236.
[96] G. Huis, "Brancheplan Duurzaam Verpakken GroentenFruit Huis," 2019. Accessed: 08-01-2024.
[97] J. Voros, "Big History and Anticipation: Using Big History as a framework for global foresight," in *Handbook of Anticipation*, 2017, ch. 95, pp. 1-40.
[98] S. Inayatullah, "Six pillars: futures thinking for transforming," *Foresight,* vol. 10, no. 1, pp. 4-21, 2007, doi: 10.1108/14636680810855991.
[99] T. Hancock and C. Bezold, "Possible futures, preferable futures," *The Healthcare Forum Journal,* vol. 37, no. 2, pp. 23-29, 1994.
[100] J. Gausemeier, A. Fink, and O. Schlake, "Scenario Management: An Approach to Develop Future Potentials," *Technological Forecasting and Social Change,* vol. 59, no. 2, pp. 111-130, 1998, doi: 10.1016/S0040-1625(97)00166-2.
[101] R. A. Slaughter, "The Foresight Principle," *Futures,* vol. 22, no. 8, pp. 801-819, 1990, doi: 10.1016/0016-3287(90)90017-C.
[102] P. J. H. Schoemaker, "Scenario Planning: A Tool for Strategic Thinking," *MIT Sloan Management Review,* vol. 36, no. 2, pp. 25-40, 1995.

[103] N. N. Taleb, *The Black Swan: The Impact of the Highly Improbable*, 2 ed. Random House Publishing Group, 2010, p. 480.
[104] "Scenario planning vs. forecasting: what's the difference?" Bedford Consulting. https://bedfordconsulting.com/scenario-planning-vs-forecasting-whats-the-difference/ (accessed 2024).
[105] C. N. Cook, S. Inayatullah, M. A. Burgman, W. J. Sutherland, and B. A. Wintle, "Strategic foresight: how planning for the unpredictable can improve environmental decision-making," *Trends Ecol Evol,* vol. 29, no. 9, pp. 531-41, Sep 2014, doi: 10.1016/j.tree.2014.07.005.
[106] "Shell Scenarios | Shell Global." Shell. https://www.shell.com/news-and-insights/scenarios.html (accessed 17-11-2024, 2024).
[107] P. Jones and K. van Ael, *Design Journeys through Complex Systems: Practice Tools for Systemic Design*. Amsterdam: BIS Publisher, 2022.
[108] A. Krishnan *et al.*, "Foresight Playbook: Overview of Foresight Tools," New York, 2022.
[109] S. Inayatullah, "Causal Layered Analysis: Theory, historical context, and case studies," in *The Causal Layered Analysis (CLA) Reader: Theory and Case Studies of an Integrative and Transformative Methodology*: Tamkang University Press, 2004, pp. 8-49.
[110] "Visioning- MSP Guide." Wageningen University & Research. https://mspguide.org/2022/03/18/visioning/ (accessed 15-11-2024, 2024).
[111] K. van der Heijden, *Scenarios: The Art of Strategic Conversation*. John Wiley, 1996.
[112] T. J. Gordon, "Cross-Impact Method," in *Futures Research Methodology*: The Millennium Project, 1994, pp. 1-18.
[113] M. Baghai, S. Coley, and D. White, *The Alchemy of Growth: Practical Insights for Building the Enduring Enterprise*. Basic Books, 1999, p. 272.

[114] J. C. Glenn, "The Futures Wheel," in *Futures Research Methodology 3.0*: The Millennium project, 2021.
[115] E. Boulding and K. E. Boulding, *The Future: Images and Processes*. Sage Publications Inc., 1994.
[116] A. McGregor. "Vision and strategy toolkit- Jisc." Jisc. https://www.jisc.ac.uk/guides/vision-and-strategy-toolkit (accessed 2024).
[117] F. van Duijne and P. Bishop, "Introduction to Strategic Foresight," 2018.
[118] "DESTEP Analysis: Your Guide to External Environment Analysis." Lucidity. (accessed 23-01-2024, 2024).
[119] "De voordeligste supermarkt van Nederland | Dirk." https://www.dirk.nl/meer/over-dirk/historie (accessed.
[120] "NEN-EN-ISO 14040:1998 nl," ed: NEN, 1998, p. 10.
[121] "DEMOGRAPHY | English meaning- Cambridge Dictionary." Cambridge Dictionary. https://dictionary.cambridge.org/dictionary/english/demography (accessed 09-10-2024, 2024).
[122] "Leeftijdsverdeling." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/leeftijd/bevolking (accessed 2023).
[123] "Bevolkingsteller." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/bevolkingsteller (accessed 2023).
[124] "Huishoudens nu." Centraal Bureau voor de Statistiek. (accessed 2023).
[125] J. van Sonsbeek, F. Bos, J. Ebregts, and E. Verkade, "De Nederlandse economie in historisch perspectief," 2023.
[126] "Bevolkingsgroei." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/bevolkingsgroei/groei (accessed 2024).
[127] "Ouderen." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/leeftijd/ouderen (accessed 2023).

[128] K. van Oudenhoven-van der Zee, "50 jaar SCP: Op weg naar een veerkrachtige en empathische overheid," 2023.
[129] R. Maslowski. "De sociale staat van Nederland." Sociaal en Cultureel Planbureau. https://digitaal.scp.nl/ssn2020/onderwijs/ (accessed 2024).
[130] F. van der Mooren and R. de Vries. "Steeds meer hoogopgeleiden in Nederland: wat voor beroep hebben ze?" Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/longread/statistische-trends/2022/steeds-meer-hoogopgeleiden-in-nederland-wat-voor-beroep-hebben-ze-?onepage=true (accessed 2024).
[131] "Bevolking in de toekomst." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/bevolkingsgroei/toekomst (accessed 2023).
[132] L. Stoeldraijer, P. Feijten, and C. van Duin. "Bevolkingsprognose 2023-2070: minder geboorten, meer immigratie." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/longread/statistische-trends/2023/bevolkingsprognose-2023-2070-minder-geboorten-meer-migratie (accessed 2023).
[133] "Huishoudens in de toekomst." Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/woonsituatie/huishoudens-toekomst (accessed 2023).
[134] A. de Jong, S. te Riele, C. Huisman, C. van Duin, T. Husby, and L. Stoeldraijer, "Regionale bevolkings- en huishoudens prognose 2022- 2050," Den Haag, 2022.
[135] "Trends in de detailhandel en de betekenis voor de factor arbeid," Zoetermeer, 2017.
[136] "Groei en krimp per gemeente." Centraal Bureau voor Statistiek. https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/regionaal/groei-en-krimp (accessed 2024).
[137] "Netherlands is second-largest exporter and importer of goods in EU." Centraal Bureau van Statistiek. https://www.cbs.nl/en-gb/news/2024/17/netherlands-is-second-largest-exporter-and-importer-of-goods-in-eu (accessed 2024).

[138] "World Competitiveness Ranking." International Institute for Management Development. https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-competitiveness-ranking/ (accessed 28-05-2024, 2024).
[139] "Nederland blijft tot top Europese innovatielanden behoren." Rijksoverheid. https://www.rijksoverheid.nl/actueel/nieuws/2023/07/06/nederland-blijft-tot-top-europese-innovatielanden-behoren (accessed 28-05-2024, 2024).
[140] "Toekomst Nederlandse economie: innovatief, duurzaam, sterk en welvarend." Rijksoverheid. https://www.rijksoverheid.nl/actueel/nieuws/2023/06/30/toekomst-nederlandse-economie-innovatief-duurzaam-sterk-en-welvarend (accessed 21-03-2024, 2024).
[141] "Verduurzamen van Nederlandse bedrijfsleven." Ministerie van Economische Zaken en Klimaat. (accessed 2024).
[142] I. Mossig and M. Lischka, "Globalisation, Economic Interdependencies and Economic Crises," in *International Impacts on Social Policy: Short Histories in Global Perspective*, F. Nullmeier, D. González de Reufels, and H. Obinger Eds. Switzerland: palgrave macmilan, 2022, ch. 23, pp. 289-304.
[143] "SOCIOCULTURAL | English meaning- Cambridge Dictionary." Cambridge Dictionary. https://dictionary.cambridge.org/dictionary/english/sociocultural (accessed 2024).
[144] C. J. M. Schuyt and E. Taverne, *1950: Welvaart in zwart-wit*. Sdu (in Dutch), 2000, p. 580.
[145] J. Lelieveld, *Cultureel-mentale ontwikkelingen in Nederland na 1945*, 3 ed. ThiemeMeulenhoff (in Dutch), 2022.
[146] J. Verriet, "Ready Meals and Cultural Values in the Netherlands, 1950-1970," *Food and History,* vol. 11, no. 1, pp. 123-153, 2013, doi: 10.1484/j.Food.1.103558.

[147] R. Haex, "AllerHande: A Cultural History of Dutch Food Culture, 1955-2000," Bachelor of Arts BA thesis, Geesteswetenschappen, Utrecht University, Utrecht, GE3V18003, 2020.
[148] J. Maasbach, M. Witteveen, and K. Koelemeijer, "BNR 25 jaar | De metamorfose van de Nederlandse winkelstraat," in *Hoge Bomen*, A. van Soest, Ed., ed: BNR, 2023.
[149] CBRE, "De (online) toekomst van boodschappen," 2023.
[150] M. Rol and M. Lambregts. "Detailhandel food: veranderde consument vraagt meer creativiteit." https://www.rabobank.nl/kennis/s011087550-detailhandel-food-veranderende-consument-vraagt-meer-creativiteit (accessed 13-02-2024, 2024).
[151] "FNLI Brancheverduurzamingsplan 2019-2025: Duurzame & Recyclebare Voedselverpakkingen," Den Haag. Accessed: 08-01-2024.
[152] S. Eikelmann, M. Hoogenberg, J. Langkammer, F. Starke, M. Worm, and J. Pujol, "The future of grocery shopping," 2022.
[153] R. ten Klooster and B. de Koeijer, "A trend-based analysis of packaging material amounts per capita per day in the Netherlands," presented at the 31st IAPRI World Conference on Packaging, Mumbai, 25-05-2023, 2023.
[154] J. Verriet. "De voedselgeschiedenis van Nederland: een korte introductie." https://www.voedselgeschiedenis.nl/voedselgeschiedenis-van-nederland/ (accessed 15-02-2024, 2024).
[155] M. de Krom, Vonk, M., Muilwijk, H., "Voedselconsumptie veranderen: bouwstenen voor beleid om verduurzaming van eetpatronen te stimuleren," Planbureau voor de Leefomgeving (PBL), Den Haag, 2020.
[156] N. Menkveld, R. Morren, S. Driessen, S. van der Graaf, H. Hofstede, and J. de Ruyter, "Halvering van voedselverspilling in 2030. Hoe dan?," 2019.
[157] L. van Lieshout and J. Knüppe, "Voedselverspilling bij consumenten thuis in Nederland in 2022," Milieu Centraal, Den Haag, 02-2023 2023, vol. 2024. [Online]. Available:

https://www.milieucentraal.nl/eten-en-drinken/voedselverspilling/hoeveel-voedsel-verspillen-we/
[158] H. Ritchie. "Food waste is responsible for 6% of global greenhouse gas emissions." Our World In Data. https://ourworldindata.org/food-waste-emissions (accessed 20-12-2023, 2023).
[159] "Consumer food waste: fact sheet," n.d.
[160] F. Wikström, H. Williams, J. Trischler, and Z. Rowe, "The Importance of Packaging Functions for Food Waste of Different Products in Households," *Sustainability,* vol. 11, no. 9, 2019, doi: 10.3390/su11092641.
[161] *RetailDetail: Eindejaarsboek*, Antwerpen: Jorg Snoeck, 2023, pp. 6-100.
[162] "Uitgaven aan voedsel." Wageningen University & Research. https://agrimatie.nl/PublicatiePage.aspx?subpubID=2525&themaID=2904&indicatorID=2914&sectorID=2908 (accessed 05-02-2024, 2024).
[163] C. T. M. van Rossum *et al.*, "The Diet of the Dutch," Rijksinstituut voor Gezondheid en Milieu, 2022-190, 2023.
[164] M. van Egmond, C. Rutzerveld, and D. van der Zee, "Welkom in de supermarkt van de toekomst," in *Voeding van morgen*, M. Scheurs, Ed., ed: BNR, 2021.
[165] R. A. Buchanan. "History of technology | Evolution, Ages, & Facts | Britannica." Encyclopedia Britannica. https://www.britannica.com/technology/history-of-technology/The-Industrial-Revolution-1750-1900 (accessed 10-05-2024, 2024).
[166] "Supermarkt van de toekomst: vol interessante technologische ontwikkelingen." AGConnect. https://www.agconnect.nl/partner/all-the-way-up/supermarkt-van-de-toekomst-vol-ontwikkelingen (accessed 12-02-2024, 2024).
[167] H. W. Lintsen and J. W. Schot, *Techniek in Nederland in de twintigste eeuw*. 2003.

[168] A. Shalimov. "How Technology is Transforming the Food Industry." Eastern Peak. https://easternpeak.com/blog/how-technology-is-transforming-the-food-industry/ (accessed.
[169] B. J. Copeland. "History of artificial intelligence | Dates, Advances, Alan Turing, ELIZA, & Facts." Encyclopedia Britannica. https://www.britannica.com/science/history-of-artificial-intelligence (accessed 15-09-2024, 2024).
[170] C. P. v. d. Leefomgeving, "Nederland in 2030 en 2050: Twee referentiescenario's," 2015.
[171] "Gartner Hype Cycle Research Methodology | Gartner." Gartner. https://www.gartner.com/en/research/methodologies/gartner-hype-cycle (accessed 2024).
[172] M. Gray, "The History and Development of Packaging," *Journal of the Royal Society of Arts,* vol. 87, no. 4511, pp. 633-658, 1939.
[173] D. Twede, "The birth of modern packaging," *Journal of Historical Research in Marketing,* vol. 4, no. 2, pp. 245-272, 2012, doi: 10.1108/17557501211224449.
[174] S. J. Risch, "Food packaging history and innovations," *Journal of Agricultural and Food Chemistry,* vol. 57, no. 18, p. 4, 23-09-2009 2009, doi: 10.1021/jf900040r.
[175] "Brancheplan Duurzaam Verpakken 'out-of-home' 2019-2022," 25-11-2019 2019. Accessed: 10-01-2024.
[176] R. Dhanani. "The History of Sustainability & The Word Sustainable | Timeline." The Sustainable Agency. https://thesustainableagency.com/blog/the-history-of-sustainability/ (accessed 27-11-2024, 2024).
[177] K. W. Kenyon and E. Kridler, "Laysan Albatrosses swallow indigestible matter," *The Auk,* vol. 86, no. 2, pp. 339-343, 1969, doi: https://doi.org/10.2307/4083505.
[178] "About us- Club of Rome." https://www.clubofrome.org/history/ (accessed 22-11-2024, 2024).
[179] "Dit is Milieudefensie!- Milieudefensie." Milieudefensie. https://milieudefensie.nl/over-ons/over-milieudefensie (accessed 2024).

[180] J. C. Farman, B. G. Gardiner, and J. D. Shanklin, "Large losses of total ozone in Antarctica reveal seasonal ClOx/NOx interaction," *Nature,* vol. 315, pp. 207-210, 1985, doi: https://doi.org/10.1038/315207a0.
[181] "IPCC- Intergovernmental Panel on Climate Change." IPCC. https://www.ipcc.ch/ (accessed 22-03-2024, 2024).
[182] "Emissies van broeikasgassen berekend volgens IPCC-voorschriften." Centraal Bureau voor Statistiek. (accessed 2024).
[183] "As pollution increases, world falls further behind climate targets." NOAA Research. (accessed 22-11-2024, 2024).
[184] "Waarnemingen klimaatveranderingen." Koninklijk Nederlands Meteorologisch Instituut. https://www.knmi.nl/kennis-en-datacentrum/achtergrond/waarnemingen-klimaatveranderingen (accessed 2024).
[185] W. D. N. M. S. Tennakoon, M. P. N. Janadari, and I. D. Wattuhewa, "Environmental sustainability practices: A systematic literature review," *European Journal of Sustainable Development Research,* vol. 8, no. 3, p. 18, 2024, doi: https://doi.org/10.29333/ejosdr/14604.
[186] Y. de Kluizenaar, C. Carabain, and A. Steenbekkers, "Klimaatbeleid en de samenleving," Den Haag, 2020.
[187] "Klimaatdemonstratie in Amsterdam grootste ooit in Nederland, opstootje op podium." NOS Nieuws. https://nos.nl/collectie/13871/artikel/2497565-klimaatdemonstratie-in-amsterdam-grootste-ooit-in-nederland-opstootje-op-podium (accessed 2024).
[188] "'Aanval' op supermarkten om plastic." NOS. https://nos.nl/op3/artikel/2234736-aanval-op-supermarkten-om-plastic (accessed 04-12-2023, 2023).
[189] "Ruime meerderheid Nederlanders bereid individuele maatregelen te treffen om klimaatdoelstellingen te halen." Duurzaam-ondernemen.nl. https://www.duurzaam-ondernemen.nl/ruime-meerderheid-nederlanders-bereid-individuele-maatregelen-te-treffen-om-klimaatdoelstellingen-te-halen/ (accessed 2024).

[190] "Nieuwe afspraken Raamovereenkomst Verpakkingen," L. VNG, Ed., ed: VNG, 2019, p. 6.
[191] M. Rouw and E. Worrell, "Evaluating the impacts of packaging policy in The Netherlands," *Resources, Conservation and Recycling,* vol. 55, no. 4, pp. 483-492, 2011, doi: 10.1016/j.resconrec.2010.12.013.
[192] *Council Directive of 27 June 1985 on containers of liquids for human consumption,* E. Union 85/339/EEC, 1985.
[193] "Beleid en wetgeving verpakkingen- KIDV." Kennisinstituut Duurzaam Verpakken. https://kidv.nl/wet-en-regelgeving (accessed 2023).
[194] "Van Afval Naar Grondstof: Uitwerking van acht operationele doelstellingen," 01-2014 2014.
[195] "Roadmap Plastic Pact NL: Acties naar 2025," Plastic Pact NL, 01-01-2022 2022.
[196] "Nationaal Programma Circulaire Economie 2023-2030," 2023.
[197] "Nederland circulair in 2050," 2023. [Online]. Available: https://www.rijksoverheid.nl/onderwerpen/circulaire-economie/nederland-circulair-in-2050
[198] "De Warenwet, na 100 jaar nog steeds van waarde!? Is het een flexibele bejaarde?," ed: Ministerie van Volksgezondheid, Welzijn en Sport, 2020, p. 3.
[199] "Is het Voedingscentrum onafhankelijk? | Voedingscentrum." Voedingscentrum. (accessed 11-09-2024, 2024).
[200] "Online sales and purchases (web shop) | Business.gov.nl." Rijksdienst voor Ondernemend Nederland. https://business.gov.nl/regulation/long-distance-sales-and-purchases/ (accessed 2024).
[201] *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation),* E. Commission, 2016.
[202] "Corporate sustainability reporting." The European Commission. https://finance.ec.europa.eu/capital-markets-union-and-

financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en (accessed 2024).
[203] "Thema Leefomgeving | Voedselomgeving." Rijksinstituut voor Volksgezondheid en Milieu. (accessed 12-02-2024, 2024).
[204] B. Fischer. "Houden supermarkten het vol tegen de innovatieve nieuwe formules?" Foodlog. https://www.foodlog.nl/artikel/houden-supermarkten-het-vol-tegen-de-innovatieve-nieuwe-formules/ (accessed 12-12-2023, 2023).
[205] "Supermarkt wordt 'superant'." FoodService Instituut. https://fsin.nl/actueel/nieuws/542/supermarkt-wordt-superant (accessed 12-02-2024, 2024).
[206] R. Trends. "Aandeel huismerken groeit gestaag in Europa." Retail Trends. https://retailtrends.nl/news/70802/aandeel-huismerken-groeit-gestaag-in-europa (accessed 19-02-2024, 2024).
[207] "Reimagining Retail Commerce in 2023," 2023.
[208] R. Berger. "Vier grote trends voor het supermarktlandschap." Consultancy.nl. https://www.consultancy.nl/nieuws/25279/vier-grote-trends-voor-het-supermarktlandschap (accessed?, 2023).
[209] "Amazon gaat foodretailmarkt in Benelux openbreken." Emerce. https://www.emerce.nl/nieuws/amazon-gaat-foodretailmarkt-benelux-openbreken (accessed 15-02-2024, 2024).
[210] S. Huot. "Random Choice Generator Online Tool." Text Fixer. https://www.textfixer.com/tools/random-choice.php (accessed.
[211] "ChatGPT | OpenAI." OpenAI. https://openai.com/chatgpt/overview/ (accessed.
[212] "Document 32003H0361: Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises." European Union. https://eur-lex.europa.eu/legal-content/NL-EN/TXT/?from=EN&uri=CELEX%3A32003H0361 (accessed 2024).
[213] "Miro | De werkomgeving voor innovatie." Miro. https://miro.com/nl/ (accessed.
[214] "De Plastic Wijzer," ed: Afvalfonds Verpakkingen, 2023.

[215] M. Gladwell, *The Tipping Point: How Little Things Can Make a Big Difference*, 1 ed. Little, Brown and Company, 2000.
[216] C. S. Dweck, *Mindset: The New Psychology of Success*. Ballantine Books, 2007, p. 320.
[217] P. Oudeyer and F. Kaplan, "What is intrinsic motivation? A typology of computational approaches," *Frontiers in Neurorobotics,* vol. 1, p. 14, 2007. [Online]. Available: https://doi.org/10.3389/neuro.12.006.2007.
[218] T. Dewett, "Linking intrinsic motivation, risk taking, and employee creativity in an R&D environment," *R&D Management,* vol. 37, no. 3, pp. 197-208, 2007, doi: https://doi.org/10.1111/j.1467-9310.2007.00469.x.
[219] F. W. Geels, "Multi-Level Perspective on System Innovation: Relevance for Industrial Transformation," in *Understanding Industrial Transformation: Views from Different Disciplines*, X. Olsthoorn and A. J. Wieczorek Eds. Dordrecht: Springer, 2006, ch. 9, pp. 163-186.
[220] F. W. Geels, "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study," *Research Policy,* vol. 31, pp. 1257-1274, 2002.

Appendices

List of used AI tools

During the course of the research and the formulation of the thesis several tools have been used in order to:

1) provide inspiration for the (improved) formulation of own content
2) enhance the overall quality of the writing of the thesis and developed scenarios

All content generated by the tools has been reviewed thoroughly and edited accordingly. The author takes full responsibility for the content of the work. The following tools have been used throughout the research:

- ChatGPT[1,2]
- DeepL Translate / DeepL Write[2]
- Grammarly[2]

Appendix A: Exploratory Interviews

In this appendix, elaboration is given on the interviews that were held to gather knowledge which has contributed to some of the insights that correspond to Chapters 2 and 3 and, along with other insights, led to the proposed transition prerequisites discussed in Chapter 8.

Firstly, elaboration is given on the objectives of the exploratory interviews and the applied methodology. Next, the participants that were interviewed and how they were obtained are discussed. Furthermore, the process of the exploratory interviews and methodology are discussed, and some recommendations are given.

A.1 Objectives and methodology

The concept of sustainability is multifaceted, complicated, and ambiguous. Companies and organisations associated with the food packaging supply chain have been called to act on climate change and take on responsibility. However, the food packaging supply chain is a large system that consists of many different parties of which many have different and oftentimes conflicting interests. To gain a better understanding of the internal operations of this chain and the different parties, exploratory interviews were conducted. The objectives of the interviews were to find out how the supply chain is set up (distribution of roles and tasks, relations, interests, and functions), how supply chain organisations view sustainability and sustainable packaging (e.g., definitions, motivation, focus and responsibilities of organisations) and how organisations view the future of packaging, sustainability, and sustainable packaging. Subsequently, answers were compared and differences and similarities between the responses were analysed.

The exploratory interviews were tailored to the type of organisation of the participants, of which the different questions can be found in Sections A.1.1 and A.1.2. Questions were posed in a semi-structured manner, following the orderliness of the list and depending on the progression of the interviews.

A.1.1 Main questions

The following questions were posed to all participants. The questions are divided into themes and were posed according to the structure as listed below.

Organisation profile and function

- Could you briefly introduce yourself and your organisation?
    - What organisation do you work for and in which position?
    - How long have you worked at this organisation?
    - How long have you been in this position?
    - What is the size of your organisation?
    - How would you describe the organisation its profile and its tasks?
    - How would you describe your job profile and tasks?
- Could you briefly elaborate on your background, which or what kind of organisations you have worked for, and for how long?

Organisation and supply chain position

- What is your role within the food packaging supply chain as an organisation?
- Which parties within the food packaging supply chain does your organisation deal with and what do those relationships look like? Who do you depend on and in what ways?
    - E.g., they supply goods, we supply goods, they determine what we supply, etc.
    - Would you say there is a mutual exchange in services, or would you define it as something different?
    - How do you experience their influence on choices in packaging material(s) and design?
- Which or what type of supermarkets does your organisation have a relationship with? What do those relationships look like?
    - What kind of services do you perform for supermarkets, how do they come about and vice versa?
    - What kind of information do you need to provide and vice versa?
    - Would you speak of a mutual exchange in services, or would you define it as something different?
- How do you experience the influence of supermarkets on the choices in packaging materials and design?

Packaging and sustainability

- What is the definition of 'sustainability' that your organisation applies?
- In what ways does your organisation engage in sustainability?
- What motivates you and your organisation to work on sustainability and why?
- How does this translate to the products and or service(s) you deliver? What is involved and what is important?
- What are sustainable packaging solutions according to you and/or your organisation?
- How do you and your organisation experience the importance of sustainable packaging solutions?
- Does your organisation want to apply, adopt, produce, or design sustainable packaging solutions? Why and to what extent?
    - E.g., recycling or reuse, but also moving away from packaging completely and rethinking of the current food system and current packaging solutions.
    - Does your organisation already do this? Why or why not?
- What are the obstacles you face in switching to sustainable packaging solutions?
    - What role do you play in this as an organisation? Who do you depend on?
    - What role does the supermarket play in this?
    - What role do other stakeholders of the chain play in this?
    - Are there any specific packaging requirements or trends in the food industry that you find challenging, especially when considering sustainability?
- What are the opportunities and possibilities you encounter or see in switching to sustainable packaging solutions?
    - What role can you play in this as an organisation?
    - What role does the supermarket play in this?
    - What role do other stakeholders of the chain play in this?

- How do you collaborate with supermarkets or other stakeholders to produce, design, adopt or implement more sustainable packaging solutions?
- Are there any revolutionary emerging technologies, materials or trends (food-wise, but also socially or technologically, etc.) which you think could have a major impact on sustainable packaging solutions?
- What do you think is necessary to fully commit to sustainable packaging solutions?
    - Who can facilitate that? How do we get there?
    - What can your organisation contribute to that?
    - What can a supermarket contribute to that?
- How do you think supermarkets can cooperate with your type of organisation to achieve sustainable packaging solutions?
    - In what way could supermarkets support your efforts towards sustainable packaging solutions?
- What do you think about the statement “supermarkets have a monopoly”?
- Are there any topics that weren’t covered during the interview that you think are important to touch upon? If so, which ones?

A.1.2 Organisation-specific questions

During the interviews, some participants were asked several questions specific to their organisation. These questions can be found below, according to their corresponding organisations. Furthermore, an indication is given of during what topic of discussion the questions were posed, where applicable.

Food production companies (A2, A3)

- Why do you use packaging for your products?
    - Which packaging functions are of importance to your organisation?
    - How does packaging influence the shelf-life and quality of your products?
    - Could the product do without “standard” packaging? For example, in glass pots?
- What is important to your organisation when you produce or purchase packaging or packaging solutions?
- Can you tell me about the different packaging that you use for your products?
    - What materials are used?
    - Is it recyclable/reusable?
    - Do you produce it yourself or do you purchase it? Do you have packaging technologists/specialists/engineers or is it outsourced?

Governing bodies (A8, A10)

No alternative questions were posed to governing bodies that do not correspond to the main questions.

Other organisations (A1, A8)

Organisation profile and function

- Which sorts of projects are you involved in?
- Why is your organisation concerned with the supermarket of the future?
- Which themes are you engaging in within the supermarket of the future?
    - Are you looking at themes such as technology? Nutrition? Consumers? In-store? Logistics? Food supply chain?
    - What do these themes translate to?
- How do you envision the supermarket of the future?
- Which trends and developments will influence the supermarket of the future?

Organisation and supply chain position

- Which organisations are you involved with in the food supply chain, and what do these relationships look like? Who do you depend on and in what ways?
- With which or what
- Why do these relations exist?

Packaging production / retail companies (A11)

Packaging and sustainability:

- Could you elaborate on the different packaging you produce or design?
- What is important to your organisation when you produce or purchase packaging or packaging solutions?
    - Can you tell me more about the interaction and what is necessary to get packaging to supermarkets?
- Does your organisation want to apply, adopt, produce, or design sustainable packaging solutions? Why and to what extent?
    - E.g., recycling or reuse, but also moving away from packaging completely and rethinking the current food system and current packaging solutions.
    - Does your organisation already do this? Why or why not?

Supermarket chains / retail organisations (A4, A6, A7)

Instead of supermarkets, supermarket chains and retail organisations are questioned on their relations. For example, instead of asking what the influence of a supermarket is, it is questioned what the influence of their relations is. The following questions were established solely for supermarket chains and retail organisations:

Organisation and supply chain position:

- How do you choose which products are included in your product offer?
    - What influence do stakeholders have on your product offer?
    - Are some products or brands preferred or prioritised?
    - Which criteria must products/product suppliers meet?
    - What is the influence of consumer demand on your product offer?
    - What is the influence of trends on your product offer?

Packaging and sustainability:

- Why do you use packaging for your products?
    - What packaging functions are of importance to you as an organisation?
    - How does packaging influence the shelf life and quality of your products?
    - Could the packaging be altered or left out completely?
- What is of importance when your organisation purchases or outsources the production of packaging or packaging solutions?

Waste management companies (A5)

Organisation and supply chain position:

- How do you collaborate with stakeholders to process or manage waste?

Packaging and sustainability:

- What types of waste do you process or manage?
- How much waste do you process or handle per year?
- How much of that waste is food packaging waste?
- What is of importance to your organisation when processing or handling packaging or packaging solutions?

The questions on sustainable packaging solutions are altered to align with the function of waste management companies, which is to process or handle waste.

A.2 Participants

To acquire participants, individuals were approached via mail and LinkedIn using contact information obtained through a personal network. The participants of exploratory interviews had to meet the following requirements:

> The participant is employed by an organisation that is part of the food packaging supply chain in the Netherlands as previously depicted in Section 3.2 (Figure 8, page **Fout! Bladwijzer niet gedefinieerd.**) **OR**
>
> The participant is employed by an organisation that influences the design of food packaging or the configuration or processes of the food packaging supply chain (e.g., consultancy, governmental body) **AND**
>
> The participant must possess a basic knowledge level of the processes, packaging and operations within the food packaging supply chain and subsequently has worked or still works with these aspects **AND**
>
> The participant must possess sufficient knowledge of their employing organisation and its processes, products and/or services.

Ultimately, eleven individuals participated in the exploratory interviews. Information on the participants can be found in Table 10. The eleven interviews lasted between 45 and 90 minutes.

Participant	Role	Role experience (years)	Type of Organisation	Size of Organisation [212]	Topic-related industry experience (years)
E1	Owner	5 - 10	Packaging Consultancy	Micro	5 - 10
E2	Product Manager	0 – 2	Food Production	Medium	10 – 20
E3	Packaging Technician	0 – 2	Food Production	Large	2 – 5
E4	Quality & Sustainability Manager	5 – 10	Food Retail	Large	5 – 10
E5	Product Manager	2 – 5	Waste Management	Large	5 – 10
E6	Sustainability Manager	0 – 2	Food Retail	Large	10 – 20
E7	Quality Manager	10 - 20	Food Retail	Large	10 – 20
E8	Project Manager	2 – 5	Research & Development	Small	5 - 10
E9	Project Manager	5 – 10	Municipality	Large	5 - 10
E10	Policy Officer Sustainability	2 – 5	Ministry	Large	2 - 5
E11	Sustainability Advisor	0 – 2	Packaging Production	Large	5 - 10

Table 10: Additional information on interviewees.

Appendix B: Scenarios

The four scenarios described in Chapter 6 can be found in this appendix. The scenarios are divided into two sections: the first section describes the macro-environment, and the second section describes the micro-environment. The scenarios that have been used during the workshops are in Dutch. A brief summary of each of the four scenarios is given in English.

B.1 Scenario A (Local x Environmental Awareness)

Food production in the Netherlands has been organised locally to ensure self-reliance as a result of extreme weather and flooding in Europe, which had caused a strain on the national food supply. The societal awareness of climate change and sustainability is high, and policy measures are focussed on climate change mitigation and adaptation. The Dutch food supply system has been entirely localised to guarantee independence and self-reliance. Citizens have spread across the country and live in self-sustaining communities, which each has a single supermarket that sources their product offer from within a 50-kilometre radius. Supermarkets are equipped with cultivation areas where customers can directly harvest fresh vegetables, fruits and herbs through subscription-based business models. Dutch food production has significantly increased in efficiency and yields harvests superior to traditional food production methods as a result of strong national investment in green technologies such as vertical farming and hydroponics, which is supported by automated systems and advanced data analytics.

Scenario A (macro): een lokaal en milieubewust Nederland

Een aantal jaren geleden vond er in West-Europa extreme neerslag plaats waardoor veel gebieden met overstromingen kampten. De massale wateroverlast zorgde ervoor dat een groot deel van de Europese en Nederlandse voedselproductie mislukte. Als gevolg kwam er een grote druk te staan op de nationale voedselvoorziening, en als een van de grootste landbouwexporteurs ter wereld had de Nederlandse economie het zwaar te verduren. De overstromingen en de gevolgen ervan dienden als wake-up call voor politiek en burger.

Politiek is het Nederlandse beleid sterk ingericht op duurzaamheid en klimaatadaptatie. Subsidies en belastingvoordelen stimuleren groene en circulaire initiatieven, en boetes en regelgeving dwingen achterblijvers om te verduurzamen.

Om te voldoen aan de groeiende vraag naar duurzame producten, minder afhankelijk te zijn van buitenaf en zelfredzaamheid te garanderen komt de Nederlandse voedselvoorziening tegenwoordig volledig van eigen bodem. De voedselproductie is lokaal ingericht om overbelasting van (natuurlijke) gebieden en afhankelijkheid van één bron te voorkomen. Met dezelfde reden zijn burgers meer verspreid over het land gaan wonen in kleinere gemeenschappen. Men komt en doet veel samen en als gevolg hiervan voelt men zich sterker verbonden met de medemens.

Om voldoende en een consistente voedselvoorziening te garanderen heeft Nederland flink geïnvesteerd in groene technologieën en energie waardoor klimaat robuuste voedselproductie mogelijk werd. Zo wordt er gebruikgemaakt van productiemethoden zoals vertical farming, agroforestry, hydro- en aquaponics. Deze methoden worden versterkt door het gebruik van geautomatiseerde systemen en data om een grotere efficiëntie te behalen dan van nature mogelijk zou zijn. Op deze manier kan er binnen de natuurlijke grenzen worden voldaan aan de grote vraag

aan voedsel. The daily food demand can be met with great accuracy while customers can view real-time data on inventory and environmental impact of a product.

Scenario A (micro): de lokale en milieubewuste supermarkt

Ook de supermarkt heeft zich moeten aanpassen aan de herinrichting van het land. Zo hebben ze zich net als hun klanten verspreid over het hele land: elke gemeenschap beschikt over een supermarkt. Het grootste deel van het assortiment komt van boeren en producenten binnen een straal van 50 kilometer, wat de lokale economie ondersteunt en transportafstanden sterk vermindert.

De supermarkt groeit ook deels haar eigen producten in grote moestuinen. Verscheidene kruiden, fruitsoorten en groenten kunnen door de klant het hele jaar door in de supermarkt worden geoogst. Klanten van de moestuinen betalen maandelijks of jaarlijks een vast bedrag en krijgen hiermee toegang tot de verste, duurzaamste en gezondste producten. Het gebruik van geautomatiseerde systemen met technieken zoals sensor-gestuurde kweekverlichting zorgen voor een verveelvoudiging van de natuurlijke opbrengst. Verdere technologische ontwikkelingen rondom automatisering en data in combinatie met de korte transportafstanden zorgen ervoor dat er met grote nauwkeurigheid kan worden voldaan aan de wisselende dagelijkse vraag naar producten. Mensen met een abonnement kunnen vanaf hun mobiel gegevens van hun supermarkt en producten inzien, zoals de beschikbare voorraad op locatie, de milieu-impact en de levenscyclus van een product. Dit draagt bij aan de transparantie die door politiek en burger tegenwoordig wordt geëist.

B.2 Scenario B (International x Environmental Awareness)

The growing impact of climate change has heightened societal awareness of unsustainable practices. As a result, consumers, businesses and policymakers prioritise sustainability in their decisions. Dutch and European policies prioritise sustainability by stimulating green and circular initiatives through subsidies and penalties for lagging parties. Investments in technology have driven breakthroughs in energy efficiency and sustainability. Meanwhile, global food systems are being restructured to minimise ecological footprints while remaining globally interconnected.

Customisable meal boxes, which contain processed foodstuffs, are nowadays our main source of food. The meal boxes are produced daily in supermarkets, and data exchange between supermarkets and customers enables the synchronisation of demand and supply while enabling delivery and pick-up opportunities with automated systems for efficiency.

Physical supermarkets have evolved into experiential hubs, which offer in-dining experiences in automated and robotised restaurants. Moreover, consumers can learn about sustainability, the food system and food technologies in immersive exhibits. This transformation aligns with consumer demands for transparency.

Scenario B (macro): een internationaal en milieubewust Nederland

De grootte en toenemende impact van klimaateffecten hebben ervoor gezorgd dat de maatschappij zich bewuster is geworden van haar eigen impact. Men ziet nu in dat de processen en activiteiten die we voorheen toepasten niet kunnen worden voortgezet. Als gevolg van dat bewustzijn zijn milieu en duurzaamheid de zwaarstwegende factoren in alle overwegingen die door consumenten, bedrijven en de politiek worden gemaakt. Zo wordt er in het Nederlandse en Europese beleid sterk gefocust op

duurzaamheid: groene en circulaire initiatieven worden met subsidies en belastingvoordelen gestimuleerd, terwijl achterblijvers worden gedwongen om zich te verduurzamen door middel van financiële heffingen en regelgeving. Ook consumenten willen beslissingen maken op basis van duurzaamheid, en verwachten daarom dat de industrie en de overheid transparant zijn.

Om de door de Europese Unie en Nederland haar gestelde doelen en eisen op het gebied van verduurzaming te halen, is er flink geïnvesteerd in de technologische sector. Zo zijn er verschillende doorbraken geweest in de energiesector waardoor energie met minimale impact, slim en efficiënt kan worden opgewekt, verbruikt, en opgeslagen.

Doordat het voedselsysteem voorheen voornamelijk globaal opereerde en het ecologisch en economisch te veel impact zou hebben om dit systeem naar een lokaal niveau te brengen, opereert het gros van de voedselindustrie nog steeds internationaal en op globaal niveau. Nederland is bijvoorbeeld nog altijd een grote exporteur van landbouwproducten. Alle internationaal opererende systemen zijn wel dusdanig aangepakt dat ze een minimale ecologische afdruk achterlaten, of zelfs gebruik maken van afvalstoffen.

Scenario B (micro): een internationale en milieubewuste supermarkt

Al ons eten kopen we tegenwoordig in de vorm van maaltijdboxen die aan de hand van modules zijn samen te stellen. Alle ingrediënten zijn voorgesneden en voorgegaard, en voor de gemaksconsument zijn hele maaltijden zelfs van tevoren klaargemaakt. Maaltijden zijn binnen de kortste keren klaar met het gebruik van een smart oven die het eten na herkenning op de juiste manier voorbereidt. Gerechten zijn met kruiden en uitbreidingsmodulen aan te passen naar eigen smaak. De maaltijdpakketten worden dagelijks samengesteld in de supermarkt. Vraag vanuit de klant en het aanbod vanuit retailers worden aan de hand van data non-stop geüpdatet, en de partijen kunnen dit via een digitaal platform van elkaar inzien. Op dit digitale platform kunnen klanten hun wensen en keuzes ook aangeven, evenals de bezorg- en/of eventuele afhaalmomenten. Bij het afhalen wordt de klant herkend door middel van een persoonlijke digitale sleutel, waarna de bestelling vanuit de koeling binnen enkele minuten bij de klant is.

Omdat de klant niet meer door te winkel hoeft te lopen om alle boodschappen zelf te verzamelen, is het toegankelijke deel van de fysieke winkel opgezet als ervaringscentrum. In de supermarkt kan men nieuwe gerechten uitproberen en elkaar ontmoeten in een restaurantgedeelte waar alles is geautomatiseerd en gerobotiseerd. Bovendien kan men in de supermarkt aan de hand van augmented reality en immersieve exhibities leren over duurzaamheid, de voedselketen, duurzame voeding en voedingstechnologieën. Deze exhibities dragen bij aan de transparantie die door consumenten wordt geëist.

B.3 Scenario C (Decrease in Legislative Measures x Chain Management)

The combination of resource scarcity, international tensions, and large-scale material consumption led to a virgin resource crisis in which material prices rose to unprecedented levels. This compelled governments and industries to innovate and focus on closing material loops. The Dutch government eased regulations and invested in recycling infrastructure, which enabled businesses to develop circular economy practices. Collaboration between industries and research institutions accelerated

technological advancements such as alternative materials and more effective and efficient recycling systems.

The impact of international tensions and growing material prices could be felt in all layers of society, which resulted in a shift in consumption patterns to more circular behaviour. Because of a general increased focus on circular economy, supermarkets embraced their central societal role by establishing collection hubs for packaging waste. Advanced machines efficiently sort any packaging waste in bulk. Consumers are subscribed to supermarkets to be able to deposit packaging waste, and in return receive personalised discounts that can be spent in those supermarkets.

Scenario C (macro): een circulair Nederland met open beleid

Alhoewel materiaalschaarste al langer een probleem was, zorgden de combinatie van toenemende internationale spanningen en grootschalig materiaalverbruik voor een nieuwe grondstofcrisis. Primaire grondstoffen zoals zeldzame metalen, aardolie en agrarische producten werden minder gedolven en verhandeld vanwege verstoringen in productie en opgelegde economische sancties als gevolg van internationale conflicten. Dit leidde tot ongekend hoge materiaalprijzen waardoor landen en verschillende industrieën werden gedwongen om creatief te zijn en hun bedrijfsvoering te herzien. In reactie hierop werd er in Europa grootschalig ingezet op ketenbeheer, en ook in Nederland werd er met man en macht gewerkt aan het opzetten, verbeteren en bovenal het sluiten van grondstofkringlopen. Om dit te faciliteren liet de overheid de touwtjes vieren door nauwelijks nieuwe wetgeving voor ketenbeheer te implementeren. Hierdoor kreeg de industrie ondertussen ook de ruimte kreeg om te innoveren. De Nederlandse overheid introduceerde verder versoepeling van reeds bestaande wetgeving en investeerde tegelijkertijd in infrastructuur voor recycling en hergebruik, wat de basis legde voor bedrijven om te werken aan een circulaire economie.

De stimulering van innovatie werd verder bevorderd door nauwe samenwerkingsverbanden tussen de industrie en onderzoeksinstellingen. De samenwerking leidde tot de ontwikkeling van nieuwe technologieën en businessmodellen, en eveneens de voltallige toepassing van alternatieve materialen. Een voorbeeld van zo'n nieuwe technologie is een geavanceerde sensor die in één opslag alle materialen in een product kan identificeren.

De impact van de internationaal oplopende spanningen en stijgende grondstofprijzen was voelbaar in alle lagen van de samenleving. Nederlandse burgers werden zich steeds meer bewust van de economische verschuivingen en pasten hun consumptiepatronen er enigszins op aan. Men hield de portemonnee vooral gesloten en men hield langer vast aan bestaande producten in plaats van nieuwe producten aan te schaffen.

Scenario C (micro): een circulaire en vrije supermarkt

De supermarkt speelde decennialang al een belangrijke rol in de voedings- en levensmiddelenindustrie als centraal punt waar een divers assortiment aan producten te koop was. Daarnaast was het een plek waar vrijwel iedere persoon uit elke hoek van de samenleving eens per week te vinden was. Met de toegenomen focus op een circulaire economie hebben supermarktorganisaties deze centrale rol omarmd door inzamelhubs op te zetten binnen hun winkels. In deze inzamelhubs wordt al het verpakkingsafval van consumenten verzameld.

Het inzamelen van verpakkingsafval gaat ten opzichte van vroeger veel sneller dankzij de nieuwe technologische ontwikkelingen. In plaats van bijvoorbeeld één voor één je flesjes in een statiegeldautomaat te stoppen, kan de consument verpakkingsafval inleveren in een speciale

kunststoffen zak. Een geavanceerde machine leest in een keer af wat voor verpakkingsmaterialen zich in de zak bevinden en sorteert deze direct na ontvangst. De consument sluit een abonnement af bij supermarktorganisaties om afval in te mogen leveren en krijgt hiervoor in ruil gepersonaliseerde kortingen en aanbiedingen voor terug. Deze beloningssystemen dragen actief bij aan de inzameling van afval en versterkten de transitie naar een circulaire economie.

B.4 Scenario D (Increase in Legislative Measures x Chain Management)

Worldwide, countries faced devastating climate effects which disrupted production and transport of raw materials, intensifying the pressure on resources. Combined with stockpiling and consumption as usual, this led to severe resource shortages. The European Union pushed various ambitious targets on sustainability to combat climate effects, resource shortages, and to strengthen their economic position in relation to other global superpowers. To meet these targets, the Dutch government implemented strict legislation focussing on sustainability, public health, and circular economy. Businesses must take full responsibility for the entire life cycle of the products they market, report to government, and are required to be fully transparent to avoid hefty financial penalties. This stimulated technological advancements such as real-time monitoring of material flows and resulted in a large part of the population blindly trusting the safety of products. Meanwhile, there is a part of the population which demands comprehensive information for informed decision-making.

Supermarkets comply with laws through automated hybrid refill and return-on-the-go systems which allow customers to use reusable packaging. Reusable packaging is cleaned and refilled on-site. Self-service kiosk with augmented reality provide personalised shopping experiences, which offer detailed product information tailored to consumer preferences and dietary needs.

Scenario D (macro): een circulair Nederland onder streng toezicht

Over de hele wereld kregen landen steeds meer te maken met de verwoestende gevolgen van verscheidene klimaateffecten zoals aanhoudende overstromingen, langdurige droogte, en krachtige orkanen. Deze klimaateffecten verstoorden de productie en het transport van primaire grondstoffen, wat de druk op deze schaarse producten aanzienlijk vergrootte. In combinatie met het hamstergedrag van landen en ondertussen de voortzetting van de dagelijkse gang van consumptie leidde dit tot een groot tekort aan grondstoffen. Om zowel de klimaateffecten als het grondstoftekort aan te pakken werd er vanuit de Europese Unie sterk aangestuurd op verschillende klimaatakkoorden waarmee ambitieuze doelstellingen moesten worden behaald, waaronder de European Green Deal. Het halen van deze doelstellingen zou de positie ten opzichte van andere continenten en wereldmachten moeten versterken, wat de economie een lift zou geven. Om aan deze doelstellingen te voldoen heeft de Nederlandse overheid strenge wetgeving geïmplementeerd die zich richt op duurzaamheid en het creëren van een goedlopende circulaire economie. Bedrijven worden verplicht om verantwoordelijkheid te nemen voor de volledige levenscyclus van de producten die zij op de markt brengen én verhandelen. Er wordt ook van hen geëist om hier transparant over te zijn. Wanneer producten, of de bedrijven zelf, niet voldoen aan de strenge regelgeving worden bedrijven hier financieel flink voor beboet. Dit stimuleerde de industrie om technieken te ontwikkelen waarmee onder andere real-time monitoring van grondstofstromen en materiaalgebruik mogelijk is.

In het kader van duurzaamheid staat ook de volksgezondheid centraal in de nieuwe wetgeving. Om veilige en gezonde producten te garanderen, wordt er streng gecontroleerd op productsamenstelling,

materiaalgebruik en verschafte productinformatie. Bedrijven moeten bovendien gedetailleerde rapportages publiceren. Door deze ontwikkelingen is er een groot deel van de bevolking die blindelings vertrouwt op de veiligheid van producten die op de markt worden aangeboden. Ondertussen is er ook een sceptisch deel van de bevolking die om uitgebreide informatie vraagt waarmee ze weloverwogen keuzes kunnen maken.

Scenario D (micro): een circulaire supermarkt onder streng toezicht

Ook supermarkten moesten geloven aan de strenge wetgeving rondom duurzaamheid en circulaire economie, maar ook wetgeving rondom veiligheid en gezondheid. Vooralsnog hebben supermarktorganisaties een goede balans gevonden met de implementatie van geautomatiseerde hybride refill- en return on-the-go systemen.

Klanten doen hun boodschappen door een bestelling samen te stellen en te plaatsen aan een interactieve, selfservice kiosk. De boodschappen worden door een geautomatiseerd systeem bij elkaar gezocht en gebundeld. Klanten nemen hiervoor hun eigen verpakkingen mee, die bij het inleveren in de supermarkt worden schoongemaakt in speciale in-house spoelstations. Na reiniging van de verpakkingen worden ze automatisch naar de juiste vulstations gestuurd waar ze worden gevuld met producten die bij de kiosk worden gekozen door de klant. De boodschappen kunnen binnen een mum van tijd door de klant worden meegenomen naar huis.

De selfservice kiosken zijn uitgerust met Augmented Reality technologie voor een gepersonaliseerde winkelervaring. Klanten kunnen uitgebreide productinformatie vinden welke kan worden afgestemd op hun persoonlijke voorkeuren, dieetwensen en interesses.

B.5 Discussion and recommendations

Scenarios that are built on driving forces are tools that attempt to provide certainty in situations …

Er zijn veel verschillende manieren om scenario's te maken, waarvan ik er een aantal heb geprobeerd en uiteindelijk met een methode aan de haal ben gegaan. Er zijn zoveel verschillende insteken die je kan nemen.

It is recommended to have parties engage in the development of scenarios on their own. It is hypothesised this allows parties to actively challenge the short-term vision and tunnel visioning they often face.

- Scenario's zijn een middel om een zekere zin aan zekerheid te geven aan de toekomst, en dat te gebruiken voor beslissingen die je in het heden wil maken, bijvoorbeeld als je aan de voorgrond van een transitie staat. Je bent niet verplicht om vooraf een trendanalyse te verrichten en deze trends te gebruiken als basis voor je scenario's. Je kan ook invulling aan de toekomst geven door simpelweg wat te verzinnen. Het probleem hiermee is dat je onzekerheid in stand houdt, want het is vaak iets ongegronder – alhoewel het wel op persoonlijke ervaring gebouwd kan zijn.
- Ik heb de scenario's nu gebaseerd op een heel erg uitgebreide trend analyse en dus een veelomvattende trend matrix. Dat is echter absoluut niet nodig om scenario's te kunnen gebruiken. Je kan scenario's ook toepassen op puur expert-kennis. Echter is het wel zo dat hoe meer je zo'n trend analyse breed uit zet, des te meer de kans is dat je in aanraking komt met nieuwe perspectieven.

The scenarios were constructed by first conducting an extensive trend analysis. The author emphasises that it is not a requirement to conduct (extensive) trend analyses. Scenarios can be created purely based on experiential knowledge or brainstorming techniques, and so forth. When done in group settings, this may add additional value to the trend analysis through discussion and collaboration, broadening the perspectives, which subsequently may provide new insights or lead to more radical or relevant ideas. However, a trend analysis, when employed broadly, may also

Scenarios

- Het zou verder kunnen worden onderzocht welke varianten van scenario's bijdragen aan het verbreden en vergroten van perspectieven, om te kijken welk soort scenario het meest effectief daarin is.
- All futures are thinkable, worth to consider, and isolated focus on a future should be avoided.

Appendix C: Workshops

The following appendix discusses some of the relevant components of the workshops. For instance, it elaborates how the questions for the workshops were established as well as the workspace format utilised during the workshop sessions. Furthermore, the workspace formats are shown and information is provided on the questions that were posed during the follow-up, and in what manner.

C.1 Workshop questions

- Hoe zijn de vragen opgezet?
    - Nadenken over wat belangrijke vragen zouden zijn
    -

C.2 Workspace format

As discussed in Section 7.2, the workshops were hosted on a digital open-access platform called Miro [213]. A workspace was established prior to and subsequently used during the workshops to support participants during the review of the scenarios. Furthermore, the workspace allowed the capture of the workshop results. Depending on the number of participants during a workshop, either a two-person or three-person format was used. The only difference between the two formats is the number of participants thus also the number of toolsets.

Prior to the workshops,

- Hoe is deze opgezet?
    - Nadenken over wat belangrijke vragen zouden zijn
    - Rangschikken van vragen (wat is het doel?)
        - Opbouwen naar evaluatie scenario
        - Dus eerst in kleine stappen: wat voor effect globaal? En op je organisatie? En op duurzame verpakkingsoplossingen?
        - Tijdsbestek?
        - Belemmeringen?
        - Kansen?
        - Wat is je reactie?
    - Ruimte geven om los te gaan
    - Sommige vragen duidelijk open, want wil kijken naar de antwoorden en vergelijken hoe ze verschillen, vooral open hun reactie, niet beïnvloeden
    - Bij sommige vragen wil ik puur bv. rangschikking zodat ik het heel snel met elkaar kan vergelijken
    - Maar vraag vaak nog wel om uitleg want ik wil wel de reden erachter weten; zodat het niet voor mij als onderzoeker open voor interpretatie blijft.
- Mensen kregen van tevoren al een kleur aangewezen, waarbij ze moesten invullen in de blokken met hun aangewezen kleur:
    - Wie ze waren (naam)
    - Wat hun functie was
    - Met welke verpakkingen hun organisatie te maken had
    - En een korte omschrijving van hun bedrijf
- Zo geraakten ze al een beetje wegwijs met Miro, wisten ze met welke kleur ze te maken hadden – en dat scheelde tijd tijdens de workshop (want hoefde dat niet meer uit te leggen).

Workspace format (2-persons)

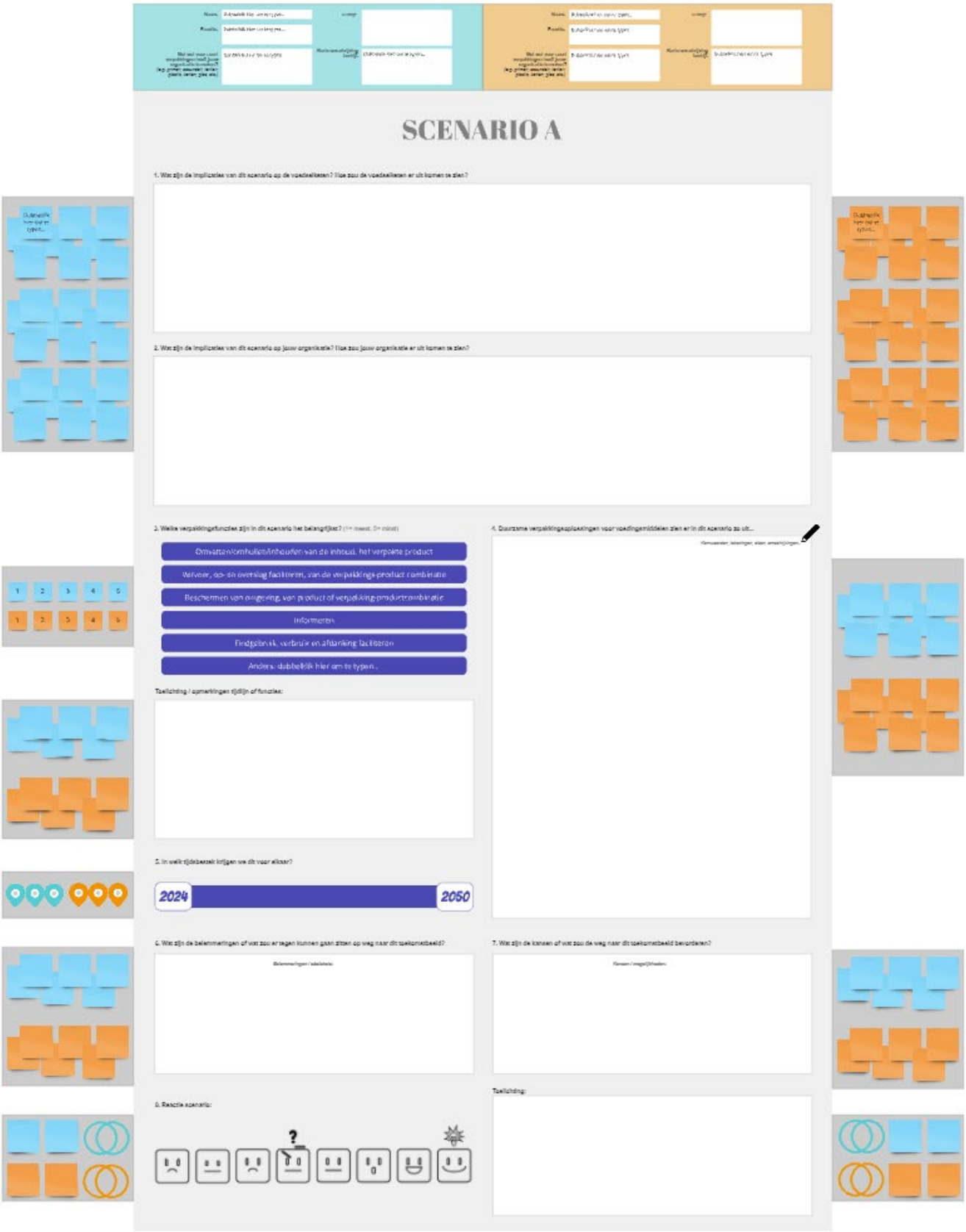


Figure 23: The workspace format used during workshops with two participants.

Workspace format (3-persons)

Figure 24: The workpace format utilised during workshops with three participants.

Alternative workshop and workspace format

As mentioned in 7.2 Structure of the workshops, the alternative workshops with participants W16 and W17 differed from the original workshops as these participants were only available for half an hour and were employed by the same organisation. Similarly, the workspace format also differed.

The workshop differed in the sense that there were no other participants from different organisations with which the two discussed input that was generated during the workshops. However, the two

participants still answered the questions separately and afterwards still discussed the individual answers. Furthermore, only questions 5 to 8 were covered (Table 6, page 55), instead of all eight questions. Additionally, instead of answering the questions per scenario, all scenarios were covered simultaneously. Finally, instead of a regular follow-up as discussed in 7.3.2 Follow-up and D.3 Follow-up questions, the participants were asked to indicate how radical, plausible and relevant they found the scenarios during the workshop itself. Following the workshop, which lasted about 25 minutes, 10 minutes were taken to discuss what they had found of the workshops and the scenarios in general.

Figure 25: The alternative workspace format used during one of the workshops.

C.3 Follow-up questions

All participants were sent the same follow-up via Google Forms, in which they received the same set of questions. All questions were mandatory. Some questions were open questions and others were either a check-box grid in which they could tick multiple boxes or multiple choice in which only one answer could be given.

Questions

GENERAL

Who are you?

Short answer text …

Which scenarios did you work with?

Option 1: Scenario A & B:

Option 2: Scenario C & D:

SCENARIO-RELATED QUESTIONS

How radical did you find the scenarios that you worked with? Indicate what is applicable per scenario.

	Not radical at all	*Not radical*	*Neutrally radical*	*Radical*	*Incredibly radical*
Scenario A	☐	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐	☐
Scenario D	☐	☐	☐	☐	☐

How plausible did you find the scenarios that you worked with? Indicate what is applicable per scenario.

	Not plausible at all	*Not plausible*	*Neutrally plausible*	*Plausible*	*Incredibly plausible*
Scenario A	☐	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐	☐
Scenario D	☐	☐	☐	☐	☐

How relevant did you find the scenarios that you worked with? Check what applies to you.

	Not relevant at all	*Not relevant*	*Neutrally relevant*	*Relevant*	*Incredibly relevant*
Scenario A	☐	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐	☐
Scenario D	☐	☐	☐	☐	☐

Did you discuss the scenarios and/or workshops with colleagues afterwards?

Option 1: Yes, the scenarios

Option 2: Yes, the workshop

Option 3: Yes, both

Option 4: No

Option 5: No, but I will

Option 6: Other: [type own answer]

How did reading the scenarios affect you?

Long text answer…

Have you come across any new insights or ideas since the workshop? Check what applies to you.

☐	Yes, because of the scenarios
☐	Yes, because of the workshop
☐	Yes, because of discussion with colleagues
☐	No, I did not get any new insights or ideas
☐	Other: [type own answer]

What new insights or ideas did you gain?

Long text answer…

How do you think the scenarios could help you and/or your company/organisation?

Long text answer...

WORKSHOP-RELATED QUESTIONS

What did you think of the workshop, the process and the content of the workshop?

Long text answer…

Did the workshop meet your expectations? Why or why not?

Long text answer…

What did you find the most and least valuable about the workshop?

Long text answer…

Do you have any other remarks about the workshop?

Long text answer…

CLOSURE

Is there anything else that has not been covered but you would like to share or ask?

Long text answer…