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# Preface

This is the final report written in the light of the academic course “Engineering for Sustainable Development”, TU Delft. The assignment for this course is to perform a backcasting assignment on a desired, to be developed sustainable future; in this case in relation to packaging waste in day-to-day products distributed by the supermarkets.

The report documents the way the students involved designed a possible route towards a sustainable future in relation to packaging waste caused by day-to-day food consumption. The structure of the report is based on the five-step backcasting method as described by Quist (2013). The report is written to provide the teacher insight in the lessons learned by the students in order to grade them on their capacity in achieving the learning goals set for the course.

At this stage the group owes many thanks to Udo Pesch for his valuable feedback on the handed in concept and lessons learned from this. Also, the group would like to thank Bertien Broekhans and Eefje Cuppen for their dedication and organisation of the course. Furthermore, we would like to thank our stakeholder experts, Cathrien Ruoff and Roel van Raak, for their feedback and thoughts on the matter.

*Delft, May 18th 2014*

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# 1 Abstract

This report presents an overview of the waste management system in the present and in the future. The focus and scope of this study is addressing the unsustainabilities of the current waste management system with respect to packaging wastes. The problem in today's system is that energy from waste is being produced in an unsustainable manner and the material loop is not closed resulting in significant accumulated wastes polluting the environment. Subsequently, the importance of various stakeholders is addressed and the influence they are going to have on the future waste management system is discussed. The suggested future system consists of closed material loops that reduce the need for packaging and uses more recyclable materials. The changeover is expected to be complete by the year 2065. Backcasting analysis is employed to define the pathway and the intermediate goals to be met in order to realise the future vision. The challenges are expected to be related to technology, culture/behaviour and rules & regulations. The viability of the future system is discussed with people having expertise and insights on the future of waste management system and suitable changes are made to ensure the attainment of the target within the aforementioned time frame. A six step action agenda is formulated as the first step towards a sustainable waste management system.

**Keywords:** Waste management; Back-casting; Sustainability; Packaging materials

## 2 Introduction

This is the final report of the materials group that takes part in the course “engineering for sustainable development”. The course aims at letting the student experience the complexity, tensions and dilemmas that come with sustainability, having them consider their role as an engineer in relation to this and to have them interdisciplinary analyse and design a pathway towards a sustainable future on a subject of choice. This report finds its main function in providing the tutors with insight on the lessons learned by the students during the course.

### Focus and scope

The focus of the materials group for this report are the unsustainabilities (waste) in day-to-day packaging used and produced in order to transport food from the producer to the customer. In relation to this the main question answered in the report is “what would a future sustainable supply chain in the food industries’ packaging used look like and how can this be achieved?” The focus in this report is on the products distributed currently by the supermarkets within the Dutch urban context. The report describes a desirable future connected to the related unsustainabilities, in a societal as well as technical perspective. By using the backcasting method described by Quist a possible road towards that desired future is elaborated upon. The backcasting method consists of five steps (Quist, 2013):

- A. Strategic problem orientation
- B. Develop sustainable future visions
- C. Backcasting analysis
- D. Elaboration and defining follow-up agenda
- E. Embedding of action agenda and stimulating follow-up

Every step will be elaborated upon in a separate chapter, starting with the strategic problem orientation in chapter two. The conclusion in chapter six will draw general conclusions on the main research question as mentioned above.

### 3 Strategic Problem Orientation

This chapter aims at defining the current unsustainabilities (waste) in day-to-day packaging used and produced in order to transport food from the producer to the customer. Both the technological and the societal problems will be described. This chapter serves as a basis for the following steps in the backcasting method in a way that it defines the problem to be solved during the steps. The next chapter will define a desirable future in relation to the unsustainabilities and surrounding problems described in this chapter.

#### Problem

Two of the main challenges of our age lie in developing ways to produce energy in sustainable manners and finding a way to close material loops. Finding a solution to the aforementioned problems translates into being able to meet the need of the present without compromising the ability of future generations to meet their own needs, referring to the Brundtland definition of sustainable development (World Commission on Environment and Development, 1987).

Day to day packaging mostly concerns the materials part of sustainable development. In 2008 a total generation of post-consumer plastic waste in EU-27, Norway and Switzerland was 24.9 Mt. Packaging is by far the largest contributor to plastic waste at 63% (Bio Intelligence Service, 2011). Per capita this results in 30.6 kg a year.

There are several end-of-life options to deal with plastic waste, including recycling, disposal and incineration. In 2008 the recycling rate of plastic packaging was only 21.3%, leaving 78.7% to incineration and disposal (Bio Intelligence Service, 2011). Incineration and disposal lead to losses of material what seems to compromise the ability of future generations to meet their packaging need when using the same materials.

#### Packaging

The need for packaging results from the need for fresh food every living person has. It helps producers of food to bring their product in a clean and safe environment from production or harvesting (via several jobbers) to its customers. However, when the product is delivered and consumed there is no use to the packaging anymore and it is disposed of by the customer. The need for fresh food cannot be replaced by something else. The way in which the food will be brought to the customer can be. Several products in the supermarkets are packaged in packaging that is recycled or reused in large amounts. Think of beer bottles that are collected again by the supermarket or glass packaging collected at other points and to a high degree are being recycled.

In the beer bottle example the responsibility of reuse / recycling stays with the producer / supermarket. The group responsible for this report holds the opinion that by extending the responsibility of the producer or supermarket on recycling or reusing the packaging of products a major contribution could be made in relation to diminishing the amount of plastic waste generated in the EU. This is in line with the EU directive on producer responsibility (Tojo & van Rossem, 2007). By rethinking the material flow and the costs involved this even might bring profits to the producers / supermarkets. However, some changes need to be made in the supply chain. The vision shares the opinion that a solution to these unsustainabilities might be on the local / regional scale by reorganising supply of food on a local and regional scale, incorporating the handling and reusing / recycling of the packaging used.

A reorganisation of the supply chain involves several stakeholders that all have their demands, interests and desires. Thereby a change in technologies is also inevitable due to the fact that the recycling technology is not in place yet. The solution should take into account the demand side in relation to the products (customers) and the supply (suppliers) side in order to become successful. In defining a solution and the road towards this these are of major importance.

## Stakeholder Analysis

The major stakeholders in this chain are the consumers, producers of agro goods – farmers, milkman etc., producers of branded goods, manufacturers of packaging materials, recycling plant, provider of logistics and supermarket which forms the hub linking all the stakeholders together. Some of the external stakeholders are national government, local municipality and incinerator/landfill operators.

### Importance of stakeholder

Influence of stakeholder	Unknown	Little/No importance	Some importance	Significant importance	
	Significant influence	-	-	National Government	Supermarket
	Somewhat influential	-	-	Local Municipality	Producers of branded goods
	Little/no influence	-	Producers of packaging	Producers of agro products	Consumers (people)
	Unknown	Incinerators Landfills	-	Providers of logistics	Recycling units

Table 1: importance influence graph (DEPI, 2013), adapted

## Current scenario and stakeholders views

The current waste management scenario is a combination of incineration, landfills and recycling. In the Netherlands the waste generated is about 113.7 million tonnes, of which 37% is treated on land, 59% is incinerated and 4 % is deposited in landfills (Bio Intelligence Service, 2011). The supermarkets in today's scenario are a collection point for reusable glass bottles, which are sent back to the manufacturers. They are also engaged in collection of plastic PET bottles, which are sent to the recycling units to manufacture recycled plastics. The suppliers of packaging produce non-recyclable plastic, which is the cheapest by cost and hence in demand (Das, 2010). The producers of goods engage in minimal waste management, except in case of glass bottles, which they receive from the supermarkets. These bottles are cleaned, refilled and sent back to the consumers. The recycling units are drawn by the profits of recycling glass compared to recycling of plastics due to the higher economic benefits and ease of glass recycling (Spencer, 2013). The incineration plants are setup at a high cost and there are agreements with the government to provide them a steady supply of waste in order to recover and profit from their investment. The government has realised the dangers of future growth of incinerators and there is a focus on improving on the source segregation and recycling of waste.

The most important player wielding the most influence is the supermarket. It forms the hub for all the future operations, their opinion and willingness to shift to a new chain of operations is very critical. At the same time the presence of a state institution like the national government or local municipality is essential to enforce the regulations and allow fair trade practices. The next level of importance is given to the producers of branded goods as they have invested heavily in marketing of their products and might be reluctant to shift to a system, which attaches less importance to the branding. They are expected to play a big role in the design of packaging for the goods. The producers of packaging and agro products wield little influence but are of importance to the system. They are mere producers, delivering goods as per the specifications of their end users. The consumers who buy products from supermarkets are regarded with high importance but they have little influence in the decision making process. The providers of logistic services are very critical to the functioning of the system, so they are very important but their influence is unknown. The influence and importance of landfills and incinerators is undetermined, but their growth is static and expected to decline in the future (Afvall Sverige, 2007) as the world moves towards a sustainable waste management system.

## Conclusion

This chapter focussed on describing the main unsustainabilities in relation to the packaging of day-to-day products distributed by supermarkets. By only looking at the waste produced by the industry the problem seems relevant and it became clear that both society as well as technology are involved in the problems that needs to be solved in order to become sustainable. To achieve this, major reorganisations in the supply chain are needed what poses the question if it is feasible at all. Looking from a different perspective though there might be opportunities in savings to both the customer and supplier by reducing the paid-for waste materials in an effective efficient way. However, this asks for changes in the system as a whole. Various stakeholders involved in the process of waste management are subsequently discussed. Stakeholder analysis is performed to understand the influence and importance of all the aforementioned stakeholders. This analysis plays a critical role in the deciding the future pathway towards waste management, by relating the stakeholder analysis to the views of the stakeholder about the current waste management situation.



## 4 Sustainable Future Vision

In this chapter a more desirable, future waste management system will be envisioned. In stating its various ambitions and objectives, the aim is to describe a future sociotechnical system in which the previously mentioned waste problems have been addressed and solved. This chapter will describe the way the new system would affect daily lives and how it will influence cultural, technical and behavioural aspects.

### A future system

To create a more desirable future, one might start by clearly stating a number of ambitions for the more sustainable recycling and waste management programme of the future. For that, one can use the ambitions set by the Trias Energetica (Duijvestein, 1993) or the Ladder by Lansink (Geels & Kemp, 2007) and adapt them for material and waste streams; it would end up to be similar to a kind of Trias Materialis, as formulated by Wouters and Bol (2009) and consist of the following aims:

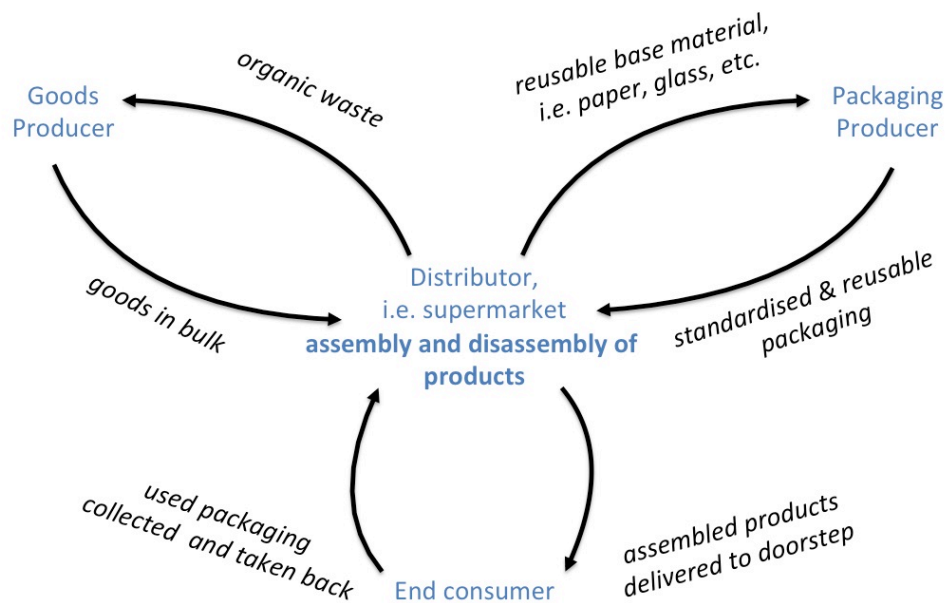
1. To reduce the need of packaging
2. To use recyclable and renewable materials for packaging
3. To use less recyclable, for example oil derivatives, packaging more efficiently

Consequently, the ambitions can be translated into desirable and implementable measures to achieve said goals. These are some ways one can achieve the mentioned aims, the following are stated per measurable point and addressing the previously described problems. One could:

1. Reduce packaging intervals between the goods producer and the end consumer; decreasing the amount of package fabrication and storage at both ends of the supply chain.
2. Introduce more standardised packaging for easier and more varied reuse; reducing the amount of specialised, brand specific packaging production and collection.
3. Close the chain of packaging distribution by collecting packaging at the end consumer; reusing the empty delivery vans to pick up waste and thus return the discarded packaging to supply chain.

From this, a future scenario for a different kind of goods and package distribution can be formulated that addresses those goals. A more desirable future would not make the *end consumer* or the *city council* responsible for waste management and recycling, but the *distributor* who brought the goods in the first place. By using the existing infrastructure of centralised distribution of for example supermarkets, the current system of separate waste collection could be integrated within the pre-existing delivery system. Since current retail strategies foresee evermore tailor-made deliveries at home (Amazon, 2014a; Best Buy, 2013), it would be wise to integrate those movements within the grander scheme of waste management, thus hopefully providing double benefits:

- A stabilisation of the number of delivery and collection movements; the increase of delivery moments is compensated by the reduction or abolition of separate collection movements.
- The benefit of reintroducing reusable and recyclable packaging at the core of assembly and distribution; decreasing the risk of contamination or unnecessary destruction of packaging.



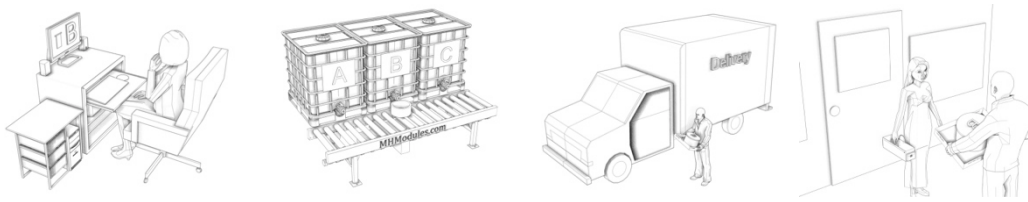
**Figure 1:** ; Scheme of the proposed supply chain of goods (own illustration)

By adopting a closed loop system for the distribution of goods and its packaging one can reduce, or perhaps fully absorb, the amount of waste. In making the distributor, i.e. the Dutch supermarket, responsible for both the distribution and the collection of packaging, a single stakeholder would become accountable for the entire packaging waste stream. In doing so, it would hopefully provide an incentive for reducing the amount of waste and for increasing the reusability of packaging. As illustrated above, such a system would consist of a distributor acting as an assembly, distribution and collection hub, controlling all facets of the packaging waste stream. Standardization and recyclability of packaging would become in the interest of the supermarket, as would the combination of delivery and collection voyages. Anticipating the mentioned increase in online ordering of daily groceries, this system could significantly reduce the amount of packaging ‘moments’: Bulk delivery of goods to the distributor allows larger or even no goods-specific containers to be used for transport; assembly at the hub could allow consumer oriented and standardized packaging, further increasing the reusability of containers. Branding and its specific casing could be reduced to a mere virtual and online existence.

## A picture of life

Such a system would however demand a rethinking and reorganising of packaging streams. By making the distributor responsible for assembly, a supermarket would for instance need the capacity to both store bulk goods and assemble those goods into packaging. The supermarkets centralised distribution points would for example receive milk in large tank trucks and repackage that into standardized milk bottles for home delivery. The new system can only be implemented if assembly of goods is made part of the core business of distribution.

Secondly, end consumers could be faced by an increase in the amount of waste collection at home. The mentioned, foreseen increase of delivery moments could alleviate this necessity by collecting on a more regular basis at home, hopefully reducing the amount of packaging to store for collection. To describe the profound impact such a system change would have on society as a whole, it is perhaps best to envision the sequence of events:



**Figure 2:** Sequence of events within the new system

online ordering -> filling standard packages -> delivery -> handing over waste (own illustration)

1. *Order online*; end consumers order their daily groceries online, either by themselves or through automated systems based on their spending and/or stocks at home. One could think of 'smart' fridges or cupboards keeping an inventory of the goods at home and taking over the stock management process.
2. *Filling standard packages at the hub*; once the hub, i.e. supermarket, has received the order it continues to assemble the order into standardized and reusable packages. The goods themselves were brought to the hub in bulk packaging that in itself is reusable, but on a grander scale.
3. *Delivery*; using an intricate system of product tracking and electric vans of various sizes, the goods are delivered to the consumer's the doorstep in the most efficient way, at the most convenient time for the consumer.
4. *Handing over waste*; upon delivery of the goods at home, the consumer can hand over the empty packaging ready for reuse en reintegration in the chain. By doing so, the responsibility of the waste collection has been taken over by the deliveryman and the hub he stands for.

## Conclusion

Adopting a closed loop system for the distribution of goods with a supermarket hub at its core could reduce the amount of waste. Making the distributor responsible for both the distribution and the collection of packaging would make a single stakeholder accountable for the entire packaging waste stream, from the farm to the fridge. Such a system would however entail transference of the waste collection responsibility from the local councils to the distributor. A similar transference would occur for the responsibility of goods packaging from the goods producer towards the distribution hub. These transference processes demand far-reaching cultural, technical and behavioural changes. The following chapter will further delve into these matters.

## 5 Pathway

In order to create the future vision, changes have to be made. These changes can be divided into four main focus points (Quist, 2013). The first point will be about the technological changes. In order to create the future vision some technological changes have to be made. The second will be about the changes that have to be made regarding the cultural and behavioural changes. This will explain the changes that have to be made in the (standard) behaviour of the people. The third will be about the relation between the different actors in the production chain. And the last one is about the rules and regulations. Do these have to be changed in order to create the changes in that time period?

For the back casting assignment three periods of change will be described. The first period is the period between 2065 and 2050, the second 2055-2025 and the third 2025- present. For each of these periods the focus points mentioned above will be discussed.

### First period: 2065-2050

During this period the last steps have to be taken. These are only relatively small steps left, as the main changes will be made during the period of 2025 to 2050. The main technological challenge will be the change of the supermarket to a producer of product. During this step the supermarket will receive the products in bulk from the producers and the supermarket will then combine the product with the packaging. This is more of a logistical challenge than a technical challenge, as the technology to reuse packaging and put a new product in already exists. The main challenge during this period will be in the culture of the supermarket. The supermarket will become more of a distribution and production centre than a place people will go in order to get their groceries. Because the supermarket will now receive products directly from the goods producers, no additional distribution centres of manufacturers are needed. This however, can lead towards a single large “supermarket” per city and will be the end of the local supermarkets in the neighbourhoods. In order to keep the supermarkets close to the people the local supermarkets will be the distribution point in the neighbourhood. The ordered products are put into the packages at the local HUB and will then be transported towards the local super market. The consumers have the choice to pick it up themselves or make use of the delivery system, which will deliver their grocery’s at home. So the main goal of this period will be to transfer the supermarket into a central distribution HUB that creates consumer products by joining the packaging and the product.

### Second period: 2055-2025

During the second period the focus will be on the packaging. In order to create more simplified packaging the package has to be standardised. This will be the main technological challenge. This standardized packaging has to be stackable in order to decrease the amount of space used in the house of the consumer. During some interviews on the street about the future vision (see Appendix C) the main reaction was that the consumers didn’t have enough space in their apartment to store all this packaging. In order to solve this problem the packages have to be stackable. Also the different types of packaging must be able to stack on top of each other to reduce the amount of space needed to store the used package. Another change that has to be made in order to reduce the amount of waste created by the packaging is to use a deposit system. When a consumer buys a product, they will pay a small amount of money for the deposit. When he later on returns the used package to the supermarket, they will get their deposit back. As studies have shown the deposit system helps to increase the recycling percentage of a package (Ferrara & Missios, 2005). When the products are bought online and delivered at home the consumer will be able to give the used packages to the delivery guy, who will take them to the supermarket. The standardized packaging has some cultural influences as well. Due to the standardized package, branding will be harder. Also, because the consumer buys its products online he/she will only see the brand on a screen. There will be no possibility to attract a consumer by a nice and attractive package anymore. This will not only influence the consumer who buys the products off a screen instead of a shelf in the super market, but also the producers who will not be able to make consumers buy their product with attractive packaging. As a result of this the producers will give a large amount of resistance to this idea. One of the advantages for them is the decrease in costs for the packaging. Also their branding market will shift towards the online branding of the product. The main focus of this period will be on the transfer from brand specific packaging towards a more anonymous standard package. The transformation to a number of standard packages will be the milestone in this period.

## Third period: 2025-present

The last period is the one between 2025 and the present. The main focus of this third period is to start making consumers aware of the benefits of staying at home to order their groceries online. In order to change this behaviour the supermarkets have to promote online shopping. By making sure the online bought products can be delivered rather quickly, it will take less time to do the shopping. It will also give the consumer the possibility to pick the time the groceries will be delivered at their house so they will be at home (Deloitte, 2013). The consumer will also have the possibility to order online and then pick up the products at their local supermarket. With this system the supermarket will become more of a warehouse than a place to display the products. The technical challenge of this step is the packaging. During this period the amount of different materials used for packaging will be reduced. When creating packages it will only be allowed to use one type of materials in order to reduce the amount of hybrids (Yang et al., 2012). This material has to be easy recyclable and/or cleaned. Also the production process has to be relatively easy and emission friendly. In order to decrease the cost of the production and recycling process of the material only a few materials will be selected. During this stage the consumer will be made more aware of the future system and will be guided towards more online shopping. The main milestone of this stage is the creation of packaging, which only consists of easily recyclable materials.

### Time period

		2065 - 2055	2055 - 2025	2025 - Present
Challenges	<b>Technical challenge</b>	Change of supermarket to a production hub. Combining raw bulk products with packaging.	Standardised packaging. All packages must be easily stackable in order to reduce space.	Creating easy recyclable materials for all packaging.
	<b>Cultural/ Behavioural challenge</b>	Supermarket becomes local pickup point or distribution centre	Increase shopping rate in order to reduce the amount of used packaging kept at home	Increase online shopping in order to change towards a more online-based supermarket.
	<b>Actor relations</b>	No more display showcases for customers in the supermarkets.	Change from product branding to online branding.	Supermarket will have less contact with shoppers so will start to change into a warehouse.
	<b>Rules and regulations</b>	-	Introduction of deposit system on all packaging	All packaging must be made of only a few materials to increase recyclability rate.

Table 2: Summary of the pathway

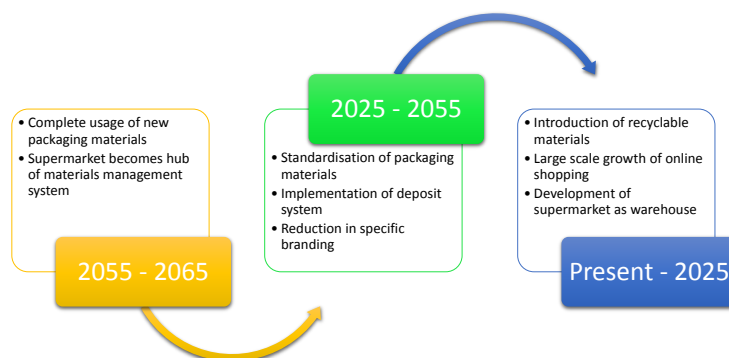


Figure 3: pathway summary

## 6 Elaboration by means of stakeholder views

To assess the viability of the future vision and the measures it entails, two experts have been interviewed and asked to offer their views on the suggested pathway. For this, an expert in the field of waste management in both theory and practice, Roel van Raak (see Appendix A), and an expert from the field of packaging, Cathrien Ruoff (see Appendix B), have been invited to provide feedback on the proposed vision and pathway. In this chapter they will discuss the role of the various stakeholders. Given their expertise they will in particular comment on the stakeholder views of the supermarkets, the brands and goods producers and the government in its various embodiments.

### Supermarkets

Firstly, the proposed gradual development of the supermarkets into a hub for distribution and collection of goods appears to be a concern in the suggested path. Roel van Raak states that supermarkets will probably not cooperate; based on his experience, he foresees that the supermarket companies will not, without a clear incentive or necessity, adhere to this new role. In Van Raak's opinion online businesses seem to be the key industry stepping into that role. Their current move into daily groceries, and in doing so taking advantage of their existing infrastructure, might be a better alternative for the new envisioned hub company. For instance, Amazon's intention and on-going experiment with fresh products seems to indicate a certain willingness (Amazon, 2014b). Another online giant, Best Buy, seems to operate along the same lines and is currently introducing a circular element to their distribution of luxury goods (Best Buy, 2013).

Cathrien Ruoff expresses similar concerns about the supermarkets interest in further evolution of their distribution role, yet she proposes starting a new type of company altogether. In her opinion, the supermarket corporations prefer to see their local branches as the last stop in the supply chain. Carrefour's (Carrefour group Communications Department, 2013) and Ahold's (Responsible Retailing team Ahold, 2013) intention to facilitate online ordering whilst promoting local pick-up, instead of home delivery, clearly reaffirms this. Both experts therefore seem to agree that it is unlikely that current supermarkets will evolve into to new hub. Whether it should be an online giant stepping in, or a new player on the groceries retail market, the option within the new system remains open for debate.

### Goods producers

Another problem might be the reluctance of the goods producers to change to a new system of packaging. Unless such a system is introduced nation wide, or better continent wide, Van Raak predicts possible objections by the industry to the new standardised system. He provides the example of soda bottles manufacturers who protested heavily against bottles differing from nation to nation. In their lobby efforts they succeeded and secured a departure from a deposit system, like that of the Netherlands, towards standardized rPET bottles across the continent. These bottles are still recyclable but come at the cost of being less reusable. Ruoff and Van Raak promote therefore a more active role for the government in setting standards or perhaps even imposing them. Ruoff cites the example of the government's involvement in tobacco packaging for instance; because of the higher goal, reducing the number of tobacco related deaths, the government provided the impulse for a radical change in packaging. It resulted in a new standard that according to Ruoff would never have been developed by the industry itself, if left to their own devices. A leading role for government is hence suggested. Perhaps through adopting incentives or, more difficult, regulation could this new standardization be achieved.

## Government

The role of the government is sadly not uniform or entirely predictable. Van Raak states that local governments might be reluctant to change. Not only do many of them have their own individual collection system, many have continued to invest heavily in incineration plants. Van Raak continues that the current surplus of capacity in these plants and today's emphasis on energy instead of reuse might make local councils less cooperative.

Ruoff adds to these concerns about the government's ambitions the problem of enforcement. She states that passing legislation or setting standards is often not enough; following up on these by enforcing new rules and legislation is a required role for the national government. Yet these new regulations should be not overly complicated if such a path towards a new waste system is to be truly successful. According to Ruoff, new regulation should be a stark contrast with the over 750 regulations on the environment currently in place in the Netherlands.

## Brands

On the point of branding both experts see that a clear advantage is to be gained by moving branding to a fully virtual and online environment. Both Van Raak and Ruoff think that it is one of the promising elements of this vision and its pathway. The new system could result in less waste and better spend PR-money for the brands. For this, a virtual environment of shopping is however a prerequisite; as such there is no incentive for supermarkets to do so. Since delivery and collection in a single trip could considerably reduce traffic, congestion and pollution (Edwards, McKinnon, & Cullinane, 2009), perhaps a government incentive programme could give the final push to supermarkets to take up the new role. Otherwise, a new player should step into that role.

## Conclusion

In summary, both experts therefore agree that it is unlikely that the current supermarket will evolve into the new hub. Perhaps a new player or an existing online shopping entity should step into that new role. For this role, the government, European, national and local, should set the boundaries and incentivize, whilst offering an alternative or obligation for local government to participate. Without an active government pushing the new rules producers and supermarkets could be reluctant to adhere to the new packaging and branding moments. For the latter to succeed an online presence and routine of groceries shopping should be fully present as they are the prerequisites for the change.

## 7 Action Agenda

There was a continuous interaction between the various stakeholders during backcasting to develop a sustainable model for the future. This interaction has to be continued post-backcasting to ensure the implementation of the new system. An action agenda was thus formulated for the first step towards sustainability, as a list of milestones to be achieved in order to attain our final goal:

- Increase awareness amongst the various stakeholders around the hub (i.e. super market) about the researched unsustainabilities of the current practice. This includes consumers, manufacturers of packaging materials and farmers.
- Research and development of uniform packaging structures made out of biodegradable/ recyclable materials to ensure minimal waste generation. On the other hand the food safety issue should also be addressed by developing better cleaning technology.
- Development of the IT infrastructure for the supermarkets to facilitate complete cloud integration of the chain, enabling supermarkets to turn into futuristic warehouses.
- Formulation/modification of laws and regulations that remove the barriers and encourage the growth of the proposed system. Financial incentives to push forward the growth towards sustainability.
- Initiation of pilot projects in model cities to demonstrate the sustainability of such a system, these projects must include a scope for two-way scalability whether expanding to a bigger corporation or shrinking it for a municipality.
- The government must change its waste management policies in order for the new system to have a meaningful impact. The focus must shift from incineration to recycling and reuse.

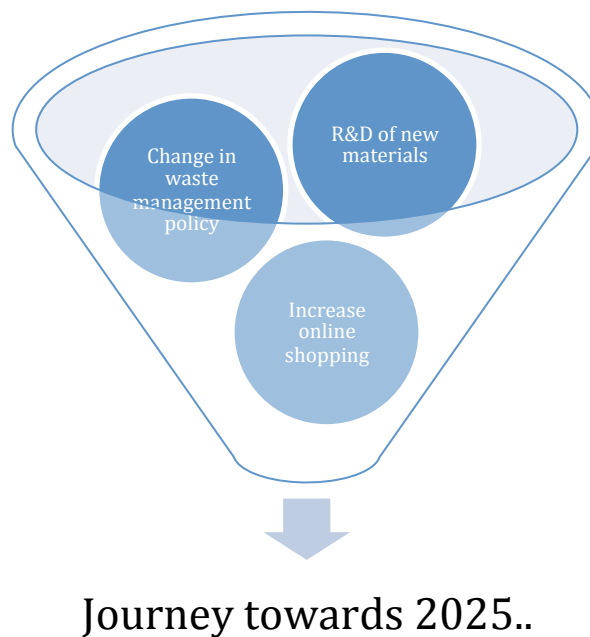


Figure 4: Milestones



## 8 Conclusions and recommendations

The aim of this report was to describe how a future, sustainable supply chain for daily groceries, their packaging and its waste could be implemented. In looking at the waste produced by the food producing and packaging industry the problem appears to be very relevant. It became clear that both society and technology are involved in the issues that need to be addressed in order for the system to become more sustainable. However, this asks for changes in the system as a whole and for the various stakeholders involved in the process to actively rethink their role. A future vision of adopting a closed loop system for the distribution of goods with a supermarket hub at its core could reduce the amount of waste significantly. Such a system would make the distributor responsible for both the distribution and the collection of packaging. As a consequence a single stakeholder would become accountable for the entire packaging waste stream. This transference of accountability and responsibility nevertheless demands far-reaching cultural, technical and behavioural changes over time, as described by Table 2 in the chapter 5.

Yet the vision and the subsequent pathway towards it attributes an important role to the supermarket. After consulting experts on the involved stakeholders it became apparent that it is unlikely that the current supermarket will evolve into the new, required distribution hub. Without an active government pushing the new system, producers and supermarkets could be reluctant to adhere to the new distribution system and its packaging and branding moments. Perhaps only a new player or an online shopping entity could step into that new role. It is clear that for the system to succeed an online presence and online routine of groceries shopping should be present as the prerequisites for the change. For that reason the first actions towards implementation should include increasing awareness about the unsustainability of the current practice and continue to develop an IT infrastructure for the supermarkets, or new entities, to facilitate a complete online integration of the chain. This process should be pushed by government, on its various scales, by formulating laws and regulations that remove the barriers and encourage the introduction of the proposed, more standardized system. The government should promote through incentives both the development and implementation of standardized packaging with no or the minimal amount of biodegradable waste. Finally, a pilot project in the urban area could work as a catalyst, demonstrating the feasibility of the new system and kick-start the move towards it.

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# Appendices

Appendix A; Interview Roel van Raak  
Appendix B; Interview Cathrien Ruoff  
Appendix C; Street interviews

## Appendix A; Interview Roel van Raak, Drift, Erasmus University, Rotterdam

What is the main focus of your company?

*Transition towards sustainability, we do teaching-research-consultancy.*

What are the obstacles to transition? (General)

*Transitions often take place over multiple generations, so keeping it all together is difficult. Lack of stimulus for the stakeholders. It is difficult to make policies that are without uncertainties. Different visions for different stakeholders, difficult to find a common attainable goal. Lack of control over all the stakeholders.*

What is in your opinion the greatest obstacle in implementing better waste management theory?

*Emphasis on energy over recycling. Large number of incinerators already in place, new ones were opened recently. Recycling glass is economically very good, same thing can't be said about plastics. Policy makers don't have enough powers to enforce what they put down as policies.*

What needs to be changed in your opinion in order to create a more sustainable world regarding the waste management of packaging of consumer products?

*Making uniform laws for NL and EU. Increasing the frequency of collection of waste. Implementation of pilot projects.*

### **Future vision**

What do you think about this vision?

*Long chain between various stakeholders, but what is portrayed as single step is multiple steps in reality (complex). Supermarket complain about the deposit areas being very dirty. Concerns about Health and safety requirements for filling packaging with food. Brands will not let go off their branding easily, huge money on marketing. Customers expect some quality from a certain brand, but in this system it is entrusted to a third party. Companies will be very reluctant to do that. Eliminate luxury goods.*

Is it reasonable to make 1 super company which is the responsible HUB in the 3 different chains?

*It requires heavy legislations and vesting of enforcing rights on a single entity. If you are modifying an existing entity (supermarket), it will require a lot of financial support. Even a lot of money might not be enough to convince the supermarket. The government might not agree with this system at all in first place to focus on other things, maybe recycling is not their priority. Government also might want to use existing waste management system and not see the need for this new type of waste management.*

### **Stepping stones**

Is there any regulation changes needed, in order to make this happen?

*Making of packaging tax, history suggests it might not be very successful. We can optimistic and drive the taxes really high, maybe some radical change will happen. Problems faced by the consumers- They live in small spaces, having 5 different containers for different purposes might be hard (only in urban areas).*

Regarding the material; are one or two materials for all packaging feasible?

*Firstly standardised packaging might not be very good for different brands. There is a talk of bio based polymers, but the thing is ultimately everything ends up as the same polymer irrespective of the source.*

*Need to change the end product to make an impact. Depending on the type of material, it should be sorted in to recycle stream or reuse stream.*

Would there be a problem with the increasing amount of traffic as a result of the more frequent shopping?

*Two contrasting views for urban and rural. Need to figure what is the best for the system. The traffic might be driven by bio-fuels or other renewable sources, so you might not make such a big impact on the environment due to the additional logistics.*

## Appendix B; Interview Cathrien Ruoff, Pakop

What is the main focus of your company?

*Everything around us serves a certain purpose. The purpose of PakOp is to find the specific purpose of products companies deliver and help them align their delivering method with the purpose of the product itself.*

What is your driving force for reducing the amount of packaging?

*Everything provides a certain function, thinking about that function can help open doors to more sustainable packaging without compromising the function.*

On the website you explained the rules about the additional cardboard box for toothpaste. Why aren't there fines given to the companies breaching these rules?

*Marketing, talked about it for seven years in politics, after a while everybody has forgotten it. Now in 2014 (20 years after discussion started) some packaging is gone but the extra carton is back.*

What needs to be changed in your opinion in order to create a more sustainable world regarding the packaging of consumer products?

*Lobby in The Hague, democracy. Norms set by companies ensure 100% recycled materials are not used. Also it is about the availability resources, there is not enough rPET. Things have to cost what it costs. That is not the case at the moment. Enforcing of norms is a knowledge intensive process. Inspectors do not have the knowledge to see "easy" improvements due to the fact that there are so many regulations to check upon. (in the Netherlands there are 750 rules about the environment!) Problem is about material, way the product has to travel (simulation), people are used to certain forms of packaging. Increasing the producer responsibility!*

### **Future vision**

What do you think about this vision?

*Better to start up new company. It is very hard to change the current context of supermarkets. It is easier to start up new chain instead of turn current system.*

### **Stepping stones**

Is there any regulation changes needed, in order to make this happen?

*Think of law on etiquettes. Information regarding gluten, E-numbers etc... Involvement of the smartphone allowed to aid in information delivery. Presence of Lignin in Ink is a big problem! Branding and marketing should move to the internet, offers great opportunity!*

Would there be a problem with the increasing amount of traffic as a result of the more frequent shopping?

*Standardised transport already present in supermarkets, take a look at current chain, see if you can find out how it works and where the proposed system bypasses current costly processes, because it does!*

## Appendix C; Street Interviews

### Questions

- A. How do you see the world in the future regarding sustainability?
- B. For this question we explained our future vision and then asked what the interviewed persons thinks of this.
- C. Do you think this future vision will fit in your ideas about the future?

Interviewee 1: Man, about 20 years old.

- A. I think in the future there will be not enough green in the environments. Due to the increasing population, the forests and will be harder to maintain due to shortage of space.
- B. The system you are describing will probably only work with a deposit system just like we currently do with the soda bottles. But this would probably result in a large amount of variation in packages and people will have to ask with every package what kind of waste is this. This vision you were describing will take away this and make it very easy for the consumer if there will be such a thing like standardised packages.
- C. I can hardly imagine it as the changes for the supermarkets so large they will never change to that system. So the consumer has to be more active in this in order to convince the supermarkets to change to your system.

Interviewee 2: Man, about 20 years old.

- A. Energy will be most important. Regarding the materials used for packaging, they will all be recyclable.
- B. It is a good idea and just expands the current deposit system. But the problem will be with the handling of all plastic waste. The amount of plastic used for packaging keeps increasing and it will consume a lot of space when I only go to the supermarket once a week.
- C. I would suggest focusing more on recyclability, as I don't care who picks up my garbage, the government or the supermarket.

Interviewee 3: Man, about 35 years old.

- A. We will be self-sufficient in our energy use as all oil wells will be depleted.
- B. The transport will be a problem as different parties will move back and forth to get the garbage. If the supermarket will deliver and take away the garbage it will save a lot of movement on the streets. The downside will be the smell of the used packages in my house. I only go shopping once a week so I would also need quite some space to store all these packages before the delivery guy takes them away.
- C. I think energy will be more important than materials used for packaging. But the packaging materials will all be made of one material for easy recyclability.

Interviewee 4: Man, about 40 years old, with family.

- A. Oil will be very expensive so we will only have sun, wind and geothermal energy.
- B. The supermarket doesn't want to produce and sell the product. It becomes a to large scale intervention. And how do you prevent the consumer for throwing everything away in one batch. I would prefer everything to be fully biodegradable. As people don't want to store it at their homes but throw it away as fast as possible. Biodegradable packaging can just be thrown away in their own garden. Also this system will have to much transport. It is already crowded on the roads and there is hardly any more space for a large amount of additional delivery trucks.
- C. I think food printing will be a better solution. As this doesn't use any waste. And as for all future ideas the mind-set of the people should really change to adopt the new ideas

Interviewee 5: Man, about 40 years old.

- A. No more use of fossil fuels as all the energy will be generated by hydrogen power plants, sun and wind power.
- B. At the moment there are already too much plastic used for all kinds of double packaged products. The government should enforce this idea directly in order to reduce the amount of plastics used. At the moment the system is kind of strange as you pay for the package, then you pay again for the recycling of it by the government and then you go to the supermarket to buy the same package again.
- C. Plastic is not good for the environment so it will lead to a more sustainable way of packaging without using (fossil) oil-based products.

Interviewee 6: Man, about 60 years old. (Well educated)

- A. Clean energy. There is enough knowledge at the moment to start it directly, like for example the cold fusion reactors and the ability to gain energy for simply using sea water.
- B. It would financially be better for the environment. The only downside is that the oil companies (they are like the mafia) keep counteracting these kind of ideas.
- C. 3d printing of food and packaging would eliminate the transportation of large amounts of bulky packaging.

Interviewee 6: Man, 72 years old.

- A. I am too old to look so far into the future. I only want my grandchildren to live in a peaceful world where there is no bad government.
- B. We should start by increasing the amount of collection points. The system you are describing is already sort of happening as the government will sort the waste at their incineration plant to pick out the recyclables. And I like the idea that the supermarkets will gain more of a responsibility about the packages they are selling.
- C. The main focus should be the mind-set of people. The government isn't forcing enough to implement your future vision in a later stage.

Interviewee 7: Woman, about 30 years old.

- A. Everything keeps on going well with no problems in the world. We have to keep looking at the result on the environment with every decision we make.
- B. I really like the idea as it would help the environment a lot.
- C. You should also look at the amount of packaging used to protect a product. I sometimes have to remove three layers of packaging before I get the product.

Interviewee 8: Woman, about 50 years old.

- A. All the energy would be privately generated so everyone will produce only what they need and the cars will ride on bio-fuels
- B. I think your system is too large to put it in the current society. You should focus more on biodegradable packaging. This makes the cooperation's more aware of the package they use to protect their product. Your system would also still have a lot of waste, which I need to store in my house, and I don't have the room for this.
- C. It would be a too radical change in the current system of the supermarkets.

Interviewee 9: Woman, about 40 years old.

- A. I don't look to the future. I live by the day and just see what the world would bring me.
- B. I like the idea, as I currently have no need for recycling. I just put everything in one bag and hope the government will recycle it.
- C. It would be a good practical way to change, as it would not use any effort for me to get rid of the waste anymore.