Supply chain implications of the deposit on returnable plastic bottles

Master Thesis

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Abstract

In this paper, I have examined the deposit scheme on one-way plastic bottles and its implications on the sustainable supply chain. I have performed this research in order to understand how the reverse supply chain of a deposit scheme on one-way plastic bottles works, how this affects waste management and whether this is Sustainable Supply Chain Management. This research will then answer the following research question: *What environmental, social and economic implications does the deposit scheme on one-way plastic bottles have on their supply chain?*

Firstly, I have performed a literature review on the topics of reverse supply chains and logistics and on deposit schemes on reusable packaging. Additionally, I have introduced the deposit schemes in Germany, Sweden and Denmark. In this literature review I have found that the main research done on reverse supply chains and logistics is done on returns management and that there is very little current research in the academic literature on deposit schemes on one-way drink containers in Europe. Thus, this paper is filling a gap in the academic literature.

Secondly, I reviewed the theory on the subject and established a Sustainable Supply Chain Management (SSCM) framework for the deposit scheme on plastic-bottles and found three propositions to answer:

P1: *A deposit scheme on one-way plastic bottles is Sustainable Supply Chain Management.*
P2: *A deposit scheme on one-way plastic bottles is good sustainable business.*
P3: *The sustainable supply chain of a one-way plastic bottle is a closed-loop reverse supply chain.*

In order to perform this research, I have done a comparative case study of the Danish and Swedish deposit scheme organisations by interviewing them and analysing the secondary data presented by them. I have then critically analysed these findings in order to analytically generalise on the deposit scheme of one-way plastic bottles and its sustainable supply chain.

I have found that both country's deposit schemes have fairly high return quotas, in my opinion, and seem to be saving on energy and are decreasing waste and CO_2 emissions. Furthermore, they both cover the SSCM framework as established by myself. However, there does not seem to be much risk awareness. The deposit scheme seems to be economically feasible as both organisations have a state monopoly. However, there was little data found on this subject. Furthermore, they also include many social and environmental aspects into their operations.

In my findings, the reverse supply chain of a one-way plastic bottle with a deposit is depicted rather less detailed, than I expected, as it does not cover all the supply chains within the supply chain. Furthermore, possibly as the organisations know they have state monopolies they are not very risk aware.

In the discussion section of this paper, I point out how the research question is answered with finding mainly positive implications for the supply chain and how both organisations state they are the world's best without saying why or how. Additionally, I am discussing the implications of having a deposit scheme on one-way drink containers as compared to simple recycling and also compared to the open-looped supply chain of the German deposit scheme. Furthermore, I criticise them for not being aware of risks as there are many changing circumstances, which they should be aware off and prepare for.

To conclude this paper, I find that the sustainable supply chain of a one-way plastic bottle is reverse closed-loop and relative. Furthermore, the implications on the supply chain are not only that it is a good sustainable business, it is also environmentally friendly and has many social implications. These social implications are much more dominant, than I initially thought. The deposit scheme on one-way plastic bottles in these two cases is, thus, sustainable in its supply chain and a circular economy and an example of Sustainable Supply Chain Management. I end this paper with presenting areas for further research.

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1. Introduction

The world is becoming increasingly more populated (United Nations, 2014). Consequently, every day more products are required, used and disposed of in some way or other. According to Mahajan and Vakharia (2016), managing the waste that we as human beings create is one of the world's biggest problems both now and in the future. They argue that one of the answers to this problem can be the 3Rs of reduce, reuse and recycle (Mahajan and Vakharia, 2016).

Every single one of the products, which we use, has a supply chain, which takes it from the sourcing of raw materials all the way to the end-consumer. For instance, if we take a plastic water bottle, the supply chain ranks from the bottle, the lid and the label being made, to the water that is being sourced and bottled, to the distributor of this water to retailers and others who buy the product, to the consumers, who drink the water. In the past academic research on supply chain management it was often considered that the supply chain ended here at this final delivery to the consumer (Blumberg, 2005). Today, the scope of thinking on this subject is widening and recently this perception has changed. It is argued that this view on responsibility for the whole supply chain from cradle to grave has been raised mainly by public awareness to problems with waste and its management (Govindan et al., 2014).

Autry et al. (2013) mention that every part of the supply chain has an environmental responsibility and that only those organisations, who manage their business in a sustainable way with a long-term agenda, have a future in the world as it is today. Many researchers like Mahajan and Vakhari (2016) argue that reverse supply chain management, meaning a supply chain, where the product goes back to the manufacturer or even the raw material producer after use, is a profitable long term investment, which mainly reduces waste.

Consequently, further and new research in this area is relevant and interesting, because it presents challenges to supply chain managers in implementing these newer ideas. Furthermore, there is a gap in the academic literature in aspects such as the reverse logistics, which take the disposal of a product into account of a supply chain and green or sustainable supply chains (Schoenheer, 2009).

Considering again the case of the plastic water bottle. A consumer will buy the bottle and drink the water. But what happens with the bottle? In some places, like in some states of the United States of America, the bottle will simply be disposed of (MRC Polymers, 2017). Plastic waste polluting, for instance, the world's oceans is constantly becoming a bigger problem, as some plastic

does not decompose and other plastics take many years to decompose (McKie, 2016). In other countries, like the UK, most plastic bottles are being recycled through collection of household waste and special recycling bins (Wrap, 2017). However, in countries such as Denmark, Sweden and Germany, the consumer is encouraged to take the plastic bottle back to the shop to be recycled or reused.

When the consumer bought the plastic bottle, she paid a deposit on it. In order to get this deposit back, she has to return the bottle (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). In Denmark and Germany, the deposit scheme in its most recent form was introduced in 2003 in order to, among other reasons, try and keep the country cleaner (Ibid.). The Danish deposit scheme is managed by the organisation Dansk Retursystem (hereinafter DRS), an organisation that has been mandated by the Danish government to handle the deposit scheme for both one-way and reusable drink containers (Dansk Retursystem4, 2017). The Swedish deposit scheme is managed by the organisation AB Svenska Returpack (hereinafter ABSR), which started in 1984 with the collection of one-way aluminium cans and included one-way plastic bottles in 1994 (Returpack, 2016).

Did Denmark and Germany really become a cleaner country through the deposit scheme? Is the scheme simply an attempt to manage waste? And what are the further implications for the supply chain of the one-way plastic water bottle as managed by the Swedish or Danish deposit scheme organisations? These are all questions that can be raised on the topic of Sustainable Supply Chain Management. This research is interesting and academically relevant, because sustainability and reverse supply chains are becoming focus areas in business and research alike in present day. The target audience for this paper is fellow students and researchers of reverse supply chains and Supply Chain Management in general. This knowledge is needed by both researchers and practitioners, as within the academic literature currently there is not much information to be found about the deposit schemes in Denmark, Sweden and present deposit schemes and their supply chains in general. Additionally, as mentioned previously, not only waste, but plastic waste in particular is becoming an ever greater problem for our planet and a deposit scheme on plastic bottles possibly helps to change that.

Thus, this paper seeks to investigate the environmental, social and economic implications for the sustainable supply chain of a one-way plastic water bottle based on a comparative case study of the deposit schemes in Denmark and Sweden. This is done in order to understand how

environmentally friendly, socially involved and economically feasible this sustainable supply chain is.

I have chosen to simplify my research by focusing on one-way plastic bottles only, as there is quite a difference between the reusable and the one-way kinds of drink containers with a deposit scheme and their supply chains. One of these differences is that ABSR does not manage the collection of reusable drink containers and there is, thus, no ground for comparison in this research. However, DRS does in their data not distinguish between the material of their one-way drink containers, which is why I will still mention one-way cans at times, in this research incidentally.

Through interviews with members and secondary data from DRS and ABSR, this paper will seek to find out how the closed-loop reverse sustainable supply chain for a one-way plastic bottle with a deposit works. Additionally, it will investigate whether this is economically feasible and sustainable. Thus, this paper seeks to research Sustainable Supply Chain Management through the cases of a one-way plastic bottle within the Danish and Swedish deposit schemes. At the end of this paper, the following research question will have been answered:

1.1 Research question

What environmental, social and economic implications does the deposit scheme on one-way plastic bottles have on their supply chain?

This paper will answer the above-mentioned research question through a comparative case study of the deposit schemes in Denmark and Sweden. The systems in these two countries can be compared, as they are managed in a similar way.

In order to perform this research, firstly the academic literature on the topic will be reviewed and analysed in connection to my research question. Consequently, theory applied in this paper will be presented and a theoretical framework and propositions will be developed. In chapter four, I will introduce the multiple methods research design, as mentioned by Saunders et al. (2012), which this paper will follow. Then the data findings from investigating the two companies in charge of their country's deposit schemes: DRS and ABSR will be presented and analysed. Afterwards, the results from this analysis will be outlined and discussed before this paper is concluded. In its conclusion, this paper will elaborate on areas for further research.

1.2 Delimitations

As this paper is limited in size and scope, there will not be a focus on every actor in the supply chain of a plastic bottle with a deposit. Instead, it will focus on the Danish organisation Dansk Retursystem and the Swedish organisation AB Svenska Returpack, who each manage their national deposit scheme. The research, thus, becomes country specific.

The deposit scheme was introduced as legislation and is not a business choice, therefore, I think the most relevant information to answer my research question can be accessed from this angle. As the information on the deposit scheme in Denmark, Sweden and deposit schemes in general is quite limited, I believe furthermore that there is a gap in the academic literature to be filled by this research. Thus, at present time, I have limited basis for comparisons of academic literature on the subject. Additionally, there is restricted access to information as I have to rely on information found on the two organisation's websites and on a member of each organisation to answer my interview questions. Unfortunately, by the time of submission the Swedish deposit scheme organisation had not yet responded to the interview questions.

2. Literature review: The reverse supply chain and deposit schemes on drink containers

In the following chapter, I will review academic and non-academic literature, which discusses my research area of reverse supply chains, reverse logistics and deposit schemes on drink containers. Accordingly, my paper's literature review represents relevant research on the topic of reverse logistics and closed-loop supply chains such as that of drink containers with a deposit scheme.

Furthermore, it will introduce the deposit schemes of Germany, Sweden and Denmark in order to explain, how such a scheme can work and why I later on in my research will compare these deposit schemes.

I have conducted my literature search through the online university libraries of the University of Manchester and Copenhagen Business School, the website 'bibliotek.dk' and through the search engine Google. Furthermore, I have re-read academic articles, which have been course literature in my Bachelor and Master Degree programmes. Additionally, I have found academic literature through the list of references of other academic literature and based on advice from course

colleagues and my supervisor. I have searched for academic and non-academic literature in English, Danish, Swedish, Norwegian and German. I did not set a time frame for when the academic literature that I have researched should have been written and published by. I have been reading and studying books, academic articles and newspaper articles to obtain the maximum amount of information. I have searched for academic and non-academic literature with the following key words: 'Pant' (deposit scheme in Danish, Norwegian and Swedish), 'Pfand' (deposit scheme in German), deposit schemes, circular economy, waste management, sustainable supply chain management, reverse supply chains, closed-loop supply chain, consumer driven supply chains and reverse logistics.

2.1 Reserve Supply Chains: Closed- and open-looped and reverse logistics

Firstly, as the supply chain of a drink container with a deposit scheme is not simply forward flowing, I will describe and analyse the research done on the topic of reverse supply chains.

The concept of the reverse supply chain has increasingly been explored since the 1980s due to environmental issues becoming more visible (Blumberg, 2005). A reverse supply chain includes the management of the final disposal of a product and its design (Ibid.). Accordingly, the value creation of a product is increased through the whole of a product's lifecycle (Genovese et al., 2015).

In the spirit of following a product full circle – from cradle to grave, life-cycle analysis is a methodological tool which tries to assess the full environmental impact of a product (Klassen and Vachon, 2011). According to Autry et al. (2013), this approach is used for all of the components of a product such as the packaging of a product in order to quantify what the end-value of a product is, if any, or if it can be repurposed. Life-cycle analysis, thus, includes all stages of the production and distribution of a product and includes the total cost of ownership in order to gain the whole picture of a product's life-cycle (Autry et al., 2013). As the life of a plastic drink container with a deposit scheme ideally ends with recycling (Numata and Managi, 2012) this assessment methodology is, however, not valid for those. Nonetheless, it could be taken into account for reusable drink containers.

Reverse supply chains can be either open- or closed-loop (Ibid.). An open-looped supply chain is a forward flowing supply chain without a return system (CIPS, 2017). Whereas a closed-loop supply chain is a supply chain which incorporates the disposal of a product and includes the 3Rs of reduce, reuse and recycle (Klassen and Vachon, 2011). Most processes in these two supply

chains still have the same flow (Abbey and Guide Jr., 2016), as can be seen in Figure 1 below and in Figure 2 on page thirteen. However, the reverse flows differ. Especially, between whether they go from Business to Consumer (B2C) or Business to Business (B2B) processes (Ibid.). Even though the consumers take home and return plastic bottles with a deposit scheme in Denmark and in Sweden, the operation is very much B2B, as the deposit scheme organisations work with organisations mostly.

Most of the research on reverse supply chains, which I have reviewed equally agrees on the definition above and further definitions explored in this section.

Klassen and Vachon (2011) illustrate in their paper on Green Supply Chain Management how the loop in the supply chain can be closed. This is illustrated in Figure 1 of this paper:

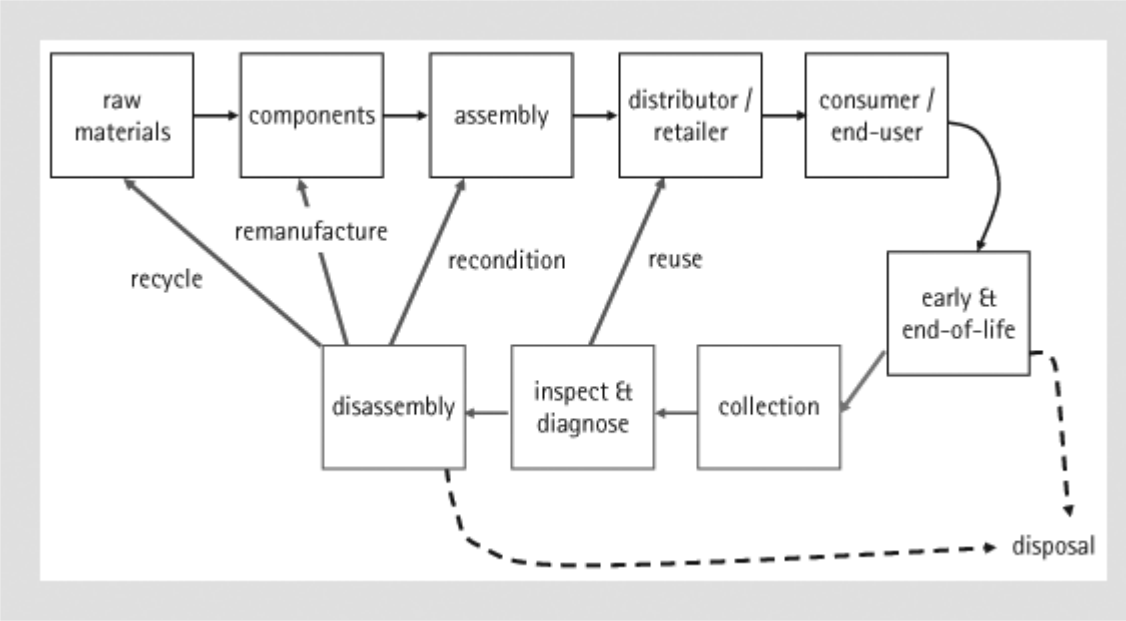

Figure 1: Extending the supply chain: closing the loop (Klassen and Vachon, 2011:8)

As illustrated above, the supply chain goes from raw materials to the consumer. Then the end-of-life is added, which can either end in disposal or disassembly. Disassembly can then lead to either disposal, recycling, reconditioning or reuse. However, each of these steps in the chain can create additional waste (Klassen and Vachon, 2011). The reverse supply chain of a plastic drink container with a deposit would ideally end in disassembly and then follow the recycling stream.

Autry et al. (2013:104) state that the reverse supply chain of a product or service is: "[…] often managed as an afterthought […]". They argue that these aspects of the supply chain are not

covered within an organisation's supply chain strategy, however they argue that there might be opportunities for the creation of reverse supply chains within the already existing supply chains (Autry et al., 2013). This is an interesting point, which I will further explore in my discussion.

According to Govindan et al. (2014) the concept of reverse logistics and closed-loop supply chain management has been given increased attention due to the rising public awareness of environmental concerns and the concept *sustainability*, which I will define in the next chapter. They define reverse logistics according to the American Executive Reverse Logistics Council as:

> *'The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.'*
> (Govindan et al., 2014:603)

Additionally, the introduction of *green laws* in the European Union and some other places, has created a need for manufacturers to take responsibility for the whole life-cycle of their product, especially at the end of their life (Govindan et al., 2014, Blumberg, 2005). It can be argued, that this tendency is part of a green movement of trying to make supply chains more sustainable (Klassen and Vachon, 2011). Increasingly, this is becoming an opportunity to increase profits through decreasing costs (Govindan et al., 2014). Accordingly, the reason to introduce a reverse supply chain to an organisation can be two-fold. I will further explore the magnitude of these reasons in the chapter on the theory of the supply chain.

Blumberg (2005) argues that reverse- and closed-loop supply chain processes are vital to master for any form of organisation at any tier of the supply chain. He argues that an understanding and good use of these processes are important for an organisation to be responsive to risks and to act responsibly (Blumberg, 2005). Thus, given the following reasons investigating reverse supply chains through research such as the mine is filling a gap in the academic literature.

Bernon et al. (2010) argue that reverse logistics is an important part within an organisation's balance sheet with a clear effect on the end result. Supply chains are normally forward flowing, which is why the reverse flow is a more costly endeavour to achieve (Ibid.).

Mahajan and Vakharia (2016) have researched waste management and found that the research into the topic of reverse supply chains is fuelled by the idea that through recycling and reuse of products, the amount of waste can be reduced. They conclude their paper by arguing that

this is in fact a result of reverse supply chains and that, furthermore, these are also profitable (Ibid.). Furthermore, as mentioned before, waste management is constantly becoming a more important topic as we cannot keep up with, for instance, the plastic waste, which we create. This affects our planet and effectively us. This is possibly one of the implications, which a deposit on a plastic bottle could have on its supply chain.

As can be seen, most researchers agree that reverse supply chains are cost-effective, however some of them do point out that the initial introduction is costly. This is an interesting point as I am researching whether or not the deposit on returnable plastic bottles is actually economically feasible.

Govindan et al. (2014) present an illustration of a supply chain, which has both a forward and a reverse flow of a product as illustrated in Figure 2.

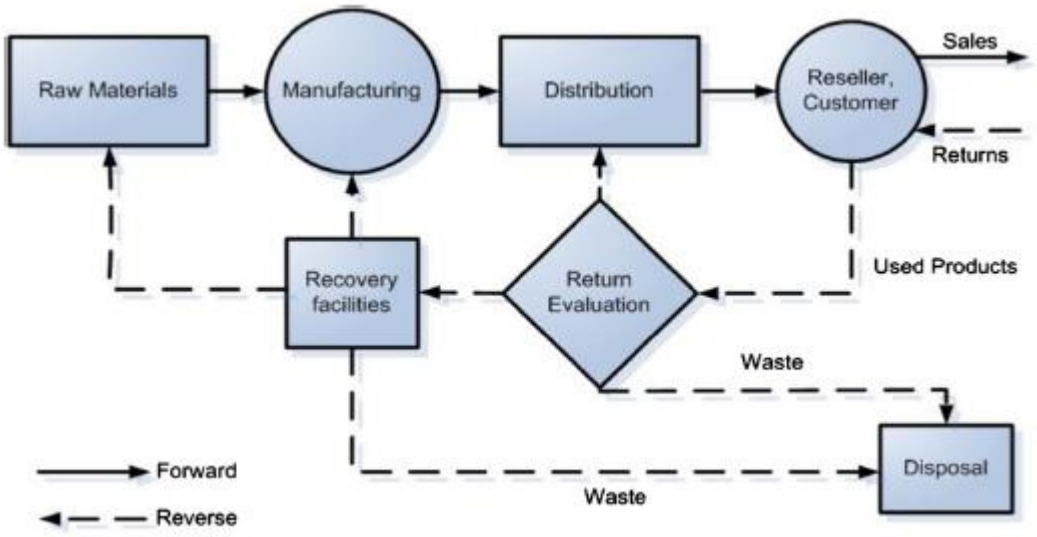

Figure 2: A generic form of forward/reverse logistics (from Tonanont et al., 2008 in Govindan et al., 2014:604)

Visibly this adds two new dimensions to the forward supply chain and makes it more complex. Unlike the closed-loop supply chain of Klassen and Vachon (2011) though, it does not consider the reuse or recycling of products. However, it does introduce the dimension of returns, which is a reverse supply chain that I will review in the next sub-section.

2.1.1 Returns Management

Based on my review of the academic literature on reverse logistics and supply chains, the reverse supply chain, which has been explored the most in past academic research is that of returns management. Consequently, I am going to explore this a little further in this sub-section.
In the consumer market, retailers often experience a return of certain products. I am certain that we all at one point in time have experienced this, because a purchase, for instance, was wrong for us or faulty. If broken these returned products are then sent back to the manufacturer for repair or recycling (Blumberg, 2005). This might be a fairly straight forward reverse supply chain or a complicated one if the return is facilitated by third party organisations, which the repair is assigned to (Ibid.).

Autry et al. argue that: "[…] returns are a fact of life […]" (2013:52). The kind of returns policy i.e. a retailer has, is up to themselves and national or EU law (Your Europe, 2017), however the ability to return quite freely is a dream for consumers and might increase sales, unless of course every product is returned (Autry et al., 2013). Again, these arguments illustrate that reverse supply chains can be a costly operation, as the returns and their transportation or repairs can be costly to retailers (Ibid.)

Methodologies such as the life-cycle analysis mentioned earlier in this paper, are not useful for returns, as these end the initial life-cycle of a product and in a way create a clean slate (Ibid.). A supply chain manager in an organisation, therefore, has a need to consider how returns are managed in the most profitable and easiest way for an organisation (Ibid.). This is partly due to that in by disregarding the length of the life-cycle of a product there will always be a need for service or disposal of some sort (Blumberg, 2005).

Repair or refurbishment of returns is a large part of closed-loop supply chains (Ibid.). Traditionally, this was done by the original equipment manufacturer themselves, since then it has often been outsourced to third parties and in the 1990s large companies that specialise in refurbishment or repair have surfaced (Ibid.).

Blumberg (2005) argued that there is a growing market for reverse and especially closed-loop supply chains, as either returns management or as a way to address environmental issues and reduce waste. In this paper, the focus will be on the latter, which arguably is a gap in the research, as the academic literature and past research does not seem to concern itself very much with these topics, but rather with returns management, as mentioned.

2.2 Reusable products and deposit schemes

Now that I have reviewed and analysed the academic research done on the topic of reverse supply chains and logistics, I need to further explore academic research, which has been done on drink containers with deposit schemes and other reusable products in order to help me answer my research question. Firstly, I will explore research, which has been done on reusable packaging. Secondly, I will discuss deposit schemes in general. Thirdly, I will introduce the German, Swedish and Danish deposit scheme as an entry point into developing the theoretical framework, which I will base my own research on.

Closed-loop supply chains can amongst others encompass reusable packaging, which can be sent back to the manufacturer after use (Ibid.). This is because reusable packaging is much cheaper than single-use packaging (Ibid.). Glock (2016) has researched returnable transport items (RTIs), such as containers or bottles and has found that these have certain advantages, such as a reduction of materials and waste. However, he states that the future of such items is not certain as it is not known how quickly or if they will be returned (Ibid.). This research points into a similar direction as to where I see my own research proceeding.

As my research question seeks to explore the supply chain implications of a deposit scheme on plastic bottles, I will now review past academic research on this topic. Most of this academic research, is already quite old, hardly any is based in Europe and it focuses mainly on reusable drink containers. However it answers some of the questions, which I will raise in today's context.

In Oregon, in the USA, there has been a mandatory deposit scheme on glass bottles of soft drinks and beer since 1972 (Porter, 1978). This means that a consumer pays a deposit on any such glass bottle, which is returned to her, when she returns the glass bottle (Porter, 1978). Gudger and Bailes (1974) argue that the Oregon bottle legislation has meant economic gains for some business sectors and increased growth in the labour market. Furthermore, there has not been a decrease in sales of these glass bottles and the legislation is deemed a success based on the economic incentive, which is the deposit and the ability for consumers to conveniently return their glass bottles (Ibid.).

In the conclusion to their article, they found that the success of a deposit scheme depends on the amount of the deposit (Ibid.). Both those papers have thus explored the Oregon bottle legislation shortly after it was introduced and have come to similar conclusions. However, it does not seem like this has been researched more recently.

Peaker (1975) also studied the bottle legislation in Oregon and found that the use of aluminium cans has declined due to the state legislation. The legislation has decreased the need for certain raw materials and there is less littering (Ibid.). Despite these advantages, it needs to be considered that the amount of energy needed to produce returnable glass bottles is higher and that the savings depend on the amount of times the glass bottle is actually being used, he states (Ibid.). Thus, unlike Porter (1978) and Gudger and Bailes (1974) Peaker (1975) raises some points of critique. These three papers answer some of the points, which my research raises, however, they mainly consider the USA and they do not consider the one-way drink containers, which are much more dominant today in at least Europe's deposit schemes, as I will explain later on in this chapter.

Other US states followed Oregon in adopting a deposit scheme (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). In Japan there is a deposit scheme as well, which has mainly been established out of environmental concerns (Numata and Managi, 2012). Sweden has had a similar deposit system since 1984 (Returpack, 2016) and Denmark has had its current deposit scheme in place since 2003 after the European Commission had criticised its former laws of banning aluminium cans (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). The current German deposit scheme was also introduced in 2003 and adapted in 2006 (Ibid.).

In Japan, as well as in Germany, there are two kinds of returnable drink containers with a deposit scheme: The reusable ones, which are washed and refilled by the bottler. Often these are made of glass (Numata and Managi, 2012). As well as the one-way bottles, which are being recycled and turned into new bottles or something else, this is common for plastic bottles or even cans (Ibid.). As I will explore a little later, Denmark and Sweden also have both kinds.

After his research on Japan in 2012, Numata briefly studied the deposit schemes of Finland and Norway (2016) and this is the most recent study on deposit schemes, which I have found in the academic literature, however this study is mainly concerned with the policies behind and the taxes within the systems and not with the deposit scheme's supply chain.

2.2.1 Trippage

The two kind of drink containers with deposit schemes as outlined above seem to have been investigated separately in the academic literature. The main body of academic literature, which I have found is concerned with the reusable drink containers. Thus, I will briefly outline some further

findings on this topic. I am doing this in order to further explain, why I am focusing on the one-way drink containers, as the reusable drink containers do not seem to be quite as relevant in Denmark and Sweden today. An American study for instance showed that consumers are not normally fans of reusable products (Abbey and Guide Jr., 2016).

Reusable drink containers are just that – reusable. They are disinfected and washed and refilled (Numata and Managi, 2012), as mentioned above. To go back to Peaker's (1975) findings that reusable glass bottles are only economically feasible if they have been used a certain number of times, I will introduce a British study by Fisher and Horton (1979). Fisher and Horton (1979) studied reusable bottles in depth in the UK in 1979 together with some comparisons to other nations, as they were concerned with the trippage rate of the reusable glass bottles. They define trippage as the number of journeys a glass bottle makes from manufacturer to consumer and back (Ibid.). Fisher and Horton's argument is that the higher the trippage rate, the less is the cost (Ibid.). They found that rates were depending on size of the bottles and the location of the consumers (Ibid.).

In their study, they found that Denmark had a quota of returning glass beer bottles of 99.35 per cent, Sweden had a quota of returning 90 per cent of glass beer bottles, whereas the UK only returned 70 to 83 per cent of bottles (Ibid.). They then went on to examine the reasons for not returning glass bottles, which were mainly that there was not enough information about it (Ibid.). Additionally, they found that the convenience of returning glass bottles was more important to consumers than the deposit amount (Ibid.). This is the opposite of Gudger and Bailes' (1974) American findings. Furthermore, they found that often retailers were the ones, who made returning glass bottles difficult as they were not positive towards the extra work involved in the deposit scheme (Fisher and Horton, 1979).

The conclusion of the study was that increased convenience, standardisation of products and an increase in information on the deposit scheme was being requested by consumers in order for them to return more of their glass bottles (Ibid.).

It needs to be added that there is no deposit scheme in the UK today, however some environmental organisations are lobbying for its revival (CPRE, 2017). Additionally, from what I have understood both the American and British academic research was concerned with reusable drink containers only and not with one-way drink containers. Therefore, my research into the supply chain of one-way plastic bottles is filling a gap in the academic literature. This is also, because the academic research so far is quite old and mainly concerned with the US. Accordingly, this academic

research can only vaguely help me answer my research question, but is still interesting as it mentions the Danish and Swedish return quotas of drink containers with a deposit, which I also wish to research, though just in the context of today.

2.3 The German deposit scheme

As my research is focused on Denmark and Sweden, I will now explore a deposit scheme a bit closer to home. Germany is the country, whose deposit scheme is most frequently covered in the non-academic literature according to my findings. Their current deposit scheme was established in 2003, like the Danish one, and widened in 2006 (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). The deposit scheme was established, because the market share of reusable drink containers had dramatically declined compared to one-way drink containers. In fact, it had fallen under the quota of 72 per cent, which was established first in 1991 and again in 1998 (Ibid.). Furthermore, the deposit scheme was seen as a more environmental packaging solution and was supposed to discourage littering (Ibid.), as in Denmark. Additionally, the deposit scheme was a way of introducing European Union legislation on packaging and waste management into German law (DPG7, 2017).

The German deposit system is managed by Deutsche Pfandsystem GmbH (hereinafter DPG) and is only in charge of one-way drink containers such as plastic bottles and cans (DPG5, 2017). This is a not for profit organisation (DPG2, 2017). The management (DPG4, 2017) and the board of DPG are made up of 50 per cent members of commerce and 50 per cent members of industry and has its headquarters in Berlin (DPG1, 2017). The DPG is in charge of the law enforcement regarding the deposit scheme, the standardisation of the deposit scheme, its labelling and the *clearing system* (DPG3, 2017). As not every store pays out the amount of deposit that it receives, there is a *clearing system* in place. This system makes sure that every store is being repaid deposits owed or pays back deposits, which they have received in excess of their own sales (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). This system is ensured through the barcodes on the drink containers and is managed electronically (DPG8, 2017). This barcode and the deposit label are in a certain blue colour to ensure their authenticity (Ibid). Consequently, the DPG ensures that the money circle is always closed (Ibid.).

The German deposit scheme law states that every bottler and retailer has to label the one-way drink containers they sell and they have to be part of the deposit system (DPG4, 2017). This is

enforced by the DPG (Ibid). Every drink container has a deposit equal to 0.25 € inclusive of value added tax and this deposit also has to be on imported drink containers, but not on exported ones (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). In the Nordic countries, there are researchers, who argue for a common Nordic deposit scheme, which covers more than one country (Denmark, Norway, Sweden and Finland or border regions of these), so that exported bottles with a deposit do not become a problem across borders (Magnus and Felixson, 2015). For Denmark and Germany's border region, there is one such transnational scheme underway (Ibid.).

Every tier in the supply chain has to help collecting the drink containers and there are controls in place to ensure this. Non-compliance will be penalised (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). Since 2006, the return of drink containers has been simplified and extended, as now all stores have to take back all drink containers of the material, which they sell themselves (DPG5, 2017). Stores smaller than 200 m² are exempt from this (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). Drink containers can either be returned through machines, which scan the barcode on the drink containers and count them automatically or can a store can return them to a counting centre (Zählzentrum), where the barcodes will then be scanned (DPG9, 2017). Afterwards, the one-way drink containers are sent to be recycled through normal recycling channels, as the DPG argues that the return of the materials to bottlers is not reasonable or economically feasible as the drink containers are one-way (DPG7, 2017).

The drink containers have a deposit sign on them and can be returned as long as the sign is visible, no matter the state of the rest of the drink container itself (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). Fruit juice, vegetable juice, milk, drinks for babies, wine and alcohol other than beer are exempt from the deposit scheme (Ibid.).

In a newspaper article from 2012 covering the deposit scheme, it was mentioned that the quota of reusable drink containers is still quite low, because most of the discount stores only sell one-way drink containers, however, these are being recycled, which is argued to be a positive result for the environment (RP online, 2012). Drösser (2015) argues that most consumers cannot tell the difference between reusable and one-way drink containers.

When the deposit scheme was first introduced in 2003, it created some chaos and retailers such as Aldi went to the German constitutional court ('Bundesverfassungsgericht') to complain against it (RP online, 2012). However, since the 2006 addition that one-way drink containers can be

returned in any store that sells one-way drink containers of their material and not only their original point of sale, the deposit scheme has been a success, as argued by this author (Ibid.). However, other authors argue that the deposit scheme is in fact not very environmental, as it decreases the amount of reusable drink containers used in favour of the disposable one-way drink containers, which we cannot actually be certain of are being recycled. (Welz, 2017).

This introduction of the German deposit scheme gives a better understanding of what a deposit scheme is and why these have been introduced. I will now introduce the Swedish and Danish deposit schemes, which also have an organisation in charge of them, but which are closed-loop reverse supply chains and which are managed quite differently. Later on in this paper, I will then further compare the cases of the Danish and the Swedish deposit systems in the analysis. I will then compare these findings to the German deposit system in the discussion chapter.

2.4 The Swedish deposit system

As mentioned in the introduction of this paper, the Swedish deposit scheme was introduced for one-way aluminium cans in 1984 and for one-way plastic bottles in 1994 (Returpack, 2016). Furthermore, it has been legislation since 2006 (Pantamera5, 2017). However, deposit schemes for drink containers have been around in the country since the 1800s (Ibid.). I have not found anything on the Swedish deposit scheme within the academic literature and will thus briefly introduce the deposit scheme from information found mainly from its website.

ABSR is also known as Pantamera and both names can be used interchangeably (Pantamera9, 2017). The organisation is privately owned, but its mission statement is made up by itself and by the Swedish government (Pantamera11, 2017). Additionally, ABSR has been mandated by the Swedish government to be in charge of the national deposit scheme for one-way drink containers (Konkurrencestyrelsen, 2001). The organisation is composed of two limited companies, one for each material (Ibid.). ABRS is mainly financed through the sale of these materials for refurbishing (Returpack, 2016). Furthermore, in Sweden there are two other organisations, which are in charge of reusable glass drink containers independent of ABRS (Ibid.).

ABSR's mission is to recycle up to 90 per cent of all one-way aluminium cans and one-way plastic bottles (Ibid.) and this work is done at their factory in Norrköping, which opened in 2003 (Pantamera5, 2017).

According to ABSR's website, Sweden is among the countries, which have the world's best deposit scheme on drink containers (Pantamera2, 2017). This is one of the reasons, why it will be interesting to explore the workings of this deposit scheme further and to compare it to another country's deposit scheme.

2.5 The Danish deposit scheme

Finding information about the Danish deposit scheme in the academic literature has proven to be quite difficult. As mentioned above, today's deposit scheme in Denmark was introduced in 2003 (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, 2014). However, as seen from the study by Fisher and Horton (1979), there was also something in place 30 years ago. The Danish deposit scheme is also considered to be among the world's best (Dansk Retursystem, 2016).

The deposit scheme in Denmark is regulated by the government and the ministry of the environment ('Miljøstyrelsen') (Dansk Retursystem4, 2017). This is similar to ABRS. DRS is a non-profit organisation (Dansk Retursystem6, 2017) that has been put in charge of the deposit scheme and not only enforces its rules, but also collects the bottles (Dansk Retursystem4, 2017). This makes the Danish deposit scheme different from the German one and similar to the Swedish one.

On DRS's website, it is stated that they seek to manage the deposit scheme at the best price possible and with care for the environment and their workers, they also continuously seek to optimise their operations (Dansk Retursystem4, 2017).

In Denmark, the level of deposit is based on the size of the bottle, its material and whether it is one-way or reusable (Dansk Retursystem7, 2017). There is also a deposit on metal cans (Ibid.). There are three different deposit signs for one-way containers: A, B and C – A is for 1.00 DKK, B for 1.50 DKK and C for 3.00 DKK (Ibid.), the division of these is as follows, as adapted from DRS's website (Ibid.):

Glass bottles – 1L	1.00 DKK
Metal Can – 1L	1.00 DKK
Plastic bottle – 1L	1.50 DKK
All bottles and cans with content of 2L -10L	3.00 DKK

Figure 3: Danish deposit levels for one-way drink containers

Reusable drink containers do not have a sign and are grouped as follows as adapted from DRS's website (Ibid.):

Glass bottles – 0.5L	1.00 DKK
Glass bottles + 0.5L	3.00 DKK
Plastic bottles – 1L	1.50 DKK
Plastic bottles + 1L	3.00 DKK

Figure 4: Danish deposit levels for reusable drink containers

For the purpose of this paper, I will focus on one-way plastic bottles mainly, as there seems to be a gap in the academic literature within this area. Additionally, littering of plastic is a big problem for the environment (McKie, 2016). Furthermore, I have found more information about how DRS manages one-way plastic bottles than reusable ones and additionally, it will be easier to compare it to ABSR in this way, as they are not in charge of reusable drink containers, but only of aluminium cans and plastic bottles, which are one-way.

To sum up this literature review, I have reviewed research on reverse supply chains and found that most researchers agree that this is both environmentally friendly and cost-effective in the long run. Furthermore, I have identified a gap in the academic literature as most research on reverse supply chains and reverse logistics covers return managements and not European deposit schemes of reusable or one-way packaging, such as drink containers.

Next I have explored the research, which has been done on deposit schemes both on packaging and on drink containers and I have found that most of this research is focused on the USA. Furthermore, the research, which is concerned with deposits on drink containers is quite old. In addition, this research investigates mainly the reusable drink containers and not the one-way ones like my paper will, further on.

I have ended this literature review by introducing how a deposit scheme on drink containers works today, by using the German deposit scheme as an example, as this seems to be the most researched deposit scheme in the academic and non-academic literature. Then I have introduced the Swedish and Danish deposit schemes, which I will explore further in the analysis of this paper, and I have pointed out their similarities and differences.

In the next chapter, I will introduce the theory, which I will use to analyse the findings I make from researching the online material of the Swedish and Danish deposit schemes and from the interviews with these organisations.

3. Theoretical framework: The Sustainable Supply Chain Management of a one-way plastic bottle with a deposit

After reviewing and analysing the academic and non-academic literature relevant to my paper, in this chapter, I will develop a theoretical framework with which I will analyse my findings. After this analysis, I will then be able to connect my findings to the literature in the discussion chapter.

In the following, I will first outline the general theory in the field of Supply Chain Management. I am doing this because, it is important to first understand all aspects of the supply chain in order to later analyse the implications, which deposit schemes on one-way plastic bottles have on it. Next, I will introduce the concept of Sustainable Supply Chain Management and develop a framework for the implications of the closed-loop supply chain of a one-way plastic bottle with a deposit. This framework presents three propositions, which I will seek to answer in the results chapter later on in this paper. Lastly, I will illustrate The Circular Economy and the open-looped sustainable supply chain of a one-way plastic bottle with a deposit, as it could look in theory.

3.1 Supply Chain Management and the theory of the supply chain

The Council of Supply Chain Management Professionals defines Supply Chain Management as follows (in Autry et al., 2013:9):

Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, SCM integrates supply and demand management within and across companies.

The Supply Chain Management processes outlined in this definition achieve value for both the organisation and the consumer (Autry et al., 2013). In order for this to work, all aspects of supply

chain management need to work together as a team. Autry et al. (2013) thus, argue that Supply Chain management is a: "[…] 'team sport' […]" (2013:14). Within this team there are many stakeholders at play.

According to Autry et al. (2013), Supply Chain Management is a determining factor for the success of an organisation. This is because it focuses on many aspects of business such as the business' product and service portfolio, its design and customer and supplier relationships (Ibid.). Furthermore, it is in an organisation's supply chain that the battle of consumer demand and supply is fought (Ibid.).

In today's world, organisations do not work in isolation. Not only are they connected to all parts of their supply chain in some way, but also across the globe to both partners and competitors alike (Klassen and Vachon, 2011). Stevens and Johnson (2015) argue that supply chain integration is the foundation of Supply Chain Management and is: "[…] characterized by 'joined up thinking, working, and decision-making' underpinned by principles of flow, simplicity, and the minimisation of waste […]" (2015:22). Furthermore, they argue that the supply chain is critical for gaining a competitive advantage with aspects such as differentiation through flexibility and cost (Stevens and Johnson, 2015).

The notion of integration between all parts of the supply chain including the consumer is an important aspect of a deposit scheme, as the whole supply chain needs to work well together to make this work. However, for this paper assessing every part of the supply chain would be too complex. Thus, it focuses on the Danish and Swedish organisations in charge of the supply chain of one-way plastic bottles with a deposit.

Carter et al. (2015) argue that there is a gap within Supply Chain Management theory, as there is little theoretical thinking and knowledge. In a recent article, they have sought to rectify that by presenting an idea of what the theory of supply chains could look like (Ibid.). They depict the supply chain as both a network with different relationships between different links of the supply chain; a Complex Adaptive System (CAS), which is self-organising, as it has limited visibility both on the upward and downward flow of the supply chain; as relative – a supply chain really consists of many supply chains; as both physical and supporting, because the supply chain both consists of the physical entities within it, such as the consumer and the organisations, but also of invisible support systems such as banks; and as having an undefined boundary (Ibid.).

I believe this depiction of the supply chain is very useful for my research, as the supply chain of a one-way plastic bottle with a deposit certainly is relative, as there are both the forward

flowing supply chain and the reverse supply chain. Furthermore, it is a CAS, as it is supposed to be self-organising and has limited visibility towards what happens with one-way plastic bottles with a deposit, which are not returned. Also, it has undefined boundaries, as it is not known how far the supply chain extends.

According to Autry et al. (2013), businesses are now entering an: "[…] 'age of supply chain management' […]" (2013:10), as the supply chain gains more importance and organisations have learned to work together between the different links of a supply chain to achieve their end goals.

Thus, effectively, Supply Chain Management is highly involved in the environment and has a range of responsibilities, as it includes and has influence on so many parts of an organisation and the complete life-cycle of a product or service (Autry et al., 2013). This is interesting to my research, as I believe that the supply chain of a one-way plastic bottle with a deposit has certain environmental implications. I am going to explore this issue further in the next section.

3.2 Sustainable Supply Chain Management (SSCM)

Recently, organisations have become more aware of the concept of *sustainability* and their own responsibilities towards the environment (Genovese et al., 2015). This is due to many reasons, such as the accountability to stakeholders of an organisation that has gained in influence and importance, the need to increase economic performance compared to both national and international competitors and the ability to create a competitive advantage (Ibid.). A stakeholder is defined by Freeman (2009), as any person with something at stake in an organisation. When sustainable practices are incorporated into an organisation, this is often defined as Corporate Social Responsibility (CSR) or corporate citizenship and in essence means doing good things, which benefit people and the planet (The Economist, 2008).

There are several branches of theory within this area such as Sustainable Supply Chain Management (SSCM), Green Supply Chain Management and The Circular Economy (Genovese et al., 2015). Overall, this paper will focus on SSCM and The Circular Economy.

Initially, I will define the concept of *sustainability* through Carter and Rogers (2008:361) as: "[…] an integration of social, environmental, and economic responsibilities […]". They state that since 2004, the publication of annual sustainability reports has started to become common place among global firms (Carter and Rogers, 2008). Carter and Rogers (2008) further argue that at this point in time, this was quite a new topic in business disciplines, where these social, environmental

and economic issues have mainly been discussed individually and not in connection with each other (Ibid.).

Carter and Rogers (2008) argue that this definition of *sustainability* is difficult for organisations to implement, as it is not very tangible. Accordingly they, furthermore, present other definitions, which are on a more microeconomic level and more tangible, such as the triple bottom line as developed by Elkington (1998, 2004 in Carter and Rogers, 2008). The triple bottom line is a microeconomic point of view of sustainability, which connects the environmental, social and economic aspects arguing that it is not enough for an organisation to act upon one of these, but that often a combination of two or more is required (Ibid.).

In their paper, Carter and Rogers (2008) question whether sustainable practices in an organisation lead to a better economic performance for that organisation compared to others, who do not have sustainable practices. They argue that it is important to note that actions that enhance social or environmental practices are only sometimes profitable (Carter and Rogers, 2008). The end goal of their paper is to develop a framework for SSCM, which is illustrated in Figure 5:

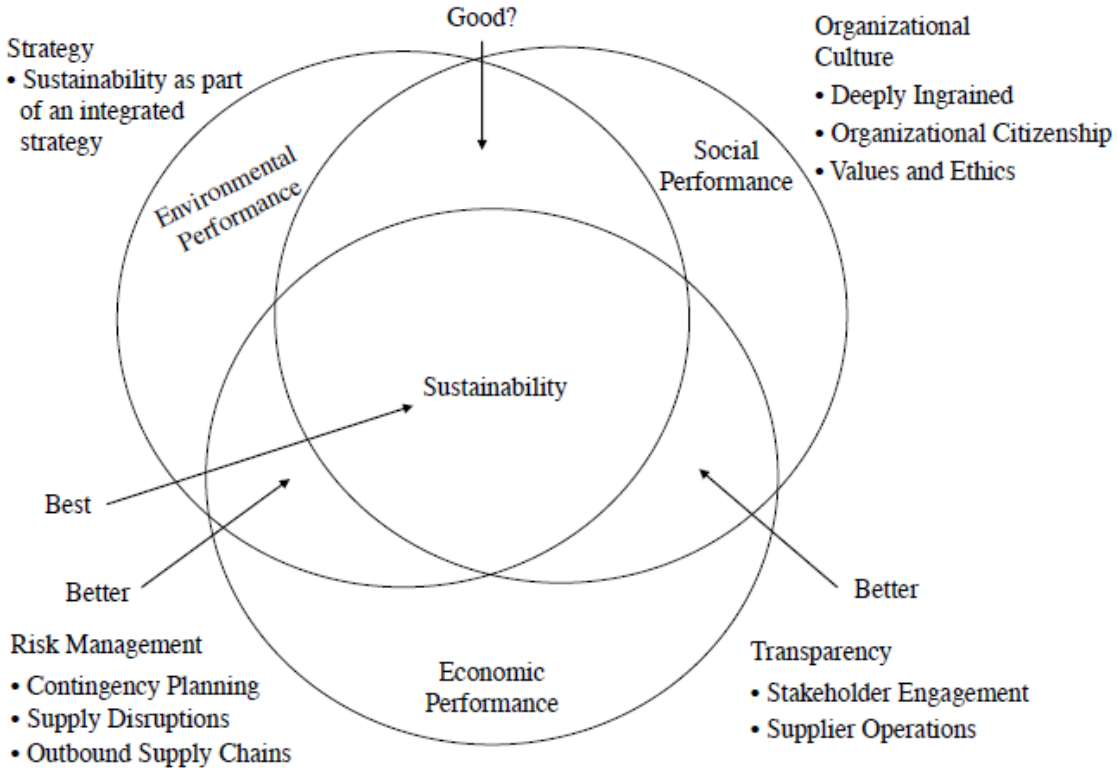

Figure 5: Sustainable Supply Chain Management (Carter and Rogers, 2008:369)

This framework is both inclusive of their own definition of *sustainability* and includes the triple bottom line. Additionally, the framework includes a number of supporting factors as illustrated in Figure 5. Among others, these include transparency towards stakeholders, as mentioned before. This transparency can be increased through relationship building along the supply chains both vertically and horizontally (Carter and Rogers, 2008). Other factors are risk management, strategy and organisational culture and these factors are equally connected as the triple bottom line concepts and are often interrelated (Ibid.).

The framework is also based upon the definition of Supply Chain Management by Mentzer (Ibid.) and Sustainable Supply Chain Management can thus be summed up as:

> *The strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key interorganizational business processes for improving the long-term economic performance of the individual company and its supply chains.*
> (Carter and Rogers, 2008:368)

It needs to be considered that an organisation's objectives are still at the heart of any operation, as laid out in the framework above. Organisations, which both consider the economic and another aspect are 'better', while it is questionable whether actions, which are social and environmental but not economic are worthwhile for an organisation (Carter and Rogers, 2008). Carter and Rogers (2008), thus conclude their paper by including certain challenges to sustainable practices: for instance, that organisations have already covered all the fast solutions for being more sustainable and then need to assess how their long-term strategies and objectives can be sustainable without compromising their objectives. However, due to the supporting factors mentioned above, among others, it becomes easier to put *sustainability* higher on the list of priorities (Ibid.). This is an interesting point, as, for instance, organisations such as DRS and ABSR have been specifically created to go the extra mile to be sustainable, it can be argued. Additionally, Supply Chain Management is a part of the organisation, where it is quite easy to be more sustainable. For instance, through implementing more efficient packaging (Ibid.). It can be argued that a deposit on one-way plastic bottles is a way to both be sustainable and increase the effectiveness of packaging – the plastic bottle – , as this packaging will ultimately be reused or recycled.

As illustrated in Figure 5, the 'best' behaviour is found when an organisation connects both social, environmental and economic aspects. Accordingly, as the deposit schemes have been created

to keep countries clean, manage waste and, thus, be environmentally friendly they must be 'best' with an interlinkage of all three aspects. This is because the economic performance needs to lie at the heart of any operation and there must also be some social aspects present in a deposit scheme. As the deposit schemes are very consumer dependent that is probably true. Furthermore in this case, it can be argued that of the supporting factors, only the transparency and engagement of stakeholders and the strategy of DRS and ABSR are relevant. This is based on the findings within the academic and non-academic literature stating that the deposit schemes both have a government mandate. I will be examining how and why DRS and ABSR collect the one-way plastic bottles and creates awareness around the deposit scheme and what its implications are for the supply chain.

Accordingly for this paper, I argue that the SSCM frameworks for DRS and ABSR could look like the following:

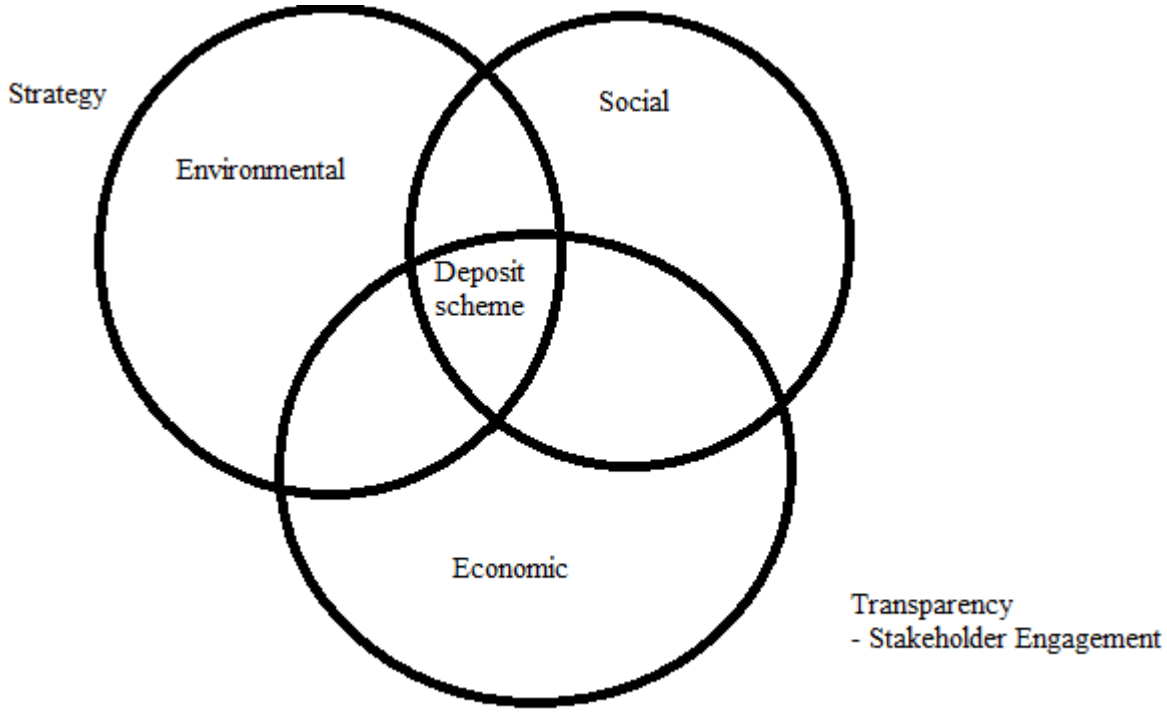

Figure 6: Sustainable Supply Chain Framework for a deposit on one-way plastic bottles

The framework above visualises, how I believe that I will find that DRS and ABSR operate their businesses. The basis of their operations is the deposit scheme and that is found interlinked between all three aspects. In the results section, I will analyse how dominant the three factors are within the

deposit schemes and what their implications are. In order to do this, I will seek to answer the following proposition:

P1: *A deposit scheme on one-way plastic bottles is Sustainable Supply Chain Management.*

There is a focus on *strategy*, which is to recycle one-way drink containers. *Strategy* is defined by the English Oxford Dictionary (Oxford University Press, 2017) as: "[…] a plan of action designed to achieve a long-term or overall aim […]" (2017:5), which in this case would be DRS's and ABSR's strategic objectives to run their organisations efficiently. Furthermore, a strategic objective for an organisation should be to gain a competitive advantage, as mentioned earlier. In order to do this, they need to be able to reach their economic goals. These possibly differ quite a lot between the two as DRS is a not for profit organisation. Still, even a non-profit organisation needs to make enough money to stay in business and, as mentioned above, these strategic objectives should still be at the heart of any sustainable business practices. This can be achieved through transparency towards and the engagement of stakeholders. Especially in the case of DRS and ABSR as these rely on several stakeholders such as stores and other customers, consumers and the government to run their business. Accordingly, I will establish this further through answering the following proposition:

P2: *A deposit scheme on one-way plastic bottles is good sustainable business.*

To sum up, I seek to compare my findings from the interviews and the two organisations' online publications to investigate whether their environmental and social practices are in alignment with their strategy and their economic performance. For this paper, I will measure the economic performance in economic feasibility, thus if revenues cover costs. This is due to the limited information that I have on the economy of DRS and ABSR. Additionally, I will through answering the propositions look into whether the deposit schemes are actually sustainable and how the environmental and economic implications are interlinked. This is because, the argument is made by Carter and Rogers (2008) that organisations, which incorporate sustainable practices perform better economically. Thus, in the case of DRS and ABSR it raises the question of what came first. My economic perspective in this paper will be that of economic feasibility.

3.3 The Circular Economy and the supply chain of a one-way plastic bottle with a deposit

Another concept within Sustainable Supply Chain Management is The Circular Economy, which includes the 3Rs of reduce, reuse, recycle (Ying and Li-Jun, 2012). This is seen as an ecological economy, which tries to change the waste of a product into a sort of renewable resource and thereby increases the knowledge of the environment and natural resources, which require protection, as the natural resources are not infinite (Ibid.). The underlining idea behind this concept is that our planet is a closed system, where extracted resources equal the amount of waste created within a certain time frame (Genovese et al., 2015).

Mahajan and Vakharia (2016) argue in their paper on waste management that the 3Rs do not only address environmental concerns, but also create jobs and thus generate economic growth. This is coherent with findings from the three studies on the Oregon bottle legislation reviewed in the last chapter. Mahajan and Vakharia (2016) have established a framework, which follows the whole life-cycle of a product and argue that according to their idea an organisation can either be reactive through reuse and recycling or be proactive through reducing (Ibid.). This is illustrated in Figure 7:

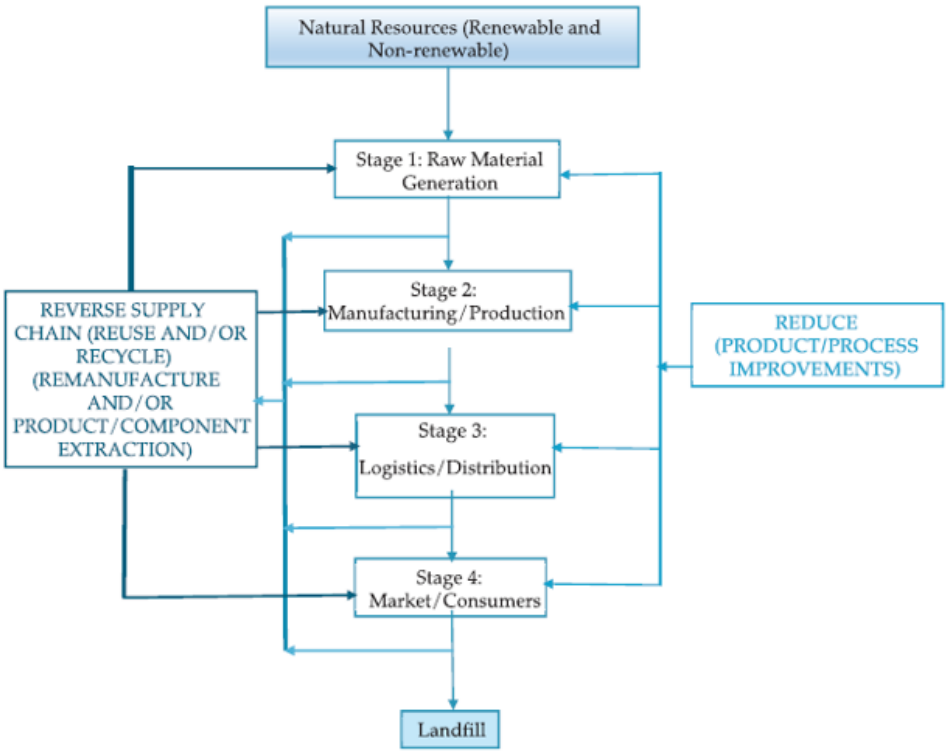

Figure 7: Cradle-to-Grave Framework (Mahajan and Vakharia, 2016:199)

This framework differs from the ones mentioned in the literature review of this paper, as it includes all of the 3Rs and focuses specifically on resources. Accordingly, it is the one which is probably most similar to the closed-loop sustainable supply chain of a one-way plastic bottle with a deposit. It could also be used for reusable drink containers. The reason why I choose to use this framework over the other two mentioned in the literature review is that it puts emphasis on that the decision of disposal lies with the end consumer, something which is very much the case for a plastic bottle with a deposit.

Genovese et al. (2015) argue, furthermore, that organisations can use The Circular Economy to gain a competitive advantage over other organisations. The Circular Economy is, thus, a form of extension of Sustainable Supply Chain Management as it seeks to reduce or delay the adverse effect on the environment due to a product's life cycle (Ibid.). Arguably, the introduction of a deposit scheme on drink containers is a form of a circular economy.

Effectively, Genovese et al. (2015) argue that The Circular Economy is trying to establish a system, which is self-sustaining. They, additionally, argue that the principle of the reverse supply chain is an implementation of the circular economy into Supply Chain Management (Ibid.). The argument that the system is self-sustaining is in alignment with my interpretation of the supply chain as a CAS, which is self-sustaining, as well.

As the supply chain of a one-way plastic bottle with a deposit is relative, I think it is important to illustrate, what this might look like. Mahajan and Vakharia (2016) have depicted a supply chain with both forward and reverse flows as illustrated in Figure 7. For a one-way plastic bottle with a deposit, this depiction can be adapted and would then look similar to the depiction in Figure 8. This framework is focusing on the reverse supply chain having the purpose of recycling, however if this was replaced with, for instance, repair, the framework could also be valuable for other reverse supply chains, such as those of return processes.

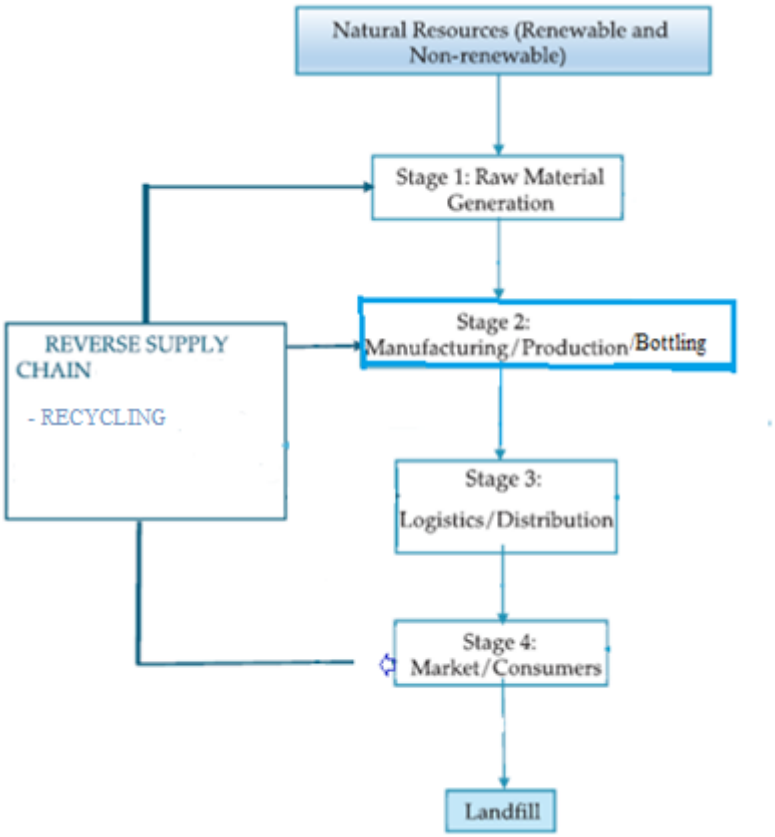

Figure 8: The closed-loop reverse sustainable supply chain of a one-way plastic bottle with a deposit

As illustrated in a simplified manner in Figure 8, the supply chain would rank from the resources required to the manufacturing of the bottle and the bottling of the drink to distribution and then to the market and the consumer. The consumer then effectively decides if she disposes of the one-way plastic bottle or takes it back for recycling, either way ends the life-cycle of the one-way plastic bottle with a deposit. The third proposition, which this paper seeks to answer is:

P3: *The sustainable supply chain of a one-way plastic bottle is a closed-loop reverse supply chain.*

3.4 The Sustainable Supply Chain Management of a one-way plastic bottle with a deposit

This chapter has examined the theory of the supply chain and has found that Supply Chain Management can be seen as team work, as it requires integration between all actors. Furthermore,

for this paper, I have identified a supply chain as being a CAS, relative and with undefined boundaries.

In this paper, I am investigating the SSCM, which has economic performance of an organisation at the heart of its operations, but also incorporates the other two other aspects of the triple bottom line: Environmental and social. Further on in this paper, I will research the SSCM of a one-way plastic bottle with a deposit through the three propositions raised in this paper. Additionally, I will also establish whether this is a circular economy and contains the 3Rs. Furthermore, I will investigate what the sustainable supply chain for this circular economy looks like.

To sum up, based upon the academic and non-academic literature reviewed and the theory introduced in this section the analysis of this paper is going to investigate, how the SSCM Framework presented in Figure 6 is indeed the basis of DRS's and ABSR's operations. Furthermore, it is going to assess whether the supply chain of a one-way plastic bottle with a deposit can be visualised as in Figure 8.

Based on this theoretical framework and by raising the three propositions:

P1: *A deposit scheme on one-way plastic bottles is Sustainable Supply Chain Management.*

P2: *A deposit scheme on one-way plastic bottles is good sustainable business.*

P3: *The sustainable supply chain of a one-way plastic bottle is a closed-loop reverse supply chain.*

I, thus, seek to answer the research question: *What environmental, social and economic implications does the deposit scheme on one-way plastic bottles have on their supply chain?*

The propositions number one and two address the implications mentioned in the research question Furthermore, proposition number three will identify the sustainable supply chain of the deposit scheme on a one-way plastic bottle and how the deposit scheme affects this supply chain. Therefore, I will be able to assess to what extent the organisations DRS and ABSR manage their supply chain and its implications and what effect this has on the Sustainable Supply Chain Management.

4. Methodology

In this chapter, I will outline the methodology and its philosophical background applied in this paper that seeks to answer the above-mentioned research question and propositions. The chapter will then explain how both quantitative and qualitative data is collected and why. Firstly, the comparative case study approach will be explained, secondly, data will be defined and the data collection through interviews and online resources will be explained. Thirdly, I will explain how I seek to analyse the data findings and lastly the philosophical background of this paper will be outlined.

4.1 Comparative case study

In this paper, I will utilise a case study approach. According to Saunders et al. (2012) a case study approach is a: "[…] research strategy that involves the empirical investigation of a particular contemporary phenomenon within its real-life context, using multiple sources of evidence […]" (2012:666). The Danish deposit scheme and the Swedish deposit scheme will each be a case study, which I will then be able to compare to one another to gain an insight into the deposit scheme utilised by both.

A case study approach is not a typical social science research approach, however according to Flyvbjerg (2001) that is only because it is underestimated as a research approach in the social sciences. He argues that the knowledge found from a case study approach, which after all is based on something concrete holds more value than predictions (Ibid.). It is also a holistic approach (Ibid.). Furthermore, Flyvbjerg argues that it is already possible to generalise based on one case study (Ibid.).

The Danish deposit scheme is different from other deposit schemes that I have read about and is, thus, an interesting and academically relevant case study of its own. Furthermore, based on my review of the academic and non-academic literature it has not been explored before. With this case study approach, I will be able to investigate the Danish deposit scheme within its own right. The Swedish deposit scheme is comparable to the Danish deposit scheme, as they only have few differences. As I have reviewed through the academic and non-academic literature it is, thus, also a case study of its own and in this way, I will be able to investigate it within its own right as well.

These two case studies will then be compared through a descriptive comparative case study. This can be done, because the deposit schemes are similar, but still have certain differences (Routio, 2007). With this descriptive research design, I will get an understanding of how the deposit schemes actually work (Saunders et al., 2012). Through the comparative case study I will be able to compare the two deposit schemes' different aspects. In the end, I will then be able to generalise based on my findings (Routio, 2007). This generalisation will be of an analytical nature. This means that the propositions made in this paper have been based on academic literature and theory findings and that they will either be verified or falsified by the results of my findings (Yin, 2010). Additionally, this then means that my propositions and theoretical framework if verified through these this comparative case study could well explain other deposit schemes examined (Ibid.).

Based on these two case studies, I can thus investigate what the implications of a deposit scheme on a plastic bottle are for the supply chain through the generalisations I have made. I can then answer my research question and then either support or dispute my propositions.

As mentioned above, a case study approach uses more than one data source and this is what my paper will do, as it will gather data both through interviews and through secondary data from DRS's and ABSR's websites and DRS's and ABSR's other online publications.

4.2 Data

In this research, I will collect both primary and secondary data. Bitsch Olsen and Pedersen (2008) define data as: "[…] an *ordered sequence of available details or events* […]" (2008:239). Secondary data is data, which someone else has already collected for a different purpose, while primary data is being collected for a new purpose (Saunders et al., 2012), such as in this paper. My primary data will be the interview findings. My secondary data will be mainly quantitative data, which I collect from DRS's and ABSR's websites and DRS's annual report from 2015. It needs to be mentioned that some of this data will be of the organisations' own marketing material.

As mentioned above my data collection, thus, comes from more than one data source, which is important in a case study approach.

4.3 Interview

In order to collect qualitative and also some quantitative data, which cannot be found through DRS's and ABSR's online resources, I will conduct two semi-structured interviews. One interview will be conducted with Jens Grønlund, Communications Consultant, from DRS. Unfortunately, at the time of submission no one in ABSR had yet responded to me regarding an interview.

The interviews will be focused, as I as the interviewer will guide the interview (Saunders et al., 2012), however they will be non-standardised and semi-structured, as I will ask eight key questions within which there is room for additional questions, which can be raised during the interview. The questions will be specific and probing as they will have a particular focus as defined by Saunders et al. (2012). For a full list of key questions see Appendices A and B in chapter ten.

Interviews are a good way to access information as they create a personal contact (Odendahl and Shaw, 2002). However, as unfortunately I am not currently local to either Denmark or Sweden the interviews will have to be conducted by email. I am aware that in this way I lose the ability to see the interviewees and to interpret their, for instance, body language (Saunders et al., 2012). Nonetheless, I in this way will still get access to valuable information, which I would possibly not be able to get access to otherwise.

After an email interview, I will be able to send a follow up email in case of any additional questions or to clarify any uncertainties. The interview with Jens Grønlund of DRS was conducted via email, where I sent him the questions, which he then answered. After receiving his answers, I sent him two follow up questions in Danish to clarify recent findings, these are outlined and translated in Appendix C. However, by the time of submission, he had not yet responded to my follow up questions.

As this paper is written in English both interviews' interview questions will be written in English. Jens Grønlund of DRS chose to answer the questions in Danish and I have then translated his replies to English, as can be seen in Appendix D.

In chapter five of this paper, I will then first objectively describe my interview findings. Afterwards I will interpret the findings in comparison with the findings from the interviewee's online resources. I will do this separately for each case. Subsequently, I will compare the findings from both cases in order to generalise in chapter six.

4.4 Analysis of Data Findings

In chapter five of this paper, I will describe and analyse the data findings. First, I will describe them each one by one and afterwards I will analyse them together. I can do this, as the two forms of data: Secondary and primary, either complement each other or can give me information, which the other cannot. It could also be that they contradict each other and thus, give me greater insight into the organisations' behaviour. In the case of DRS, I have found that the two data sources complement each other.

After the initial description in chapter five, I will analyse the respective national data findings combined and then combine the findings for the two deposit schemes in chapter six to analytically generalise from these findings towards the deposit scheme.

As mentioned, some of the secondary data is presented by the organisations themselves for mainly marketing purposes, accordingly they might have been very generous in their descriptions of themselves or they may have left certain things out. Therefore, I have to analyse this data critically. Analysing something critically means to evaluate thoroughly from every angle and to not believe everything, which has been written, in this case, by an organisation (Gould, 2011). If secondary data found seems to be unrealistic or in the case of the two organisations' websites too much in praise of their businesses, it needs to be further evaluated to see if the statements given are really true (Ibid.).

Additionally, I have standardised my searches through the secondary data to the extent that I look for data, which can answer or falsify my propositions and which is related to the SSCM framework as depicted in Figure 6 in order to try and understand how this framework fits into practice.

4.5 Philosophical Background

There are two well-known research approaches, which are deduction, this is researching something based on theory and then induction, which is the opposite – basing theoretical ideas on research findings (Saunders et al., 2012). This paper will mainly be deductive, as it will try and deduce from the general academic and non-academic literature found and theoretical framework developed onto the specific case at hand and in this way, evaluate the proposed propositions as mentioned by Saunders et al. (2012), but it will also be inductive, as it seeks to generate new theory after analysing and analytically generalising from the research findings.

In business and management research, there are four main research philosophies: Positivism, realism, interpretivism and pragmatism (Ibid.). A research philosophy is related to a researcher's ontology and epistemology (Ibid.). A researcher's ontology explains, how this person views reality, which can be either subjective or objective or both, whereas a researcher's epistemology is concerned with knowledge and whether or not this is satisfactory for the field of research (Ibid.).

This paper will utilise some positivism, as a philosophical background for its methodology, when assessing the quantitative data that will be found in the annual report of DRS or on the websites of DRS and ABSR. However, this paper is mainly qualitative in its data collection, as I believe that the field of Supply Chain Management within the broader field of business management cannot only be assessed through numbers.

My main philosophical background for this paper, is thus that of critical realism. Critical realists argue that we merely experience an image of how things really are and not the actual thing itself (Ibid.). Consequently, everything is a part of a greater context (Ibid.). In this paper, this will become apparent through the investigation of the deposit schemes, as these are part of the whole society and do not stand alone. Critical realists are objective, however as a critical realist, one is aware that a thing cannot be understood without considering the social world and structures around it and thus, how we see reality is dependent on these social structures and actors (Ibid.). I believe this is important in the cases of the operations of Dansk Retursystem and AB Svenska Returpack. A critical realist's epistemology is that knowledge needs to be found within the whole context of a situation as there otherwise can be misinterpretations (Ibid.). The ontology of a critical realist is, objective, however it is understood through the social conditioning mentioned. (Ibid.). This will be relevant in my data collection, as this is made with different people and through different publications from different national contexts and for different audiences. Additionally, this epistemology is important in the critical analysis, as it will remind me to put myself in the organisations' place and to understand why and how they have written something on their website and how this relates to the social context – the bigger picture (Ibid.).

Furthermore, as a researcher I am aware of concerns regarding reliability and validity of research findings. Accordingly, I will standardise my questions and searches on the websites and in publications of DRS and ABSR as much as possible in order to secure the quality of my data findings as advised by Saunders et al. (2012).

To sum up this chapter, in this paper I seek to compare the case of the Danish deposit system with that of the Swedish deposit system in order to analytically generalise my findings and answer my research question and my propositions. To examine each case, I will collect both quantitative and qualitative data through interviews and searches on online resources of DRS and ABSR. I will do this in a well-prepared manner to avoid any bias and I will analyse all findings critically.

5. Analysis

In the following chapter, I will present my findings from DRS and ABSR and analyse them according to the theoretical framework presented in Figure 6 in chapter three. I will do this for each case separately starting with DRS and will then combine the findings in the next chapter in order to answer my propositions about the supply chain of a one-way plastic bottle with a deposit.

5.1 Dansk Retursystem (DRS)

In this section, I will first present the findings I have made in DRS's online publications, the annual report from 2015 and the interview in two subsections. Afterwards, I will test them against the theoretical framework established in this paper.

5.1.1 Secondary Data

DRS is a not-for-profit environmental organisation, which has 480 employees (Dansk Retursystem, 2016). The organisation tries to hire employees from all backgrounds and has a special focus on gender, disabilities and refugees (Ibid.). The organisation was established in 2000 as a limited corporation (Ibid.). It has four main owners, which are breweries (Ibid.). DRS is regulated by the government (Ibid.). The board is, among others, made up of members from commerce, some of which have high ranking supply chain positions in their own organisations (Ibid.).

DRS's annual report from 2015 states that the Danish deposit scheme for drink containers is among the best in the world (Ibid.). Their return quota is that nine out of ten one-way drink containers (this includes both plastic and glass bottles and cans) get returned. With 1.1 billion drink containers a year this is their highest quota since the organisation was established (Ibid.).

In the Danish market, there are 23,000 drink containers with a deposit on them (Dansk Retursystem5, 2017). Additionally, of new one-way drink containers introduced into the Danish market another five per cent of new drink containers have a deposit on them (Dansk Retursystem, 2016). There is also a deposit on drink container cases, such as beer cases (Dansk Retursystem3, 2017). DRS has a monopoly on the deposit scheme of one-way drink containers in Denmark and their aim is to have as many returned as possible and to constantly render the scheme more efficient and easier to use by customers and consumers (Dansk Retursystem, 2016).

In DRS's annual report for the year 2015 it becomes quite clear that the organisation focuses greatly on the environment as they state that their work with the deposit scheme decreases the amount of discharge water used and CO_2 emissions released into the environment (Ibid.). Furthermore, it is argued that it is much more expensive to produce new drink containers instead of recycling them (Ibid.). Early this year, DRS was given the Danish 'green purchaser of the year' award (Dansk Retursystem1, 2017).

The 2015 annual report states that despite being an environmental organisation, DRS is concerned with more items then the climate, energy and natural resources with all parts of its operation on the agenda (Dansk Retursystem, 2016). They argue that they focus on all of their both local and global supply chain, which is why their operation is an example of a working circular economy (Ibid.).

DRS is financed in three ways, as mentioned earlier: Firstly, the returned one-way drink container's material is being sold for refurbishing and DRS gets the profit from the sale; around 10 per cent of one-way drink containers are not being returned and after deducting an amount for the Danish government, DRS keeps those drink container's deposits to run the deposit scheme; and any manufacturer and also importer, who wants to sell a drink container with a deposit scheme pays an annual fee to DRS (Dansk Retursystem6, 2017).

It is DRS's aim to collect and sort all one-way drink containers and they currently do this for free for 15,000 places all over Denmark (Ibid). The organisation has an annual turnover of 1.7 Billion DKK (Ibid.). In 2015, there was a small profit of one million DKK, thus slightly above the organisation's breakeven point, where revenues equal costs (Ibid.). Since 2011, DRS's annual turnover has grown every year, as illustrated in Appendix E (Ibid.).

DRS follows a circular economy business model as presented in Figure 9:

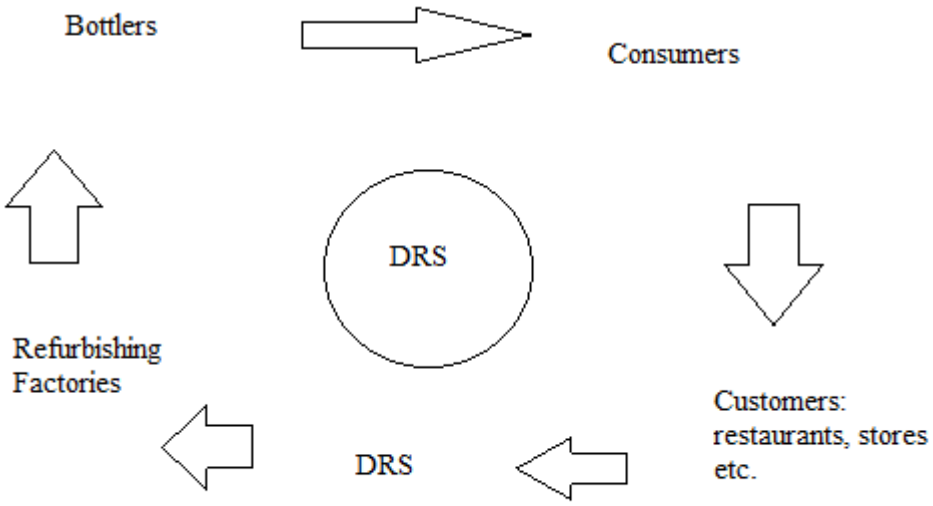

Figure 9: The circular business model of Dansk Retursystem (as adapted and translated from Dansk Retursystem, 2016:9)

In this business model, the whole closed-loop reverse supply chain of the one-way drink containers is represented (Ibid.): From the producers bottling the drinks; to the consumers buying them; to the customers, who handle the drink containers before and after use: to DRS picking them up; and to the factories, where they are being refurbished (Ibid.). DRS has one factory in Jylland and one on Sjælland (Dansk Retursystem2, 2017).

Furthermore, DRS depicts their place in the circle of society-economy-environment:

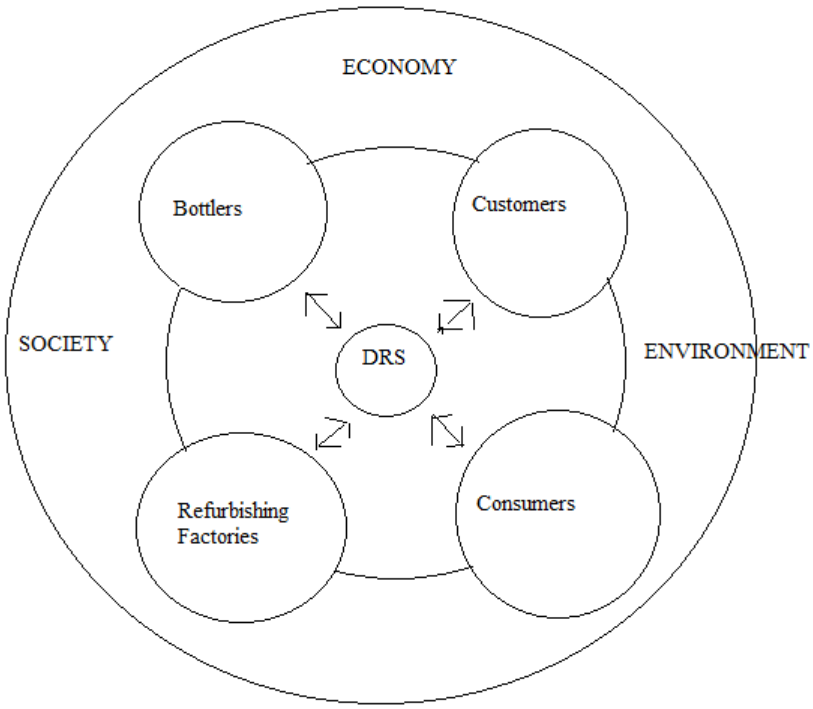

Figure 10: Dansk Retursystem within society-economy-environment (as adapted and translated from Dansk Retursystem, 2016:10)

This depiction places DRS in the middle of the three spheres with from the top their customers, who get empty one-way containers returned and the consumers, who know their one-way drink containers are recycled, because of the deposit sign on the right side and the bottlers, who register their one-way containers with DRS and the refurbishing factories, who refurbish the recycled one-way containers to the high standards of DRS on the left side (Dansk Retursystem, 2016).

A significant item on DRS' agenda is their recently developed 'Strategi2020' (Strategy 2020) within this they want to take the deposit scheme to the next level and emphasise the circular economy even more by focusing on all actors and getting closer to both their customers and the consumers of the drink containers under the slogan: "We can get even better together" (Ibid.). The strategy furthermore encompasses to further develop the deposit scheme and the technology behind it and is geared to expect growth (Ibid.). However, the strategy does not yet mention the expected deposit scheme for the Danish-German border region (Ibid.). Instead they focus on further developing the market for one-way drink containers in the rest of Denmark (Ibid.).

Other parts of the strategy include the consumers and customers of DRS, In 2015, DRS has had an analysis of the consumption patterns of these actors performed and this analysis has come to the following conclusions: The knowledge and acceptance of the Danish deposit scheme is high

among these actors; however, the deposit scheme's value for the environment and knowledge of DRS and of the fact that DRS is the leading Danish circular economy is almost non-existent (Ibid.). In conclusion to this study, DRS wants to create a better visual identity, which is customer and consumer facing by enhancing their marketing campaigns and the material they have available for consumers and school children (Ibid.). Furthermore, they want to focus on diversity and engagement of all actors (Ibid.). One way to further their new strategy, is to get CSR-certified under the Danish DS4900, which they are working on to achieve by 2017 with a focus on people, environment and economy (Ibid.). The Danish CSR standard is equivalent to the international ISO26000, which explains how an organisation can incorporate social responsibility (ISO2, 2017). Additionally, DRS will increasingly rely on wind energy for their operations and wants to develop more information for children (Dansk Retursystem, 2016).

As part of DRS's 2015 annual report they evaluate risks that they might encounter in 2016 (Ibid.). Here they mention both the upcoming deposit scheme in the Danish-German border region, the fee, which they pay to the government and the evaluation of their monopoly, which is coming up in 2016 (Ibid.).

DRS explains in their online material for school children, how one-way drink containers can live forever, if they are returned for refurbishing (Dansk Retursystem, 2015). They argue that this is the way forward as it uses less energy and saves on natural resources, which the planet is otherwise struggling to keep up with producing (Ibid.). Additionally, they argue that the deposit serves as a kind of reward to the consumer, when they return the used drink containers (Ibid.).

5.1.2 Primary Data

The interview with Jens Grønlund from DRS was done online via email. I sent him the questions and he answered them for me. I then sent some follow up questions after reading and analysing his initial responses.

To sum up the interview findings which are presented in Appendix D, Jens Grønlund argues that the Danish deposit scheme reduces plastic waste through reprocessing it on a high level. Furthermore, he argues that Dansk Retursystem's operations are sustainable as they reduce the CO_2 emissions and save natural resources. He also referred to DRS's website and a lot of questions were actually answered through information on the website and those issues are thus outlined in the previous subsection.

5.1.3 Analysis of Dansk Retursystem

The findings in the above subsections clearly point in the direction that Dansk Retursystem sees itself as an environmental organisation with a clear environmental focus to protect both the climate and raw materials. Additionally, its recycling of plastic reduces plastic waste.

DRS has a state monopoly, as only they are mandated by the Danish government to manage the Danish deposit scheme and thus, there are no other competitors in the market. According to DRS, their return quota of 90 per cent is quite high, however that still leaves 10 per cent of drink containers unreturned. DRS, though, is financed both through the sale of recycled material and the deposit of drink containers, which have not been returned. This seems rather paradoxical in my opinion. In their annual report, DRS described how its revenues covered its costs in 2015 and thus, the organisation's deposit scheme seems to be economically feasible.

Dansk Retursystem emphasises that their focus goes beyond the environmental to the whole supply chain and that they are a good circular economy – in fact, the best in Denmark, they say. If I compare Figure 8 of the closed-loop supply chain of a plastic bottle with a deposit scheme to Figure 9, which represents the Circular Business Model of Dansk Retursystem, these are quite similar. However, Figure 9 is less detailed, but it does emphasise on the consumer's decision to return.

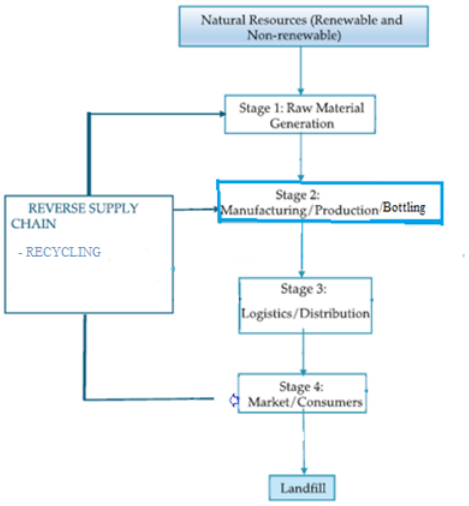

Figure 8

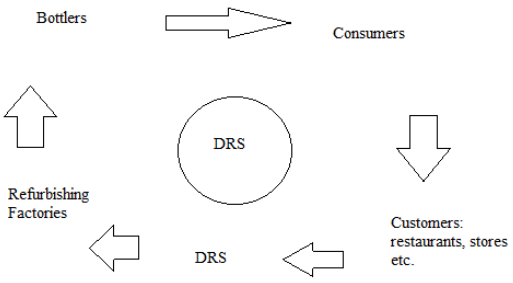

Figure 9

DRS argues that they are concerned with both the global and local supply chain of their organisation, however, Figure 9 only goes as far as the bottlers and does not explain how one-way

drink containers go from DRS to the refurbishing factories or how they get from bottlers to consumers.

In the new strategy for 2020 as presented in Dansk Retursystem's annual report for 2015, the organisation puts a further emphasis on all stakeholders and their involvement in the deposit scheme. For this purpose they have even developed a new slogan. These stakeholders are depicted in Figure 10 as the manufacturers, customers, consumers and recycling factories. Furthermore, Dansk Retursystem studied consumer perception and found that there is currently little knowledge among the consumers of Dansk Retursystem and their operations. Thus, the new focus, including all three spheres is in alignment with the triple bottom line. Wherefore, all circles in Figure 6 are accounted for and thus, the Danish deposit scheme seems to be 'best' involving all three aspects in its operations.

This new focus is also supposed to be emphasised by achieving CSR-certification with Dansk Retursystem as an organisation involved in people, environment and economy. Accordingly, Dansk Retursystem is going to great lengths to include the social into their business and hence, making their business even more 'best', supposedly, in order to keep their government mandate.

At the moment though, even though the societal sphere is included in Figure 10, this is not very visible in Dansk Retursystem's operations. Additionally, it is questionable whether the positioning of the actors in the different spheres, is really were they should be positioned. The annual report for 2015 also mentions risk, however this is only an awareness of risk and no risk management, as seen by the example of the new deposit scheme in the Danish-German border region that is underway, but which DRS does not yet want to account for. Arguably, this might increase the demand for one-way container returns.

5.2 AB Svenska Returpack (ABSR)

In the following subsections, I will present findings from ABSR's online publications. There is no annual report available on their website, but there are other publications, which contain similar data, which I will present here. Subsequently, I will test the findings against the theoretical framework established in this paper.

5.2.1 Secondary Data

It is ABSR's goal to have 90 per cent of all one-way drink containers with a deposit recycled. In 2016 this quota was at 84.9 per cent (Ibid.). This is made up of a return quota for one-way aluminium cans of 86.2 per cent and a return quota for one-way plastic bottles of 82.5 per cent (Pantamera10, 2017). This is an amount of almost 1.8 billion one-way drink containers returned annually (Pantamera4, 2017). The one-way drink containers have a deposit of either 1 SEK or 2 SEK depending on make and size and can be returned as long as the deposit label is readable and not damaged (Pantamera15, 2017). Each year 35,000 tons of one-way drink container material is collected and then shipped to the factory in Norrköping. This number is made up off 15,000 tons of aluminium and 20,000 tons of plastic (Pantamera3, 2017).

This is environmentally friendly according to ABSR, as recycling aluminium uses 95 per cent less energy than producing new aluminium (Ibid.). The environmental savings, which ABSR achieved for 2014 are depicted as follows:

	kWh / piece	CO_2 / piece
Plastic 1 SEK	0.13	0.03
Plastic 2 SEK	0.24	0.06
Can	0.21	0.34

Figure 11: Energy Savings through recycling of one-way drink containers in 2014 (adapted from Returpack, 2016:2)

ABSR argues that their work is important mainly due to the environmental motivation (Pantamera1, 2017). They argue that their business is a recycling system, which does not only save energy and reduces pollution, but which is also sustainable, environmentally friendly and effective (Ibid.).

Additionally, it is argued that the system, which has a deposit as an incentive makes sure that clean recycled material stays in the circle of becoming new food packaging (Ibid.), thus the system saves resources as less new packaging needs to be created. The system is depicted in the following way:

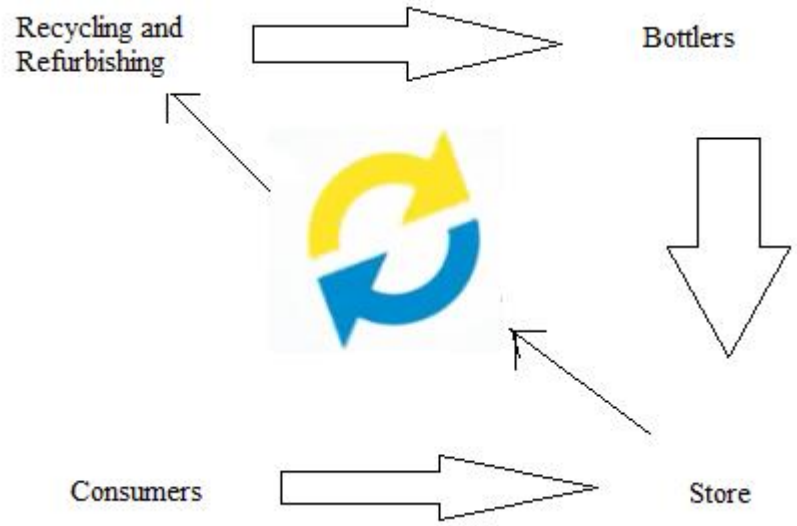

Figure 12: The AB Svenska Returpack recycling system (adapted and translated from Pantameranu, 2012:1 m 40 s)

In this system, the consumer returns the one-way drink container to the store, which is then through ABSR sent to be recycled. The recycled material becomes new plastic or aluminium drink containers, with in the case of plastic bottles only a minimum of new plastic added (Pantameranu, 2012), and is sold to the bottlers, who refill the drink containers and again sell them to the stores. ABRS is mainly financed through the sale of their recycled drink container materials (Returpack, 2016). This recycling and refurbishing process is also depicted separately for one-way aluminium cans and one-way plastic bottles in the following cycle:

Figure 13: The Recycling cycle for cans and plastic bottles (Pantamera14, 2017)

It is ABSR's vision to contribute to a sustainable cooperation, which creates the best deposit scheme in the world (Pantamera17, 2017). This is done with a focus on the environment through decreasing waste and pollution (Ibid.). Furthermore, this is achieved through a creation of sustainable relationships with all stakeholders and also, ABSR states that they have a social responsibility to inform all stakeholders of their activities and how they can contribute best (Ibid.).

ABSR had 62 employees and an annual turnover of 2.46 billion SEK in 2014 (Pantamera19, 2017). Unfortunately, there is no more recent data publicised. Furthermore, ABSR argues that when it comes to their employees they value both mutual commitment and diversity (Pantamera17, 2017). Since 2010, the turnover has been increasing annually (Returpack, 2016) as illustrated in Appendix F. However, as there is no annual report published by ABSR, there are no further numbers available, which mention the profits or similar of the Swedish deposit scheme.

In 2014, ABSR won a special price for their work at a Swedish Recycling gala ('Återvinnings Galan') (Pantamera16, 2017). Additionally, they aim at further making it more and more accessible to return drink containers with a deposit scheme (Ibid.). Also, they are CSR-certified through the international standard ISO 14001, this was giving to them due to their work being cost effective and as environmentally friendly as possible (Pantamera6, 2017). The standard focuses on environmental management (ISO1, 2017).

When a drink container is returned to a store, they are first shrunk in the drink container collection machines. Then they are being crushed, when they are loaded into the truck, which transports them to the factory in Norrköping, this is done in order to decrease transportation time and energy usage (Pantameranu, 2012). At the factory, the barcode of each drink container is scanned so that the deposit money can be allocated accordingly between the bottlers, who sold the drink container and the stores, which sold it further or have had it returned (Ibid.).

On the website of ABSR, there are both a portal for customers (Pantamera12, 2017) and a web shop to buy drink container with a deposit scheme collection bins or bags (Pantamera18, 2017). As a consumer, you can investigate how many drink containers with a deposit your own local authority has been returning in 2016 (Pantamera13, 2017).

ABSR takes part in and/or organises a range of social activities, such as sports events; anti-bullying campaigns; and environmental activities, such as clean up days (Pantamera7, 2017). Additionally, part of their website and information spreading campaign is aimed at school children with special publications, videos and competitions (Pantresan, 2017). Some of this environmental campaigning and the creation of material for school children is done in cooperation with the

environmental organisation ‘Håll Sverige rent’ (Keep Sweden clean), which ABSR has helped to create (Pantamera8, 2017). In some of this material the deposit is explained as being the *engine* behind the whole recycling system (Björnfot, 2014.)

5.2.2 Analysis of AB Svenska Returpack

The findings presented in the above subsection indicate an awareness of all three aspects of the triple bottom line: Environmental, social and economic. ABSR emphasises repeatedly how their business is environmentally friendly as it saves energy and decreases CO_2 emissions and as the organisation puts effort and time into organising environmental activities to keep the country clean, this is clearly a priority. However, the economic side of the deposit scheme has not been publicised online and since, unfortunately, I did not receive responses to my interview question by the time of the submission of this paper, I have no clear knowledge on the Swedish deposit scheme’s feasibility. In February, the organisation has been given the CSR-certification ISO 14001 with the remark that the business is cost-effective. This is one sign that the organisation must be doing well economically. However, the standard is in the environment category and does not mention social aspects.

ABSR states that their organisation is effective and sustainable, which is in coherence with the above. Additionally, they focus on having a sustainable relationship with all their stakeholders and argue that they have a social responsibility to inform and create commitment from them. This social aspect seems to be quite a big part of their work as well. As is further visible in there being a tool on the website to investigate how one’s own local authority is performing when it comes to returning drink containers with a deposit, through sport’s sponsorships and through the other social activities that ABSR is in charge of. Accordingly, ABSR encompasses all aspects of the triple bottom line in their operations.

The depiction of the life cycle of one-way drink containers in Sweden, as seen in Figures 12 and 13, only focuses on the reverse supply chain and not on the whole loop, as seen in Figure 8 with a clear focus on how the recycling is done as seen in Figure 13. This depicts a circular economy for the drink container material, which is recycled an infinite amount of times without losing any of the plastic.

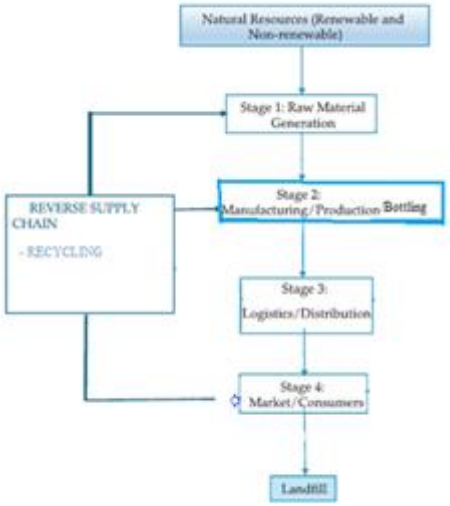

Figure 8

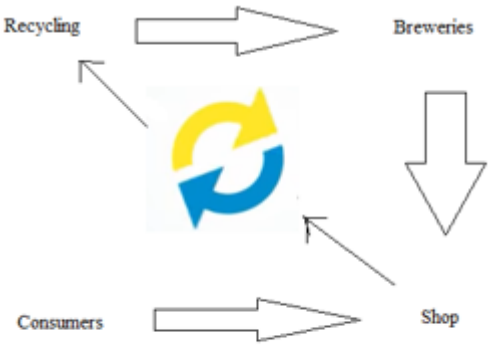

Figure 12

Figure 13

Accordingly, the focus of ABSR is quite clearly on the environmental friendly aspects of their operations, which is also stated through their website, as it says that for consumers the environmental motivation is one of the most important reasons to return drink containers with a deposit.

6. Results: The deposit scheme and its implications on the supply chain of a one-way plastic bottle

In the following section I will compare the analyses made on the Danish and Swedish deposit system in order to get a more general picture of the supply chain implications of a deposit scheme for one-way plastic bottles.

I will answer each of the three propositions raised in chapter three individually. The first proposition I will divide in two parts: Environment and social. This is done in order to fully cover each aspect of the SSCM framework presented in Figure 6. In the end of this section, I will sum up my results by generalising how the SSCM framework on one-way plastic bottles seems to be based on theory and on practice findings.

6.1 P1: *A deposit scheme on one-way plastic bottles is Sustainable Supply Chain Management*: Environment

DRS states that it is an environment organisation and despite ABSR not stating this explicitly, they still focus on the environment quite strongly. Both organisations are very concerned with CO_2 emissions and are trying to keep these down. Furthermore, they both argue that the deposit schemes save energy and resources. This is also emphasised in the academic literature by, for instance, Mahajan and Vakharia (2016). ABSR even depicts the energy and CO_2 emissions savings in Figure 11 of this paper. Next to these savings both organisations also argue that the deposit schemes reduce plastic waste, as this is recycled and put into a circle of life of food packaging or other plastic packaging if contaminated (Dansk Retursystem, 2016). This was also a research finding of Peaker's study on the Oregon bottle legislation (1975).

ABSR has several environmental initiatives, which it supports and/or has created such as 'Håll Sverige rent' (Keep Sweden clean). Additionally, ABSR argue that the environment motivation is what makes the Swedish people recycle their one-way drink containers. DRS also knows that there is an environmental motivation to the recycling of drink containers. However, through their consumer analysis, it became clear that these are not really aware of this benefit of the scheme. Accordingly, DRS now plans to rebrand itself as part of its strategy for the next three years. ABSR already performed this rebranding through the name Pantamera, which is the consumer facing name used in all promotional material.

To sum up, the environmental implication for the supply chain of a one-way plastic bottle with a deposit is that it is environmentally friendly and thus, the environmental link in the SSCM framework is quite strong. This is because, the one-way plastic bottle with a deposit is being

recycled and is thus part of a circular economy that saves energy, resources and reduces waste. Accordingly, the closed-loop supply chain of a one-way plastic bottle with a deposit is self-sustaining and relative as it contains all the circles or supply chains as explained above, as predicted in the theory chapter.

6.2 P1: *A deposit scheme on one-way plastic bottles is Sustainable Supply Chain Management*: Social

The findings in chapter five reveal that the deposit schemes also have social implications, which are quite dominant. Both organisations value diversity within their group of employees and ABSR emphasises that employees should be committed to the organisation and the organisation to its employees. ABRS has a great focus on social activities and often in its online publications emphasises on the importance of all stakeholders to make the deposit scheme work. DRS has also recently decided to put greater focus on all its stakeholders with its new slogan: "We can get even better together" (Dansk Retursystem, 2016:4). Additionally, they depict themselves as seen in Figure 10 as part of both the society, environment and economy. This is interesting as both organisation have had to plan some rebranding in order to be more consumer facing.

Many of both organisations' online publications focus on school children and DRS is going to further evolve this in the future. Thus, it can be argued that both organisations think that consumers need to be trained from early on to accept and use the deposit scheme. When it comes to the deposit, it is quite interesting how both organisations explain that it works as an incentive. However, Swedish children learn that the deposit is also the *engine* of the scheme and Danish children learn that it is a kind of *reward*. Both of these depictions place great value on the deposit and arguably, the deposit schemes would not work without it.

As part of their new strategy DRS plans to become CSR-certified by the end of this year under a Danish standard of social responsibility. Sweden has become CSR-certified earlier this year with an environment management standard. There is a difference here, as DRS wants to get certified across the whole triple bottom line, while ABSR has been certified solely on the environmental level. However, they already have a lot of social activities in place.

6.3 P2: *A deposit scheme on one-way plastic bottles is good sustainable business.*

This paper seeks to determine the economic feasibility of a deposit scheme on one-way plastic bottles as in the case studies of Denmark and Sweden. By economic feasibility I mean, whether the revenues of the deposit scheme are equal to or higher than its costs.

Both DRS and ABSR are mandated by the government to manage the national deposit schemes. DRS is in charge of both the one-way drink container and the reusable drink container deposit schemes and ABSR only of the one-way deposit scheme. As such DRS has a monopoly and even though it is not explicitly stated, I argue that this counts for ABSR as well. In the case of a monopoly, there are no competitors in the market and the economic performance is a bit different than to other businesses. It seems like both organisations are, thus, state monopolies as they have a mandate from their respective governments. Accordingly, there is no incentive and probably no opportunity for any competitors to even enter the market.

ABSR's operations are divided between the one-way plastic drink containers and the one-way aluminium cans and thus, they have individual return quotas for each material as well as one, which incorporates both materials. This is unlike DRS, who have only one return quota for three materials and there is no transparency for the different materials.

Furthermore, DRS is a non-profit organisation. In the 2015 annual report it is stated that DRS made a profit of one million DKK (see Appendix E) and thus, has a healthy business according to them. However, this profit has been declining over the last few years (see Appendix E). Additionally, DRS expects growth in the market of one-way drink containers. Unfortunately, in the case of ABSR, there is no information on profits available and the organisation has no statements anywhere explaining the healthiness of their business. Since the organisation received its ISO CSR-certification earlier this year though, partially based on being cost-effective, I would argue that their business is probably economically feasible.

In order to find the interlinkage between the environmental and the economic performance to answer the question of which came first as raised in the theory chapter, in this case the environmental performance quite clearly came first, as it is only per government laws and mandates that this deposit scheme has come into place.

To sum up, the economic implication for the supply chain of a one-way plastic bottle with a deposit is that it seems to be good sustainable business as expected in the second proposition. Based on the DRS findings at least, it is clear that the deposit scheme's income does cover its expenses,

which makes it economically feasible. However, as both organisations have a monopoly, it is not through stakeholder engagement that this is the case, but through the fact that they are the only organisation in this competition free market. Accordingly, it can be argued that this would not be the case in a free market, where perhaps revenues would not cover costs.

Additionally, the numbers publicised by ABSR are not conclusive as to whether their income covers their costs. Furthermore, with decreasing oil prices, the price that the organisations get for their recycled one-way plastic drink containers has been decreasing in the last two years, as new plastic material, which is made mainly of oil, has become cheaper (Dansk Retursystem, 2016). The price of aluminium can be fixed in a one year contract, but this is not the case for plastic (Ibid.). This can have an implication on the economic feasibility of these two organisations in the future.

6.4 *P3: The sustainable supply chain of a one-way plastic bottle is a closed-loop reverse supply chain.*

As I have already outlined in chapter five, neither of the two organisations has a clear supply chain depiction of their whole operation. DRS, however, is clearly aware of its operations being part of both local and global supply chains, and themselves and their organisation being a circular economy. ABSR also depicts a circular economy, but only on the closed-loop of the packaging, where it is explained that the clean recycled one-way drink containers stay in a circle of food packaging for an infinite amount of time. According to themselves, both organisations have a high return rate of one-way drink containers with 90 per cent for Denmark in 2015 and 84.9 per cent for Sweden in 2016, thus their reverse supply seems to work. Consequently, the predictions made by Glock (2016) that the future of returnable items is uncertain, seems to be less of a case here. However, there is still a 10 per cent of one-way drink containers in Denmark and a 15.1 per cent in Sweden, whose future is uncertain, as we do not know, what happens to those.

Figure 8

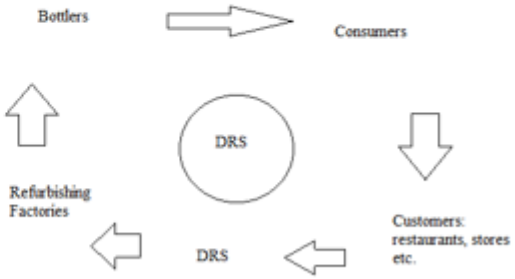

Figure 9

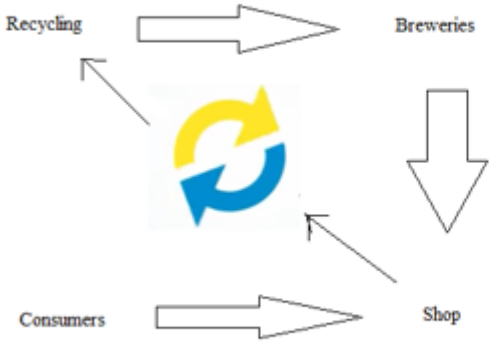

Figure 12

Based on the depictions there are in Figures 9 and 12, I argue that my depiction in Figure 8 is quite thorough. Stage 4 of Figure 8, which consists of market/consumers thus is both the consumers and the customers of the organisations, which first sell or give out the one-way drink containers and then receive them back from the consumers. This extra link is not specified in any of the depictions making borders of this sustainable supply chain undefined and the sustainable supply chain itself relative, as there clearly are more than one, but these are too numerous or too complex to be depicted in my opinion. As predicted in the theory chapter, the consumer effectively has the final say on the destiny of the one-way plastic bottle, as they decide whether they choose to recycle by returning them to the store or to waste them.

As seen in Figures 9 and 12, the organisations DRS and ABSR do not seem to give that much thought to the whole supply chain of the one-way plastic bottle – from natural resources to the bottling of the product. Instead there is a greater focus on the closed-loop of the recycling.

However, there is no specific data as to the transportation of the returned bottles from the stores and other customers to the recycling facilities. This, furthermore, emphasises how the supply chain is relative, as within this one part of the supply chain, there are several supply chains and not just one. It is interesting to see, how visibly little these organisations actually focus on the supply chain, especially DRS which depicts itself as Denmark's best circular economy and says that it focuses on the local and global supply chain.

6.5 The SSCM of a deposit scheme organisation

To sum up, based on the comparative case study a deposit scheme on one-way plastic bottles does not only have the implications that it is environmentally friendly and appears to be economically feasible, it also has social implications which include transparency and engagement of all stakeholders, as these are important for the deposit scheme and the organisations managing it to survive. This is depicted in Figure 14:

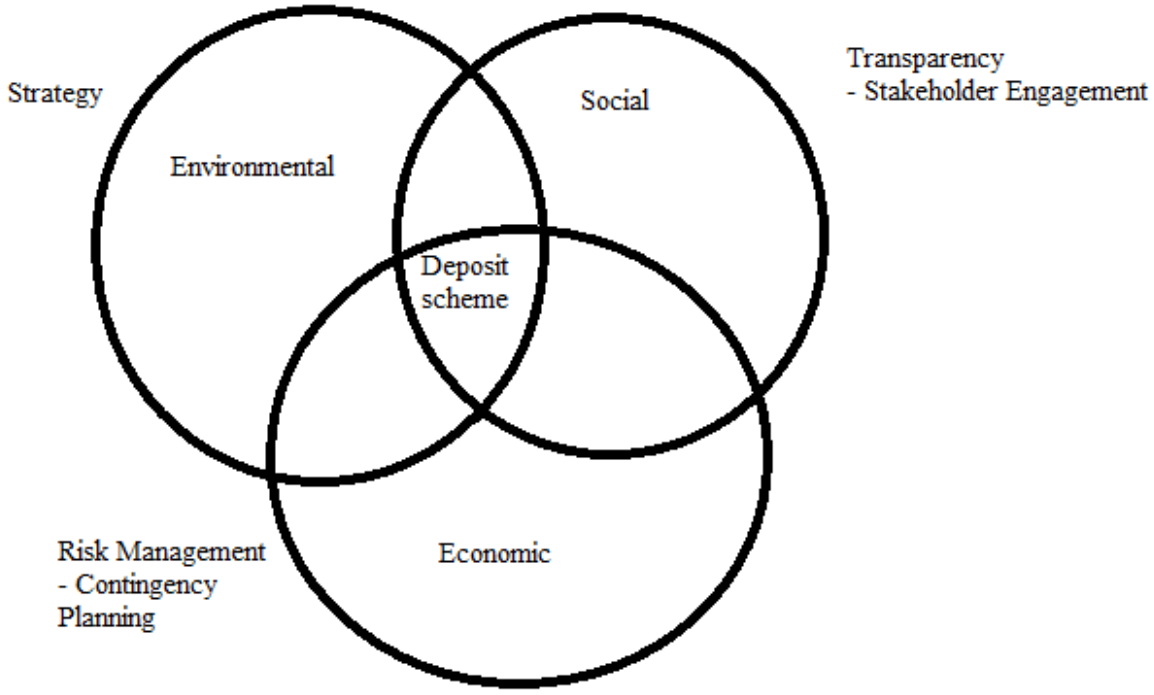

Figure 14: The SSCM framework of a deposit scheme for one-way plastic bottles based on theory and practice

The transparency with stakeholder engagement has, thus, shifted from being part of the economic, as predicted in Figure 6, to the social, as it is here that most stakeholders need to engage with the deposit scheme. This is in particular for the consumers on which the organisations rely to return the one-way drink containers. If the consumers stopped returning their empty one-way drink containers, the deposit scheme could quite possibly collapse. Furthermore, with decreasing oil prices and thus, less demand for recycled plastics, there is an economic implication of less future revenue, which could come into play. Additionally, with the Danish-German border region deposit scheme underway, there are also still improvements that need to be made by DRS and this all presents a certain risk. This new deposit scheme does not affect ABSR, but who is to say that this won't be something that will soon be at the Danish-Swedish border as well? These are just some of the further implications that neither of the two organisation seems to be thinking about. Accordingly, I would argue that risk management with especially contingency planning should also be part of the SSCM framework as presented in Figure 14.

7. Discussion: The deposit scheme on one-way plastic bottles

In the following chapter of my paper, I will discuss the findings made in chapters five and six based on four points. Firstly, I will relate the findings to the academic literature on the subjects. Secondly, I am going to discuss my research question. Thirdly, I will examine the recycling via deposit scheme vs. general recycling and lastly, I will outline the DRS' and ABSR's perception that the deposit scheme examined in this paper is among the world's best.

As put forward in the literature review in the beginning of this paper, researchers such as Mahajan and Vakharia (2016) outlined that reverse supply chain operations are often a profitable long term investment, which reduces waste. The deposit scheme examined in this paper was partially introduced in an effort to reduce plastic waste and this seems to be working quite effectively. This was introduced through government regulations, which put responsibility for the afterlife of a product back unto the manufacturer of this product, thus creating a circle from cradle to grave. In the case of the deposit scheme this circle becomes a closed-loop circular economy, which in essence is infinite.

Govindan et al. (2014) put the introduction of these *green laws* down to a raised public awareness of how the environment works and what environmental implications most consumption and manufacturing has on it. Consumers, thus, increasingly crave products, which are fashioned in

or disposed of in a sustainable manner (Sustainable Brands, 2015). Accordingly, ABSR argues that they are successful, because the consumers return one-way drink containers based on a belief that they are doing something good for the environment. DRS equally brands itself as an environmental organisation first and foremost, however Danish consumers seem to not actually know that they return one-way drink containers for environmental reasons.

This introduction of responsibility for the afterlife of a product is still a rather new thing to Supply Chain Management, which more frequently is associated with a forward-flowing motion only. To the extent that, for instance, Autry et al. (2013) mention that getting products back for one reason or another is not often managed explicitly. Additionally, they also argue that Supply Chain Management can be seen as a team sport, as it requires effort and transparency from every part of the chain (Ibid.) and in a case of both reverse and forward-flowing supply chains around the same products and between the same actors this is probably the case. Autry et al. (2013) also argued that there is a gain to be made by implementing a reverse supply chain into the forward-flowing supply chain. In the case of the deposit scheme examined in this paper, this is quite different, as the deposit scheme is managed by an independent organisation, which has its own transportation links. Here a whole independent loop has been added to the forward-flowing supply chain. However, as mentioned by Mahajan and Vakharia (2016), this still seems to be a profitable operation.

Bernon et al. (2010) argued that a reverse supply chain often comes at a great cost, at least during the introduction of it. DRS states that it is a non-profit organisation and despite it having a profit of one million DKK in 2015, this number has been declining in the last few years. Accordingly, in my opinion, it is probably reasonable of DRS to be a non-profit organisation, as this market is not that profitable. ABSR has gained a CSR-certification among other things for being cost-effective, however the organisation has not publicised any economic information other than their turnover. Thus, any conclusions made on the economic feasibility of ABSR are inconclusive. Nonetheless, the cost of a reverse supply chain must be low enough in the long run and it must be economically feasible, since both organisations have received a government mandate to be in charge of their national deposit scheme and consequently are state monopolies. DRS' mandate was up for review in 2016 (Dansk Retursystem, 2016) and as I cannot find data on this and unfortunately my follow up questions hadn't been answered by the time of submission, I have to suspect, this means that their mandate was renewed. I would argue the government would not have renewed this if the deposit scheme was not economically feasible.

The introduction of the *green laws* and consequent supply chain modifications such as the deposit scheme could arguably have had negative implications for the supply chain of the one-way plastic bottle, as put forward how this made the supply chain more complex and costly. However, the add-on to the forward-flowing supply chain of a one-way plastic bottle seems to only give positive implications to the supply chain as it overall decreases waste, energy and resources used and is cost-effective. Accordingly, the supply chain of a one-way plastic bottle with a deposit has become a self-sustaining circular economy, which does not require many new packaging resources. The deposit scheme consequently uses Supply Chain Management and its tools of sourcing and transportation to address environmental issues such as the decrease of plastic waste, which is affecting people and planet. As pointed out by Autry et al. (2013), Supply Chain Management is a good area within which an organisation can work on being more environmentally friendly.

However, it is not quite clear whether there is additional waste created through the deposit scheme, for instance, what about the estimated 10 per cent of one-way drink containers that are not returned? These still need replacing in a way, I assume. As mentioned by Glock (2016), this makes the future of all reusable packaging such as one-way drink containers quite uncertain. There is no law making consumers actually return their empty one-way drink containers, which is quite interesting as these are in effect the driving force behind the deposit scheme. Consequently, anything could happen to the one-way drink containers.

Accordingly, it is quite interesting that neither of the two organisations focuses greatly on their full supply chains and on all the implications on these. For instance, the mentioned factors of sinking oil prices and new deposit scheme introductions are not something that they cover in their publications. As pointed out by among others Autry et al. (2013), Supply Chain Management departments within an organisation is, where sustainable practices can be most easily implemented, however, it seems like the DRS and ABSR are not quite as forward thinking in realising that yet.

As outlined in the introduction of this paper not every country has a deposit scheme on one-way drink containers. In some, like the UK, one-way drink containers are merely recycled as part of the household waste. This raises the question as to what is the difference between recycling through returning a one-way drink container to the store and by simply recycling it at home by putting it into the recycling bin. Instinctively, it seems much easier to simply recycle a one-way drink container at home instead of having to return it to a store, does it not?

As introduced in the literature review of this paper, the German deposit system is not a closed-loop supply chain (DPG9, 2017). The one-way drink containers are favoured by bottlers

because they present a forward flowing supply chain only, unlike the reusable drink containers (Welz, 2017). The return quota, however, is, in my opinion, very high at 98.5 per cent (Ibid.). After their return through the machines or a counting centre (Zählzentrum) though, the one-way drink containers are sent through normal recycling channels and do not stay in the closed-loop of food packaging recycling as emphasized by DRS and ABSR (Ibid.). Compared to the use of reusable drink containers in Germany then the one-way drink container deposit system is not environmentally friendly (Ibid.)

As put forward by both DRS and ABSR, recycling one-way drink containers with other plastic waste compromises them and might break the cycle of them being refurbishing into food packaging in which way some plastic would be lost. Accordingly, in the Danish and Swedish deposit system this cycle is kept and food packaging is preserved. The question is whether the consumers are even aware of this fact. Furthermore, the deposit schemes are still only in place, because of government regulations and it is not quite certain if for one-way drink containers, they would be there without these regulations.

Gudger and Bailes (1974) investigated the Oregon bottle legislation in the 70s and concluded that the legislation created growth in the labour market. This is also the case now, as both DRS and ABSR only exist because of the deposit schemes in their respective countries. In the 70s, Gudger and Bailes (1974) with their American research and Fisher and Horton (1979) with transnational research disagreed whether the convenience or the level of deposit was, what made deposit schemes work. The American academic research rated level of deposit over convenience, while Fisher and Horton (1979) found that convenience was much more important. DRS today is also aware of the convenience factor in the deposit scheme and argues that it constantly works on optimising this aspect. This same can be said for ABSR. Fisher and Horton (1979) also found that consumers need to be informed about the scheme and its how's and why's. ABSR have recently campaigned greatly and changed their public name in order to further inform consumers of their work and DRS has put this campaign work as part of their 2020 strategy.

Effectively, thus the deposit schemes of today and those of 40 years ago still work on the same basis and still are absolutely consumer dependant. Consequently, both DRS and ABSR argue that they operate a deposit scheme, because the deposit serves as an incentive. Further, each has their own way of explaining how exactly this works, as ABSR argues that the deposit is the *engine* behind the whole scheme, while DRS argues that the deposit is a *reward* to the consumer. Despite this naturally not being the case, as the consumer only gets back what she has already paid, it is still

interesting to see that next to the environmental motivation of the deposit scheme, there is a sentiment of being paid for returning a one-way drink container added to it. Possibly this is what makes the deposit schemes necessary and more effective than just household recycling?

Both deposit schemes investigated in this paper praise to be themselves among the world's best. I cannot find any more information on what that means and which criteria, the organisations rank their deposit schemes on. Accordingly, it is not quite certain at this point whether being the world's best means having the highest turnover, the highest return quota, the most effective deposit scheme or something quite different. Additionally, it is interesting that in February, the Swedish organisation got certified under an ISO-standard, whereas the Danish organisation plans to only get certified under a Danish standard. This Danish standard does have an ISO counterpart, however it is probably not as easily identifiable internationally as an ISO-standard.

From what I can find, the German deposit scheme does not seem to rank itself among the world's best. Arguably this is not surprising, as it is open-looped and ends with the supposed recycling of the drink container materials (Welz, 2017). Interestingly though, the German deposit scheme seems to have the highest return quota with only 1.5 per cent of one-way drink containers not being returned (Welz, 2017). The Danish and Swedish deposit schemes do not have the issues, which the German deposit system has, as ABSR and DRS manage all administrative, logistics and other parts of their deposit schemes. A little further research suggests that it is in fact the Norwegian deposit scheme, which proclaims itself to being the best deposit scheme in the world (Infinitum, 2016). At least that is what the Norwegian organisation in charge of the national deposit scheme writes in their annual report (Ibid.). Everything else in the report is quite similar to the Swedish and Danish deposit schemes, thus, maybe the secret to having a deposit scheme with positive environmental and economic implications for the sustainable supply chain of a one-way plastic bottle is to have one organisation in charge of the closed-loop supply chain and a deposit, if not an environmental agenda, which keeps the consumers motivated.

To sum up this discussion, the Danish and Swedish deposit schemes set itself quite well into the academic literature in the field of deposit schemes and reverse supply chains. The scheme examined in this paper has positive environmental and economic implications on the supply chain of a one-way plastic bottle with a deposit as put forward by this paper's research question.

Additionally, this discussion makes a valid case for a deposit scheme as opposed to simple recycling as a deposit scheme seems to be having a higher return quota. Consequently, the deposit schemes of Denmark and Sweden seem to be among the world's best deposit schemes, as they have

an organisation in charge of them and a deposit as a consumer incentive to return one-way drink containers and thus, make the scheme work.

8. Conclusion

In this paper, I have sought to investigate the deposit scheme on one-way plastic drink containers through a case study of the Danish deposit scheme organisation DRS and the Swedish organisation ABSR. These organisations proved to have many similarities in how they managed their respective deposit scheme and thus, I could make analytical generalisations from my findings in order to answer my research question and propositions.

The deposit scheme examined in this paper, thus, has positive environmental and economic implications as it is saving energy and reducing CO_2 emissions and plastic waste. This is an interesting aspect of these deposit schemes, as plastic waste is getting a bigger problem for the environment today and thus, introducing more national deposit schemes in other places could possibly help with this situation. Both organisations have a government mandate and are, consequently, state monopolies. DRS is a non-profit organisation, which in 2015 reached a small profit. ABSR does not publicise their profits and losses thus making a judgement on economic feasibility inconclusive. Accordingly, it can only be assumed that the deposit scheme is economically feasible mainly because it exists in a market with no other competition.

Another implication of the deposit scheme is the social aspect. Both organisations highly value their employees and both organisations are very aware of the fact that they need all their stakeholders and specifically their consumers to make the deposit scheme work. Additionally, the organisations have a lot of promotional material for school children. ABSR recently went through a rebranding to get a more consumer facing name and DRS will be doing the same within the next years. Subsequently, Figure 6 as illustrated in this paper had a flaw as it depicted the stakeholders to be part of the economic performance, however as illustrated in Figure 14 this is really a social aspect. Both the environmental and social aspects of the deposit scheme are more dominant than the economic, as the schemes were introduced by legislation and simply have to work, however the cost.

Either organisation depict itself as having one of the best deposit scheme of the world, but there is no transparency as to what that is or why and accordingly, it can be wondered whether this is simply a marketing stunt.

This research proved to be interesting as the deposit scheme on plastic one-way drink containers is a reverse supply chain and a circular economy, something which is not yet often examined in academic literature. Furthermore, this is interesting and academically relevant as either organisation does mention its sustainable supply chain and circular economy, but only ever some aspects of it and never a full depiction from cradle-to-grave as presented in Figure 8 of this paper. As both organisations argue they focus on their supply chains and quite clearly are within a business where the supply chain is very important this is strange. However, I did not have access to business internal material and thus, I do not know for certain that they do not have more accurate depictions someone.

In conclusion, the deposit scheme of a one-way plastic drink container has positive environmental and seemingly positive economic implications, dominant social implications and is sustainable. However, neither of the organisations is very concerned with risks, possibly because each has a respective state monopoly. Nonetheless, as outlined in this paper, prices on raw materials change and new deposit schemes are underway, which could have certain implications for the management or even the business models of the Swedish or Danish deposit schemes. So despite praising themselves as being the world's best, there are still a lot of improvements that can be made.

8.1 Further Research

This paper has identified several areas for further research. As there is currently very little academic research on deposit schemes in Europe, there are still several issues raised in this paper, which can be further explained. Further research into the return quotas of deposit schemes versus normal household recycling could establish, whether a deposit scheme is a reasonable form of waste management. Since, the deposit schemes rely on consumers to actually return empty one-way containers, consumer patterns and behaviour could be an additional point for further research. Unfortunately, my research on economic feasibility of the deposit scheme is slightly inconclusive, as there is not much information to be found. Accordingly, the deposit scheme's economic feasibility is also an area for further research.

Additionally, it is unclear if next to the waste reduction a closed-loop reverse supply chain, such as that of a deposit scheme does also create waste. Furthermore, there can be more academic research done on the deposit schemes in Germany and Norway, respectively on the open-looped supply chain, which is present in Germany and on why Norway's deposit scheme markets itself as

being the best and if that really is the case. It could also be interesting to investigate the new deposit scheme, which will be developed for the Danish-German border region. My research has solely focused on one-way drink containers and thus, there are also more options to research the reusable drink containers used, for instance, in European deposit schemes, such as the German, today.

9. Appendices

Appendix A – Questions for Returpack

1. What is the business case for ’pant’?
2. What percentage of PET bottles is actually returned?
3. How are they returned?
4. How is the supply chain of the PET bottles managed?
5. Does ‘pant’ reduce plastic waste?
6. How do you involve stakeholders such as retailers and consumers in your work?
7. Would you say that ‘pant’ is a sustainable practice?
8. At which level of the supply chain are the PET bottles recycled?

Appendix B – Questions for Dansk Retursystem

1. What is the business case for ’pant’?
2. What percentage of PET bottles is actually returned?
3. How are they returned?
4. How is the supply chain of the PET bottles managed?
5. Does ‘pant’ reduce plastic waste?
6. How do you involve stakeholders such as retailers and consumers in your work?
7. Would you say that ‘pant’ is a sustainable practice?
8. At which level of the supply chain are the PET bottles recycled?

Appendix C – Follow up questions to Dansk Retursystem

(English translations given by myself)

1. Ved du hvornår jeres 2016 årsrapport bliver lagt op?

   Do you know when your 2016 annual report becomes publicised online?

2. Og jeg går ud fra, at I har bestået evalueringen i 2016 og har fået forlænget eneretten?

   And I suppose that you passed the evaluation in 2016 and that the monopoly has been extended?

Appendix D – Responses from Dansk Retursystem

(English translations given by myself)

1. What is the business case for 'pant'?
   Dansk Retursystem er en privatejet non-profit virksomhed med eneretten til at drive det danske pant- og retursystem i hht. pantbekendtgørelsen. Bekendtgørelsen beskriver også, hvilke produkter, der er omfattet af systemet. Driften er finansieret af følgende tre forhold; gebyrer betalt af producenter og importører, ikke-indløst pant og salg af genanvendelige materialer.

   Dansk Retursystem is a privately owned non-profit company with the monopoly to run the Danish deposit scheme in accordance with the deposit scheme decree. The decree also describes, which manufacturers are incorporated in the deposit scheme. The operation is financed through three circumstances: fee paid by manufacturers and importers, non-returned deposits and the sale of recyclable material.

   Læs evt. mere her: /Possibly see more here:

   - https://www.dansk-retursystem.dk/om-os/finansiering/
   - https://www.dansk-retursystem.dk/om-os/reguleret/

2. What percentage of PET bottles is actually returned?
   DRS opererer med én samlet returprocent for alle tre emballagetyper. Vi har en af verdens højeste, nemlig p.t. 90. Se også:

   - https://www.dansk-retursystem.dk/presse/aarsrapport-noegletal/

- http://www.dansk-retursystem.dk/wp-content/uploads/2016/05/Aarsrapport_2015_Low.pdf

DRS operates with one combined return quota for all three types of packaging. We have one of the world's highest at the moment at 90 per cent. Have a look at:

3. How are they returned?

   Vi modtager både emballager fra forbrugere via fx butikker og pantstationer, og fra hoteller, restauranter, cafeer og kontorer m.m. Læs mere om returnering på hjemmesiden:

   - https://www.dansk-retursystem.dk/forbruger/
   - https://www.dansk-retursystem.dk/kundeservice/

   We receive both packaging from consumers via stores and deposit scheme stations and from among others hotels, restaurants, cafés and offices. See more about the return on the website:

4. How is the supply chain of the PET bottles managed?

   Vi sørger for at sende flasker og dåser til genanvendelse på højeste niveau. Det vil sige, at de brugte bliver til nye flasker og dåser eller andre emballager til fødevarer . På den måde sendes materialerne tilbage i kredsløb uden at miste værdi helt i tråd med principperne i cirkulær økonomi, hvor råstofferne cirkulerer til gavn for klima og miljø. Faktisk er genanvendelsen så god, at materialerne kan genanvendes igen og igen. Du kan læse mere her:

   - https://www.dansk-retursystem.dk/miljoe-klima/

   We are making sure to send bottles and cans to be recycled on the highest level. Meaning that the used become new bottles and cans or other packaging for food products. In a way the material is sent back into the circle without losing value quite in accordance with the principles of The Circular Economy, where the raw materials circle at the benefit of climate and environment. Actually the recycling is done so well that the materials can be recycled again and again. You can read more here:

5. Does ‘pant’ reduce plastic waste?

   DRS sikrer som nævnt det højeste niveau for plastgenanvendelse. Det kan vi, fordi vi kun indsamler flasker og dåser og dermed ikke andre slags brugte emballager og produkter. Den høje kvalitet i genanvendelsen sikrer ikke blot, at plasten ikke går tabt (altså bliver til affald). Den sikrer også, at vi sparer jomfruelige råstoffer.

   As mentioned DRS ensures the highest level of plastic recycling. We can do that because we only collect bottles and cans and thus no other kind of used materials and products. The high quality in the recycling does not only ensure that the plastic does not get lost (becomes waste). It also ensures that we save virginal raw materials.

6. How do you involve stakeholders such as retailers and consumers in your work?

   Dansk Retursystem er en cirkulær forretning, der er spiller sammen med bl.a. forbrugere, producenter, butikker og genanvendelsesanlæg, og derfor er vi løbende i dialog med vores interessenter. Vi arbejder p.t. på at blive CSR-certificeret, hvilket netop indebærer dette.

   Dansk Retursystem is a circular business, which plays together with among others consumers, manufacturers, stores and recycling factories and therefore we are constantly in dialogue with our stakeholders. At the moment we work to be CSR-certified, which exactly incorporates this.

7. Would you say that ‘pant’ is a sustainable practice?

   Oh yes! Ved at genanvende på højeste niveau sparer retursystemet hvert eneste år titusinder tons CO2, ligesom råstoffer bevares.

   Oh yes! By recycling on the highest level the deposit scheme yearly saves ten thousand tons of CO_2 and raw materials are preserved.

8. At which level of the supply chain are the PET bottles recycled?

   Som nævnt sikrer vi en closed loop genanvendelse af flasker og dåser med pant, på fødeemballage-niveau.

As mentioned we ensure a closed loop recycling of bottles and cans with a deposit on the food packaging level.

Appendix E – Dansk Retursystem's key numbers for the last five years

Femårsoversigt af hoved- og nøgletal

mio.kr./in Million DKK	**2015**	2014	2013	2012	2011
Nettoomsætning/Net turnover	1.791,0	1.741,9	1.561,0	1.438,3	1.441,0
Resultat af primær drift	38,3	47,1	20,6	34,3	30,8
Resultat før skat og overførsel til gebyrområder	**0,1**	**0,2**	**0,8**	**2,4**	**27,8**
Overførsel til gebyrområderesultater	0,0	0,0	-0,6	-2,0	-26,0
Resultat før skat	**0,1**	**0,2**	**0,2**	**0,4**	**1,8**
Skat af årets resultat	0,0	0,0	0,0	-0,2	-1,5
Årets resultat/Year result	**0,1**	**0,2**	**0,2**	**0,2**	**0,3**
Anlægsaktiver	400,4	408,9	459,2	451,6	434,8
Resultat af gebyrområder med aktiverede resultater	0,0	0,0	0,0	0,9	2,6
Omsætningsaktiver eksklusiv aktiverede resultater	315,3	374,3	358,0	349,9	348,0
Aktiver i alt	**715,6**	**783,2**	**817,2**	**802,4**	**785,4**
Selskabskapital	10,0	10,0	10,0	10,0	10,0
Egenkapital	**10,1**	**10,2**	**10,2**	**10,2**	**10,3**
Hensatte forpligtelser	201,1	166,5	141,2	112,4	115,6
Langfristede gældsforpligtelser	125,9	149,3	250,6	327,8	353,8
Resultat af gebyrområder med passiverede resultater	0,0	0,0	0,0	0,3	0,0
Kortfristede gældsforpligtelser eksklusiv passiverede resultater	378,6	457,2	415,2	351,7	305,7
Passiver i alt	**715,7**	**783,2**	**817,2**	**802,4**	**785,4**
Pengestrøm fra driften	199,8	143,6	83,2	128,7	76,5
Pengestrøm til investering, netto	-93,5	-49,2	-89,7	-92,4	-52,3
Heraf til investering i materielle anlægsaktiver	-96,4	-54,5	-92,7	-93,8	-52,5
Pengestrøm fra finansieringsaktivitet	-106,3	-94,4	6,5	-40,0	-29,5
Pengestrøm i alt	**0,0**	**0,0**	**0,0**	**-3,7**	**-5,3**
Uudnyttede trækningsmuligheder	0,0	0,0	0,0	54,1	22,9
Gennemsnitligt antal ansatte	483	487	415	311	303
Udbetalt håndteringsgodtgørelse til dagligvarebutikker	25,8	26,3	26,7	31,9	33,7

(Dansk Retursystem, 2016:13 with some translations)

Appendix F – AB Svenska Returpacks' deposit scheme statistics

Pantstatistik

	2014	2013	2012	2011	2010	
OMSÄTTNING /Turnover	2 460	2 367	2 256	2 147	1 793	MSEK
Utbetald Pant + hanteringsersättning inkl moms						
GENOMSNITT/VECKA	48,3	46,5	43,3	38,8	35,9	MSEK
ÅTERVINNING%						
TOTALT ALLA FÖRPACKNINGAR	84,2*	89,3	89,3	88,8	85,5	%
Pet Totalt	82,7	82,9	84,3	84,1	82,9	%
Burk	85,1*	92,8	92,0	91,3	86,8	%
FÖRSÄLJNING ANTAL						
TOTALT ALLA FÖRPACKNINGAR	1 960	1 879	1 769	1765	1715	M
Pet Totalt	711	666	609	616	592	M
Burk	1 250	1 213	1 160	1150	1123	M
ÅTERVINNING ANTAL						
TOTALT ALLA FÖRPACKNINGAR	1 651*	1 678	1 580	1568	1466	M
Pet Totalt	588	522	513	518	491	M
Burk	1 064*	1 126	1 067	1050	975	M
AVGÅENDE GODS						
ALUMINIUM	15 383	14 749	14 173	13 830	13 000	T
KLAR PET	17 949	16 926	16 422	16 840	17 000	T
FÄRGADE PET	2 332	2 400	1 856	2 220	1 700	T
Snittvikt Burk	14,46g	14,5g	14,8g	14,7g	15g	
Snittvikt PET	34,51g	35,0g	35,7g	36,8g		

(Returpack, 2016:2 with one translation)

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