Sustainable Competitive Advantage through Closed-Loop Supply Chain strategies

A research within the remanufacturing industry

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Preface

As I am intrinsically motivated to contribute something to both the remanufacturing world and the environment, the subject of my research was not randomly chosen. I have been working within the printer cartridge remanufacturing industry my entire professional life, and I have watched this industry be born, struggle and develop over the years. We are currently in challenging times in which the total printing demand is declining and competition from original equipment manufacturers and compatible new build producers is increasingly threatening the position of remanufactured products. I therefore sincerely hope that this research will contribute something to the companies that are active within this interesting industry.

Working on this master thesis for the last seven months in combination with a (new) full-time job and a family life was challenging. At the same time, however, it also gave me many fascinating insights into different aspects of strategic management and the remanufacturing industry.

During the process of writing this thesis, I came into contact with several interesting people—some of whom guided me in the right direction and contributed to my work. I would therefore like to express my gratitude to the following individuals.

First I thank my coach, Frank Wijen, and my reviewer, Erwin van der Laan. Without their experienced guidance I would never have been able to succeed. Secondly, I would like to thank the management of the Armor Group for giving me the opportunity to conduct this study despite turbulent market conditions within the cartridge remanufacturing industry. Third, I would like to thank everyone who participated in this research; I really appreciated the willingness and openness of those who were interviewed.

Finally, I would like to thank my wife Jeannette and my two children, Tijn and Siem, for their patience and encouragement. Despite my wife's own work and part-time master's studies in public health, she continued to support me, especially in difficult moments. Jeannette, I am so blessed to have you by my side. Thank you.

My journey started in September 2014 and has now ended. While these have been two enriching and inspiring years, it is now time for me to search for new paths….

's-Hertogenbosch, October 2016

Summary

The empiric results reveal that sustainable competitive advantage is highly influenced by remanufacturing strategies and product acquisition strategies of remanufacturing firms. A strategic positioning and the CLSC resources and capabilities are most important in this regard. Remarketing strategies predominantly influence the value creation of the firm.

Most frequently mentioned are remanufacturing strategies related to improving the product quality, the output and flexibility of production and the sourcing of components. Production acquisition strategies are most often mentioned in relation to increasing availability of used products and lowering the costs of used products by developing own collect systems. Finally remarketing has a medium impact on value creation. Value is mainly created by targeting the right customer with the right product offering and delivering marketing support to resellers combined with marketing activities focused on end-users.

CLSC strategies should not only focus on cost reductions. From this research it can be concluded that remanufacturers attempt a great deal in order to stay ahead of their competition. The data analyses reveal that a majority of the remanufacturers in this research use a strategic position that is based on delivering high quality products that can compete with OEM products in the market. Differentiation strategies should therefore focus on quality, additional service and price.

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1. Introduction

1.1 Motivation

The World Bank estimates that on a global scale solid waste will increase from 1.3 to 2.2 billion tons per year in 2025 (Hoornweg & Bhada-Tata, 2012). The costs of managing this waste stream are expected to grow from $205.4 billion in 2012 to $375.5 billion in 2025 (Hoornweg & Bhada-Tata, 2012). According to the Ellen MacArthur Foundation, in the consumer goods sector alone approximately 80% of the $3.2 trillion recoverable value is irrecoverably lost annually (MacArthur & McKinsey, 2014).

In the period between 1850 and 2000, the linear (i.e. take-make-dispose) economy relied on cheap and widely available resources (McKinsey, 2013). Being confronted by the global trends of doubling commodity prices since 2000 (McKinsey, 2013), an anticipated growth of three billion middle-class consumers by 2030 (MacArthur, 2014), accelerating resource depletion and pressure on the environment (Dobson et al., 2012) has made designing and developing a circular economy in which materials are resold, reused, redistributed, repaired, refurbished, remanufactured, retrieved or recycled increasingly important (De Brito & Dekker, 2003).

Circular business models alone could already realize $1.0 trillion in material savings each year (MacArthur & McKinsey, 2014). Peter Lacy, managing director of Accenture Strategy, states: "*By turning waste into wealth with new business models, companies can boost their competitiveness by reducing dependence on scarce resources and generating new innovative services that grow revenue*" (Accenture website, 2016).

Companies such as Philips and Vodafone implement "access over ownership" and "servicing" business models in order to improve recycling but also to reach more customers. Desso, a major Dutch carpet manufacturer, announced in 2010 that it would transform itself into a cradle-to-cradle company by 2020—meaning that all of the raw materials it uses will be free of toxic chemicals, designed for easy disassembly and capable of being recycled or composted. The Japanese electronics firm Kyocera is an early pioneer in the refillable toner cartridge sector. It states that conventional cartridges can have over 60 parts made from various materials—and are typically thrown away at the end of their life. This company instead produces much simpler cartridges that can be easily refilled.

This saves money over the product's lifetime, as the materials cost is reduced by 50% while waste is decreased by 90%.
According to the United States International Trade Commission, the U.S. remanufacturing industry is growing fast; in 2011, the turnover was $43 billion (www.usitc.gov).
This shift toward more circular business models provides economic opportunities for companies due to increased profits through lower input costs or the generation of new business, reduced volatility of raw material pricing and/or greater security of supply, new demand or business services or improved customer interaction and loyalty (MacArthur, 2014).
In the coming years a firm's future value creation and competitive advantage will therefore increasingly depend on strategies related to a natural resource-based view (Hart, 1995).

1.2 Positioning

In circular economy business models, the added value in products is maintained for as long as possible and there is a focus on minimizing waste. Such models therefore create more value from each unit of a resource than traditional linear (i.e. take-make-dispose) models (Di Maio & Rem, 2015). In order to capture this value, companies active in the circular economy need to implement product recovery management strategies that address the management of products, components and materials that are no longer used.

Take-back laws such as the European Union's directive on Waste Electrical and Electronic Equipment force firms to take responsibility for the collection and disposal costs of their products (Webster & Mitra, 2007). Customers are also pushing companies to adopt more environmentally friendly business practices (Porter & Kramer, 2006). Moreover, companies are discovering the economic benefits of recoverable manufacturing systems (Jayaraman & Luo, 2007). A coordinated forward and reverse supply flow of materials is therefore needed. Such a flow can be managed through closed-loop supply chains (CLSCs) in which products are taken back from customers in order to recover value (Guide & Van Wassenhove, 2009).

To find ways to close the loop, manufacturers and remanufacturers are developing product recovery management activities (Table 1) that include repairing, refurbishing, remanufacturing, cannibalizing and recycling (Thierry et al., 1995); De Brito and Dekker (2002) add redistribution as another form of direct recovery. If a product's quality is as-good-as-new, that product can be pushed back into the market almost instantly through reuse, resale or redistribution.

Table 1: Product recovery options

Table 1.

	Level of Disassembly	Quality Requirements	Resulting Product
Repair	To product level	Restore products to working order	Some parts fixed or replaced by spares
Refurbishing	To module level	Inspect all critical modules and upgrade to specified quality level	Some modules repaired/replaced potential upgrade
Remanufacturing	To part level	Inspect all modules and parts and upgrade to as new quality	Used and new modules/parts combined into new product: potential upgrade
Cannibalization	Selective retrieval of parts	Depends on process in which parts are reused	Some parts reused remaining product recycled/disposed
Recycling	To material level	High for production of original parts: less for other parts	Materials reused to produce new parts
Redistribution	To product level	Product is as-good-as-new, no major requirements	New products are pushed back into the market almost instantly

Source: Thierry et al. 1995 (adapted)

In CLSCs, a standard forward supply chain is integrated with reverse supply chain activities for returning products. Closed-loop supply chain activities are classified into three main categories: product returns management/product acquisition/asset recovery, remanufacturing and remanufactured products market development/channel design (Guide & Van Wassenhove, 2009). According to Guide and Van Wassenhove, proper coordination between and integration of these activities will lead to recovery networks that optimize value creation. The types of value that can be derived from CLSC strategies include sourcing value, environmental value, customer value and informational value (Koppius et al., 2014). Research revealed that CLSC strategies can lead to competitive advantage (Jayaraman & Luo, 2007)

This research focuses on remanufacturing. The costs of remanufacturing are on average 40–60% of the cost of manufacturing a product (Mitra, 2015). Moreover, remanufactured products are usually sold at a price that is 30–40% below the price of a manufactured product (Mitra, 2015). Remanufacturing creates value by decreasing material costs for parts and modules, increasing the availability of parts and modules, decreasing energy and disposal costs, and reducing environmental impacts (Thierry et al., 1995). Original equipment manufacturers (OEM) that close the loop and start to offer remanufactured products in addition to new products appear to gain greater overall earnings (Linton, 2008). This is because new sales may be generated as a result of a remanufactured product either being attractive for alternative applications when it has a lower price or being offered in more price-sensitive markets.

According to Heese et al. (2005), a manufacturer can gain competitive advantage when taking back used products. Being a first mover in remanufacturing can generate benefits particularly in competitive environments. Moreover, manufacturers that decide not to remanufacture may open the door for a third party to enter the market, which is why cannibalizing one's own product to deny the opportunity to other firms may be strategically important (Linton, 2008).

Nevertheless, academic research has also shown that remanufacturers are confronted with more complicating factors than OEMs. The most mentioned properties include the uncertainty in timing and volume of returns, the requirement to balance returns with demands, the disassembly of returned products, the uncertainty in materials recovered from returned items, the necessity for a reverse logistics network, the material matching restrictions (e.g. the customer preserves ownership of product), stochastic routing problems for materials for remanufacturing operations and a high variability in processing times (Guide, 2000).

Much has been written in the literature in relation to opportunities for manufacturers to proceed into remanufacturing (Atasu et al., 2008), the technical and operational sides of reverse logistics (Govindan et al., 2014), and creating value and competitive advantage for manufacturing firms by closing the loop (Schenkel et al., 2015). However, little attention has been paid as to how remanufacturers can derive sustainable competitive advantage from value creation through CLSC strategies.

This empirical research therefore focuses on the CLSC strategies of remanufacturing firms and how such strategies can create value and improve the competitiveness of these firms.

1.3 Research question

The aim of this study is to answer the central question that has been formulated. This is done by answering the two sub-questions that have been derived from this question.

Central question:

- What competitive strategies based on closed-loop supply chains will lead to sustainable competitive advantage for a remanufacturing firm?

Sub-questions:

a) What are the strategic consequences of having closed-loop supply chains for a remanufacturing firm?

b) Under what conditions do different competitive strategies lead to sustainable competitive advantage for a remanufacturing firm?

1.4 Structure of the report

The first chapter introduces the research subject from which the central research question and sub-questions are derived. Chapter 2 provides a literature review concerning the research constructs of CLSC strategies and sustainable competitive advantage for remanufacturing firms; this review also answers the study's sub-questions. The end of this chapter contains the conceptual model that originates from the literature and is used as the basis for the empirical research. Chapter 3 then describes the methodology that is utilized in the empirical research; in particular, it explains the empirical methods, the choice and size of the sample, the unit of analysis and explains how both the validity and reliability of the research is guaranteed. Chapter 4 subsequently discusses the empirical results and way in which the data is collected and analyzed. Finally, chapter 5 presents a discussion of the findings and identifies the study's limitations, conclusions and suggestions for managers.

2. Theory

This chapter discusses the existing literature related to competitive strategies, sustainable competitive advantage, and competitive strategies for remanufacturing firms that lead to sustainable competitive advantage and the strategic consequences for remanufacturing firms of having closed-loop supply chains. The first part has a focus on the strategic consequences of having a closed-loop supply chains for remanufacturing firms. The second part focuses on the conditions under which competitive strategies lead to sustainable competitive advantage and how this relates to remanufacturing firms. In the last part of this chapter the conceptual model is presented.

2.1 Strategic consequences of closed-loop supply chains

This paragraph describes the existing insights in literature on closed-loop supply chain strategies. First the definition of closed-loop supply chains is discussed, followed by an explanation on the strategic consequences of closed-loop supply chains for remanufacturing firms. This section gives answers to the following questions: what is a closed-loop supply chain? What are the strategic consequences for remanufacturing firms to have closed-loop supply chain?

2.1.1 Closed-loop supply chains

The roots of closed-loop concept can be found in reverse logistics. Closed-loop supply chains (CLSC) provide a holistic view on supply chains (De Brito & Dekker, 2002) and consists of the integration of standard forward supply chain with reverse supply chain activities for returning products (Guide & Van Wassenhove, 2009). Therefore CLSC management can be defined as follows: 'the design, control, and operation of a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time' (Guide & Van Wassenhove, 2009). Contrary to closed-loop is an open loop referring to a reverse logistics process where neither the original user nor the original functionality is in place (De Brito & Dekker 2002). Related to recycling recent research has shown that a closed-loop not necessarily displaces more primary material or by default generates more environmental benefits than an open-loop. Therefore in recycling focus should be on: how much primary resources are replaced by recycling, the reduction impact, the best level of reprocessing and increasing collection, recycling and displacement rates (Geyer et al., 2015).

Nevertheless there are many closed-loop supply chains and they can be classified by means of the different phases in the life-cycle of a product (Flapper et al, 2005). The most common phases used are: the production phase (obsolete, scrap and defects), the distribution phase (commercial returns, wrong delivery and recalls), the use phase (warranties, recalls, repair, refurbishment or remanufacturing offerings) and the end-of-life phase. As this research focuses on remanufacturing firms, predominantly the last three mentioned phases will be noted. As a consequence of closing the loop companies will need to follow competitive strategies based on closed-loop supply chains in order to differentiate themselves and optimize value creation. Through CLSC strategies companies can gain competitive advantage (Jayaraman & Luo 2007). The most important competitive strategies in closed-loop supply chains focus on: product returns management/product acquisition/asset recovery, remanufacturing and remanufactured products market development/redistribution/channel design (Guide & Van Wassenhove, 2009). Proper coordination between and integration of these strategies will lead to optimized value creation. The strategic consequences of closed-loop supply chains for companies will now be reviewed.

2.1.2 Strategic consequences

Strategy is the creation of an unique and valuable positioning while choosing a set of activities that is different from rivals (Porter, 1996). Firms introducing a closed-loop supply chain will impact their activities and positioning. The strategic consequences of closing the loop are herewith described.

In general product recovery networks have the following generic characteristics. First there is a coordination requirement between the “disposer market” and the “reuse market”. When both markets intertwine it results in a closed-loop goods flow, when the markets remain separated it is defined as an “open loop”. Second there exists supply uncertainty as availability, timing and quality of used products for recovery is difficult to control. Finally the product recovery network has a dispositioning task for returned products by which the destination of the product is only determined after inspection/testing and calculating the total recovery costs depending mainly on transportation costs (Fleishmann et al., 2001; Aras & Aksen, 2007). Therefore closed-loop supply chains can mainly be categorized in the following five processes: product acquisition (obtaining used products from the users), reverse logistics (transporting products to facilities for inspection/separation, sorting and disposition), inspection and disposition (assessing the condition of the returns and making the most profitable decision for re-processing and reuse), remanufacturing or refurbishing (returning the product to original specification or a usable product again) and finally marketing/redistribution

(creating a secondary market for the recovered products and physically moving products to users) (Fleischmann et al, 2000; Blackburn et al., 2004). Furthermore firms implementing a closed-loop supply chain will have to deal with the following strategic issues and decisions: network design, collection strategy, remanufacture or not remanufacture, leasing or selling, trade-in or buy-back programs, supply chain coordination, take-back laws and impact of recovery activities on new product design (Souza, 2013). Other important strategic factors in a closed-loop supply chain system consist of strategic costs (including life-cycle and performance costs), overall quality, customer service, environmental concerns, and legislative concerns (Dowlatshahi, 2000).

More tactical consequences and issues often mentioned are related to: acquisition of returned products and the returns disposition meaning remanufacturing, dismantling for spare parts or recycling. On a more operational level, firms in closed-loop supply chains should take into account: 'specific features (quality, reliability, delivery) customers want or expect from remanufactured products and customer education regarding the potential economic and non-economic benefits of reverse logistics' (Dowlatshahi, 2000). Moreover firms need to coordinate their reverse logistics activities with transportation modes, inbound and outbound transportation services, loads, networks, and resources in order to obtain the greatest benefits.

Finally as discussed previously closed-loop supply chains models are confronted with several uncertainties: a time-delay in remanufacturing and returns, system costs parameters in product return, re-manufacturing, yield of returned products, third party reverse logistic providers in collecting and customer demand (Ketzenberg et al., 2006; Huang et al.,2009). These uncertainties have an impact on especially product returns management, processes of remanufacturing and supply chain.

Summarizing: by adding a closed-loop supply chain firms need to develop new activities and/or existing activities are being influenced or changed. The most important activities to be added or influenced are: product returns acquisition, reverse logistics, inspection and disposition, remanufacturing or refurbishing and finally marketing/redistribution. Therefore strategic decisions need to be taken on: network design, collection strategy, remanufacture or not remanufacture, leasing or selling, trade-in or buy-back programs, supply chain coordination, take-back laws and possibly the impact of recovery activities on new product design. Finally uncertainty plays an important role in closed-loop supply chains. Uncertainty arrives from time-delay in remanufacturing,

product returns management and system costs. This uncertainty especially impacts activities like product returns management, processes of remanufacturing and the supply chain/remarketing.

Product returns management

Product returns are provoked by several reasons. Most important are: commercial returns, end-of-use returns, end-of-life-returns and repair/warranty returns (Guide & Van Wassenhove, 2009). In order to recover these returns, manufactures need to develop recovery activities like: used-product acquisition, reverse logistics, product disposition (sort, test and grade), remanufacturing/repair and remarketing (Guide & Van Wassenhove, 2002). Focusing on remanufacturing firms a continues supply of used products is needed. Research has shown that 61,5% of remanufacturing firms confirm that they do not have control over when products are returned and how many (Guide, 2000). On the other hand passively accepting all product returns is, from an economic value analyses perspective, not recommended (Guide & Van Wassenhove, 2001). In order to better control the inflow of used products a key activity of companies dealing in closed-loop supply chains is the used product acquisition or collection. Guide & Jayaraman (2000) define product acquisition management as "a complex set of activities that requires careful coordination to avoid the uncontrolled accumulation of core inventory, or unacceptable levels of customer service (insufficient cores to meet demand)". Wei & Sundin (2015) talk about core acquisition management as, "the active management of the core acquisition process in remanufacturing to achieve a better balance between return and demand, by dealing with the uncertainties in terms of return volume, timing and core quality". The following activities can therefore be classified under core acquisition management: core acquisition, forecasting core availability, managing the uncertainties of volume, timing and return, balancing returns with demand, resource planning and strategies to reduce uncertainties in returns (Guide & Jayaraman, 2000; Wei & Sundin, 2015). Some companies try to influence the flow of returns by using buy-back campaigns or offering financial incentives to product holders. The willingness of holders of return products is mainly influenced by the (financial) incentive offered and the proximity of collection points where holders can drop of their returns (Aras & Aksen, 2007). As a consequence companies active in remanufacturing carefully need to plan their reverse logistics and decide on the height of remuneration for a returned product. Using less collection points lowers fixed costs, but decreases the opportunity for product holders to return products. By increasing the incentive for product returns, the return rate of products will increase which has a positive impact on the profitability as long as the incentive increase does not evaporate the cost savings (Aras & Aksen, 2007). As the condition of the used products vary much remanufacturing firms needs to acquire

more used products than demand is foreseeing. There is also a trade-off between acquisition and scrapping costs versus remanufacturing costs this means that an optimal acquisition quantity needs to be calculated. 'When costs are linear, the optimal acquisition quantity has a closed form and increases with the square root of the degree of condition variability' (Galbreth & Blackburn, 2010). As a consequence return rates and recoverable product value are the most important scale effects impacting the costs of a reverse logistics network and therefore the profitability of a business (Guide et al., 2006).

Summarizing: product returns management is a crucial part of a closed-loop supply chain. The following activities are defined under product returns management: core acquisition, forecasting core availability, managing the uncertainties of volume, timing and return, balancing returns with demand, resource planning and strategies to reduce uncertainties in returns. Due to the variation in quality of returns there is a trade-off between acquisition costs and scrapping costs. Remanufacturing companies should therefore calculate the optimal acquisition quantity. The rate of returned products and the potential recoverable product value are the main scale effects impacting the costs of a closed-loop supply chain and thus the profitability of a business.

Remanufacturing processes

In remanufacturing managing production planning and control differs from manufacturing (Guide, 2000). Remanufacturing firms therefore need to 'plan time intervals in order to keep controlling the risks of price fluctuations in demand and supply' (Liang et al., 2007). The forecasted future (depending on historical data and the market situation) sales price of the remanufactured product is positively related to the price of the core. A too high forecasted sales price can therefore lead to paying a high core price leading to a loss in case of obsolescence of a core product or competition of newer version of products (Liang et al, 2007). Setting the future forecasted sales price too low could lead to low core prices for which suppliers may not be motivated enough to return products.

Another important key area in remanufacturing is inventory control management, especially when products are returned to the original producer for reuse (Fleischmann et al., 1997). Controlling external component orders and the internal component recovery processes are needed to guarantee service levels and minimize costs. Proper stock valuation of returned items and forecasting of future returns are other important parameters.

Furthermore important criteria for starting remanufacturing products are that equipment is largely available (economies of scale needed), all units have the same configuration (learning curve requirement) and units can be brought back to current state of technology (non-obsolescence requirement) (Ferrer & Swaminanhan, 2009). Proper management of remanufacturing systems needs long term planning, as savings from remanufacturing may decrease if used cores become less and less available. Also remanufacturing companies are confronted with several issues related to production planning and control, this is especially related to product volume & quality and the nature of products & processes. A high level of coordination in production planning (scheduling) is required in order to deal with the lack of a defined sequence in production steps. Process planning therefore plays a critical role in remanufacturing strategies as this influences the yield of remanufacturing, the reliability and the costs (Jiang et al., 2015). Therefore a 'coherent integrated production/process planning and control system for remanufacturing is needed that is integral to closed-loop supply chain system' (Guide et al., 1999). The more complex products are the less predictable the condition of the product will be, making pre- or post-acquisition assessment or returned products more important. Further the complexity of remanufacturing increases with low volume expensive products. However with high volume products uncertainty of availability of used products increases, as with high volume products post-purchase relationships between seller and buyer are often minimal or not existing. In the case of low volume products there is a larger post-purchase involvement of the remanufacturer ensuring knowledge on the location and the quality of the returned products (Guide et al., 1999).

Finally the disassembly of returned products/cores may provide variable yields of usable parts and products. Better predicting recovery rates is vital for determining purchasing volume and controlling inventory levels (Guide et al, 2000). In remanufacturing returned products/cores first undergo cleaning and inspection to determine the basic specifications such as its condition, model, year of manufacture. The second step in the process is the disassembly, so the cleaning and stripping of the product. These first two steps in remanufacturing are very important. Most products returned are not designed for remanufacturing, so proper disassembly is a key success factor in remanufacturing. Moreover disassembly provides most information related to the remanufacturing operations that is valuable for reducing uncertainties in the next phases of the process. In order to generate costs savings a remanufacturer should establish a grading system for the product returns it receives. This means grading returns in different quality classes. The benefit arises from the lower costs of

remanufacturing the higher quality products before the lower quality products (Ferguson et. al, 2009).

Summarizing: remanufacturing firms need to make use of time intervals in order to monitor the risk of price fluctuations in supply and demand as there is a positive link between the forecasted sales price of a remanufactured product and the price of a core. Furthermore remanufacturing firms have to manage remanufacturing systems, stocks of returns and coordinate process planning and control activities integral to the closed-loop supply chain systems. Finally remanufacturing companies can benefit from a grading system for returned products that leads to lower remanufacturing costs.

Supply chain

During the closed-loop supply chain processes a substantial part of the recoverable value is lost in time. The facts of time-value decay and the proportion of new returns are therefore relevant parameters in remanufacturing. This should be considered while designing a reverse supply chain. Moreover like in forward supply chains reverse supply chains also have to deal with a trade-off between speed and cost efficiency (Blackburn et al., 2004). Determining where in the supply chain the testing and evaluation of the condition of the returned products is done is key in this case. Cost efficient reverse supply chains centralize the testing and evaluation. Responsive reverse supply chains decentralize these activities in order to minimize time delays. Depending on these parameters a reverse network can also be designed by making use of preponement. Preponement means early product differentiation or disposition done by partners upstream in the supply chain to avoid processing returns with no recoverable value. Companies dealing with high return rates and substantial recoverable value of product returns should design a responsive and decentralized supply chain model when the rate products loose value is high. Companies dealing with many unused product returns with lower possible recoverable value should better focus on preponement (Guide et al., 2006)

Furthermore within a closed-loop supply chain firms have to deal with several different actors. De Brito & Dekker (2002) classify these as follows: forward supply chain actors (as supplier, manufacturer, wholesaler and retailer), specialized reverse chain players (such as jobbers, recycling specialists, remanufacturers etc.) and opportunistic players (entities that have another core 'business' but take the benefit from reverse logistic activities, such as charity organizations etc.). Some of these actors may be responsible for or organize the reverse chain, others may just execute a

task in the chain or play just an accommodators role. However the three main actors in a closed-loop supply chain are: the retailer, the manufacturer/remanufacturer and the collector or used products. The acquisition efficiency and the performance of the whole CLSC depend on the party that leads the channel. Decisions are taken on retail price, transfer price and effort to take back products. Research has shown that a retailer-led closed-loop supply chain gives a better result than a manufacturer-led or a collector-led-model (Choi et al., 2013). Channel leadership should therefore be moved from upstream to downstream. The supply chain agent closest to the customer, the retailer, has an incentive to push market demand for a product. This motivates collectors as there will potentially be more used products to be collected. The more upstream the channel leadership will be the higher the wholesale/retailer price and the lower market demand. Besides this an upstream channel leadership increases manufacturing/remanufacturing costs. Furthermore adding reverse logistics to the existing supply chain can have significant impact in case of important structural differences between forward and reverse channel costs structures combined with a high number of returns.

At last customer expectation and education on remanufactured products needs to be managed. This because there continues to be a lack of purchase intention of customers for remanufactured products (Wang et al. 2013). Remarketing activities are therefore needed.

Summarizing: depending on the return rate and on the possible value to be recovered reverse supply chains should be designed responsively or by making use of preponement. Next remanufacturing firms with a closed-loop supply chain will have to deal with different actors within the supply chain. The acquisition efficiency and the performance of the close-loop supply loop are influenced by the actors leading the channel. As being closest to the final customer a retailer-led closed-loop supply provides the best results. Moreover adding a reverse supply chain can have a significant impact on the firm's activities and costs. Finally customers also need to be convinced and educated to buy remanufactured products.

2.2 Competitive strategies & sustainable competitive advantage

In these paragraphs first the most important views on competitive strategy are discussed followed by specific competitive strategies for remanufacturing firms. Subsequently the conditions under which these competitive strategies will lead to sustainable competitive advantage are explained. Finally value creation within closed-loop supply chains is referred to in more detail as being part of the conditions under which sustainable competitive advantage can be generated. This section therefore

gives an answer to the following questions. What is competitive strategy and sustainable competitive advantage? Under which conditions do different competitive strategies lead to sustainable competitive advantage for a remanufacturing firm?

2.2.1 Competitive strategy

Competitive strategy has several paradigms. There are in total four main paradigms discussed in literature: attenuating competitive forces, strategic conflicts, resource-based view and dynamic capabilities view (Teece, 1997). Although each individual view can be connected with strategy building at the level of remanufacturing firms, most frequently mentioned in literature are competitive strategies related to competitive forces, resources and/or dynamic capabilities. Therefore only these three views are further elaborated.

First the competitive forces view is about finding a profitable and sustainable position against the forces in the industry. It is about how a firm positions itself within the industry (Porter, 1985). The view focuses on the returns from market power and summarizes three generic strategies in order to be able to achieve better performance than competitors: cost leadership, differentiation and focus. Moreover strategy is seen as the basis for competitive advantage. Firms need to make a choice about what type of competitive advantage it seeks. Not making a decision leads to mediocrity and often not to competitive advantage. In relation to this competitive strategy is also about being different, it is about deliberately choosing a different set of activities to deliver a unique mix of value (Porter, 1996). Furthermore strategy is about configuring the activities a company performs and performing different activities than competitors or performing them in a different way (Porter, 1997). The sustainability of these strategies depends on how the competitive advantage coming from these strategies can withstand erosion from competition (Porter, 1985).

Second from a resource based view resources and capabilities form the basis for strategy formulation as resources and capabilities provide direction and are the fundaments of profit for the firm. ‘Business strategy is seen as a search for returns to the resources which provides competitive advantage over and above the costs of these resources’ (Grant, 1991). Organizational capabilities are formed from the competences and abilities of individuals and arise when a company can deliver on it (Ulrich & Smallwood, 2004). Related to this view the essence of strategy design should therefore be based on the effective use of the core resources and capabilities of the firm, but also on the development of new resources. The key to a resource based-approach to strategy formulation is

about knowing and understanding the relationship between, resources, capabilities, competitive advantage and profitability.

Finally from a dynamic capabilities perspective companies can gain competitive advantage by following a strategy built on responsiveness and fast product innovation combined with management capabilities to coordinate and re-assign internal and external competences. Dynamic refers to the capacity to renew competences in order to harmonize them with the changing environment. Capabilities stand for the role of strategic management in adapting, integrating and reconfiguring internal and external organizational skills, resources and functional competences in order to match these with the environment (Teece, 1997).

Summarizing: competitive strategies can be based on competitive forces, strategic conflicts, resources and/or dynamic capabilities. At the level of remanufacturing firms, most frequently mentioned in literature are competitive strategies related to competitive forces, resources and dynamic capabilities. Therefore strategy in the remanufacturing industry is about being different, making effective use of core resources and capabilities and adapt, integrate and/or reconfigure internal and external skills, resources and competences in order to establish a match with the environment.

2.2.2 Competitive strategies in remanufacturing

In remanufacturing activities are summed up into three main categories: 1) product returns management/product acquisition/asset recovery, 2) remanufacturing and 3) remanufactured products market development/remarketing/channel design (Guide & Van Wassenhove, 2009). As competitive strategy is about configuring activities a company performs, about performing different activities than competitors or performing them in a different way (Porter, 1997) and about the effective use of firms resources and (dynamic) capabilities (Grant, 1991; Teece, 1997), remanufacturing firms should develop strategies related to their main activities, resources and capabilities being: product acquisition, remanufacturing and remarketing in order to create value and competitive advantage (Jayaraman & Luo, 2007; Heese et al., 2005; Schenkel et al., 2015b). According to Guide & Van Wassenhove (2009) proper coordination between and integration of these activities will lead to recovery networks that optimize value creation. The main competitive strategies and the conditions for sustainable competitive advantage related to remanufacturing firms will now be discussed.

Product acquisition strategies

In remanufacturing used products or cores need to be obtained from the end-user in order to recover the added value and return products to functional use again. The acquisition of used products needs to be carefully handled as the supply-chain management of recoverable remanufacturing differs extensively from standard manufacturing supply-chains. Moreover in recovery activities (like remanufacturing) there is much uncertainty. Uncertainty in demand for remanufactured products and uncertainty in the timing, quantity and quality of product returns (Guide et al., 2000). This imbalance between supply and demand could result in too high or too low stock levels both hurting the profitability of the firm. Therefore remanufacturing firms should focus strategies on reducing uncertainty in timing, quality and quantity of product returns, balance return rates with demand rates and make recovery more predictable. Besides strategies also the use of information technologies can reduce uncertainties (Blackburn et al., 2004). Timely and accurate information can facilitate coordination between forward and reverse flows and balance returns with demands. Especially information on yield (quality) and number of returns can be valuable for a company. Remanufacturing companies can therefore gain advantage when being able to predict: volume, timing and quality of the products to be returned (Thierry et al., 1995). Accurate estimation of returns (quality, quantity and timing) is vital for determining the reverse logistics network design and the profitability of the firm (Srivastava & Srivastava, 2006). In order to better balance supply and demand in the remanufacturing industry Östlin et al. (2009) propose to use the product life-cycle perspective in order to forecast the general trends of remanufacturing volumes. The average life of a product can be predicted, but still depends to what extend the product has been used and in which environment. Another influencing factor is the willingness of end-users to return products. The willingness of returning used products can be influenced through the implementation of collection strategies (Savaskan, 2004) and through the use of optimal acquisition pricing strategies (He, 2015). The collection and pricing strategies will now be discussed.

A remanufacturer can decide between three strategies for the collection of end-of-use products (or used OEM-cores): collect the products them self directly from customers, provide incentives for the retail channel to stimulate the collection or outsource the collect activities to an specialized collection company (Savaskan, 2004). As remanufacturers cannot control the full supply chain they need to work together with partners. These partners could take care of collection, sorting, disassembly and/or cleaning of products before these are returned to the manufacturer. Using a retailer as a supply chain leader is the most beneficial collect strategy for a remanufacturer

(Savaskan, 2004). The hybrid variant of a strategic alliance between a remanufacturer and a retailer collecting used products is an effective reverse chain channel for a remanufacturer, as this will lead to the lowest wholesale and retail prices, the highest return rates of used products and the best profits (Hong et al., 2013). Moreover this indirect collection system also provides an advantage in the strategic interaction between competing retailers (interaction effect). Through buy-back payments on used products retailers are inclined to lower retail prices, which could lead to increase in sales volume for the remanufacturer (Savaskan & Van Wassenhove, 2006). Only in markets in which the retailer has less impact on pricing a direct model, in which the remanufacturer primarily does collection, is more effective. Remanufacturers only using third party collectors as suppliers for used products, may be charged a higher transfer price for the used products resulting in higher wholesale/retailer prices and lower market demand (Choi et al, 2013). Nevertheless from a collection rate improvement perspective a collector-led channel structure of CLSC provides better results (Wang et al, 2015). Furthermore a CLSC-channel can be centralized or decentralized. In case of a centralized channel, the manufacture takes the lead (manufacture-led channel) and defines the acquisition price of the product return. In a decentralized system the collector defines the acquisition price (collector-led channel).

Choosing the right collection strategy also depends on the intensity of competition. In case competition in the reverse chain channel is not strong a strategy based on a dual reverse supply chain channel, in which a retailer and a third party compete with each other on the collection of used products, will perform better on the level of retail pricing, collection rates and profits, than a single reverse supply chain in which only the retailer or only a third party is collecting used products. In case of strong competition in the reverse chain channel remanufacturers can better follow a strategy based on a single reverse chain channel in which the retailer or a third party dominates (Huang et al., 2013). Nevertheless a pro-active return acquisition management of used products is preferred above a passive strategy provided that the number of products bought back is not already large. Possible examples of pro-active product acquisition management are: advertising of the return opportunities, i.e. create awareness for environmentally friendly products and firms, developing a buyback program for used products and/or to adjusting contract design, e.g. for leasing (Minner & Kiesmüller, 2012).

Next supply chain management can also influence product acquisition strategies. Supply chain management can be defined as ‘the management of upstream and downstream relationships with supplier and customers to deliver superior customer value at less cost to the supply chain as a whole’ (Christopher, 2005). The more upstream the supply chain leader will be, the lower the supply chain

performance will be (Savaskan, 2004). Cooperative strategies among different parties in the CLSC's therefore have a positive impact on the return rates of used products. The number of returns grows when the number of alliance members increases. Especially the relationship between a manufacturer and a retailer improves the return rate of used products (Ma et al., 2015). Thus having strong relationships within supply chain can lead to market power. The success of a remanufacturer is also related to the relationships between the remanufacturer and the customers, as customers are in many cases not only customers but also suppliers of used products to the remanufacturer (Östlin et al., 2008). Depending on the resources and capabilities of each firm, companies can therefore choose from seven specific customer relationship strategies in closed-loop supply chains for remanufacturing. The relationships strategies mentioned are: ownership based: in which the product is owned by the manufacturer and operated by the customers (rental & lease), a service contract: that is based on a contract between a manufacturer and a customer including remanufacturing, direct order: in which customers return a used product, the product is remanufactured and the same remanufactured product is returned, deposit- based: in which the customer buys a remanufactured product with the obligation to return a similar used product (customers = supplier), credit based: in case a customer returns a used product they receive credits which are used as a discount when buying remanufactured products, buy-back: the remanufacturer buys back the wanted used products from a supplier (end-user, waste company or core dealer) and finally a voluntary-based relationship in which supplier gives used product to the remanufacturer. These individual relationship strategies are suitable in different situations and should therefore be managed. In general the following can be said about how to effectively manage these relationships: first the relationship strategies are often not used individually but simultaneously in order to complement each other; second the more important the remanufactured product is for the customer or the higher the perceived risk, the more often a close relationship cooperation is effective like for example an ownership-based or service contract relationship; third a high degree of control over the install based (ownership-based and service contracts) can offer OEM remanufacturers a benefit in timing of the activities within the relationship with the customer leading to crucial information on customer needs; fourth remanufacturing can cause a bad customer response in case of losing functionality in the customer value-adding process, this can be reduced by planning the remanufacturing in periods of slow operational activity in order to reduce the perceived costs of the relationship; fifth remanufacturing can become more effective when there is a win-win situation between the remanufacturer and the customer, for example when the customer delivers a used core at the same moment a remanufactured product is delivered, this enables the remanufacturer to offer products at a low-

cost; finally a take back system can be a basis for a long-term successful relationship based on mutual commitment and trust.

Additionally forming a strategic alliance with an eco-non-profit organization in the collection process of used products could also be part of a relationship strategy. Within such an alliance value creation mainly occurs when the cooperation improves the green image of the company stimulating sales and the value of the company (brand, goodwill), generate more profits because of lower product acquisition costs by making use of the collection network of the organization and finally value is created because the company can focus on their core business and competences instead of collection processes (Kumar & Malegeant, 2006).

Related to OEMs involved in remanufacturing they sometimes follow different competitive strategies. Provided that remanufacturing is very profitable, an OEM manufacturer could take the strategic decision to increase the number of used products/cores in the market in the first period in order to be able to introduce remanufacturing in the next period (Ferrer & Swaminathan, 2009). Furthermore under the condition of increased competition OEMs are more likely to use all available cores in order to be able to offer remanufactured products at more competitive pricing. Subsequently OEMs offering remanufactured products can choose between two collection strategies for used products: a push or a pull strategy (Lehr, 2013). In a push model customers push back products to the OEM at the moment they are used. In a pull model the OEM influences by means of incentives or leasing contracts the number of collected product returns depending on the demand from the secondary market. A pull model proves to be most competitive as it improves results related to inventory stability of remanufactured products and reduces the unit cost of a remanufactured product. In relation to this it is important that the gap between an original and a remanufactured product remains fairly stable to prevent too many customers from switching to remanufactured products, influencing overall profits.

Return rates can be influenced by the acquisition price for the return product therefore optimal pricing strategies can drive profitability of the firm. The optimal acquisition pricing in a decentralized model is lower than the optimal acquisition pricing in a centralized model in which the manufacturer decides. As a consequence a centralized model can lead to reduced quantities of return- and remanufactured products. Mitigation of this problem can be done by issuing guarantees to suppliers in the form of contracts of compensation for every unit supplied or over-supplied hereby maximizing channel profits (He, 2015). Moreover it is important that remanufacturing firms align the incentives

to push the collection of used products from resellers (Guide & Van Wassenhove, 2009). As remanufacturing companies depend highly on the availability of used OEM-cores in the market, competition on the acquisition of these end-of-use products can increase. Remanufacturers should therefore put in place a dynamic pricing strategy in which they offer suppliers an attractive price for used cores and modify it based on the situation in the supply chain in order to differentiate them from competition. This could lead to cost cutting benefits for the remanufacturer (Xiong et al, 2013a). A dynamic pricing strategy for used products (cores) deliver the best benefits to a remanufacturer especially in cases when costs of loss of sales are high or when demand rates are low. This can be explained by the fact that static pricing causes more lose-sales in case demand for used products increases and inventory holding costs are rising in case of declining demand. There is also a link between the sales price of a remanufactured product and the price of a used core. Research has shown that in an open market there is a negative relationship between the sale price of a remanufactured product and the price of the used product or core (Liang et al., 2007). Further the more volatile the market the higher the price for the used core will be. On the other hand the longer the time period of the remanufacturing process the lower the prices for cores, in this case there is a risk of obsolescence. Dynamic pricing strategies in the reverse chain channel are therefore crucial for the profitability of remanufacturers. Besides defining the right acquisition price of returned products remanufacturers also need to calculate the optimal acquisition quantity to minimize total costs (He, 2015).

Finally knowing the breakpoint where the supply of used products (cores) exceeds the demand for remanufactured products can have a significant impact on the competitive advantage of a remanufacturer. Before the breakpoint remanufacturers can gain competitive advantage by identifying potential products for remanufacturing and looking at abilities to collect more used products. After the breakpoint competitive advantage can be reached when remanufacturers will focus on efficiency by limiting the acquisition of used products (Östlin et al., 2009). A remanufacturer should therefore carefully monitor supply and demand.

Summarizing: product acquisition strategies are vital for creating and sustaining the competitiveness of a remanufacturing firm. Strategies should focus on lowering uncertainty levels regarding availability, timing and quality. It is about being able to predict and balance supply of product returns with demand for remanufactured products. The implementation of information technology can drive this. Furthermore collection strategies should be based on partnerships with other stakeholders in the supply chain including customers as this is indispensable for increasing the number of product

returns. Therefore different relationship strategies should be implemented in different situations. Moreover OEMs going into remanufacturing should use pull strategies instead of push strategies related to product returns in order to generate optimal results. Also a pro-active dynamic pricing strategy of used cores is needed for reaching cost benefits. Finally knowing the product life cycle can help remanufacturers to determine the breakpoint where supply of used cores exceed the demand for remanufactured products through which competitive advantage can be obtained.

Remanufacturing strategies

Remanufacturing can be defined as: 'the recovery of value from collected products that are end-of-use by means of –re-utilization of the lasting components for the production of a product with equal functionalities as a newly manufactured product' (Geyer et al., 2007). Before starting with remanufacturing activities, companies first need to find out whether there is a demand for remanufactured products and the customers willingness-to-pay for remanufactured products, secondly if relative values can be recovered from returns at a reasonable cost and finally if there is enough access to the supply of end-of-use products (Guide & Van Wassenhove, 2009; Chen, 2014). Being green often costs more therefore a differentiation strategy is needed to earn back ecological investments. Though this can only work in niche markets where customers are prepared to pay a premium price for green products. Nevertheless in many markets a price premium on remanufactured products is not accepted. Companies can therefore only succeed under the condition of following an environmental cost leadership strategy (Orsato, 2006) by focusing on product/services and gaining competitive advantage from lowering costs. Nevertheless as being part of a closed-loop supply chain, the strategic design of the reverse logistical network should not primarily be based on transportation and logistical costs. According to Mutha & Pokharel (2009) the costs of reprocessing (inspection and dismantling of used products), remanufacturing and the costs of new modules are the most important indicators for making the decision on an effective logistical network. The most beneficial would be to locate reprocessing centers at the location where resources (energy, labor & land) are cheaper and locate remanufacturing centers at places where new modules of remanufactured products can be acquired cheaper. On the other hand designing a reverse supply chain model with a too narrow focus on costs is also not advised as time delays could occur leading to limiting the possibility of reusing products and potentially destroying product value (Guide et al, 2006).

Furthermore competitiveness of a remanufacturing firm can improve provided that remanufacturers have the capabilities of a skilled workforce and of being responsive and flexible related to the unpredictable customer demand and variability in volume and quality of product returns (Seitz & Peattie, 2004). Therefore different remanufacturing operations strategies are required depending on the complexity of the product, the production process and the stability (volume, timing, quality) of the returned product/core supply (Guide et al. 2003; Priyono et al., 2015). Flexibility is a crucial capability for companies that have to deal with low complexity and stability of returned product/core. Whereas companies dealing with high complex products and high stability of returns, need to follow an operations strategy based on fixed costs minimization (Priyono et al., 2015). Moreover a remanufacturer that is confronted with high costs for investments in the expansion of production facilities should implement flexible policies related to long term planning of collection and remanufacturing capacity above large scale capacity expansion. This will avoid overcapacity issues, provide a robust policy toward uncertain product demand and variety in quality and timing of end-of-use product returns (Georgiadis & Athanasiou, 2012). Related to production planning and control remanufacturing firms need to appropriate the right product-positioning strategies (Table 2.) varying from remanufacture to stock (RMTS), re-assemble to order (RATO) and remanufacture to order (RMTO) (Guide et al., 2003). Choosing the right strategy depends on the volume, timing and quality of product returns and the complexity of products and production processes.

Table 2: Planning and control strategies in remanufacturing

Table 2. Planning and control strategies in remanufacturing

Dimensions:	RMTS	RATO	RMTO
Returns volume	High	Moderate	Low
Returns timing	Unpredictable	Somewhat predictable	Predictable
Returns quality	Limited	Uncertain	Highly uncertain
Product complexity	Low-moderate	Moderate to high	High
Processing complexity	Low-moderate	Moderate to high	High

Source: Guide et al., 2003 (adapted)

In relation to stock management of used products remanufacturers can choose between push and pull strategies. A push model pushes through returned products to production at the moment enough quantity is available at the level of the disassembly unit. In a pull set up used and disassembled products are only pulled from stock at the moment there is a real demand for

remanufactured products. In case of a pull strategy not needed returned products are disposed of in order to prevent expensive inventory levels. Remanufacturers should only work with a pull-disposal strategy at the moment stocks of returned and disassembled products is valued lower than serviceable already produced inventory (Van der Laan, 1997).

OEMs that are pro-active in the product remanufacture ability design while introducing a new product, will be more profitable due to capturing additional market share at the moment they introduce a remanufactured variant of the product (Qiang, 2015). OEMs starting in remanufacturing can gain advantage provided that they consider a vertically integrated or hybrid strategy related to product recovery. An integrated design of a remanufacturing system combines all different sides such as production planning, inventory control, logistics network, distribution channel design, product acquisition and market segmentation. Benefits therefore can come from costs sharing by using hybrid facilities and flexible pricing strategies for new and remanufactured products (Chen, 2014). The following four conditions are leading in this. First product recovery requires OEM product or material specific investments especially in case recovery rates are uncertain (transaction costs), second tacit knowledge and other information acquired during the design, engineering and production of the new product should be leveraged and combined with cross-functional management capabilities and further in case OEMs become too dependent upon independent recovery firms for components or materials recovered, OEMs should be able to develop relationships with third-party firms or competitors in order to reduce resource dependency (Toffel, 2004). Finally key component supplier relationships should be taken into account as disturbance of the relationship can also severely damage the economic and environmental benefits of a manufacturer (Xiong et al. 2013b).

At last remanufacturing influences or is influenced by several stakeholders. Therefore it is important to align conflicting interests of stakeholders within the closed-loop supply chain in order to be able to create value, implement value adding concepts, reduce risk and stay competitive (Schenkel et al., 2015b). Cooperative strategies for stakeholders are therefore needed. Stakeholders can be categorized in two groups: primary stakeholders like: customers, suppliers, service providers and leasing companies and secondary stakeholders like: the natural environment, governmental and non-governmental organizations or the society in general (Schenkel et al., 2015b). Integral value creation in CLSC's stands for opportunity creation and risk reduction for several different groups of stakeholders. The strategic success factors in CLSC that are influenced by stakeholder relationships

are product design, customer services, business models (integral approach of entire process) and intra and inter-organizational information processing (Schenkel et al., 2015b).

Summarizing: remanufacturing firms can increase competitiveness by focusing on lowering transportation, reprocessing, remanufacturing and used product costs, hiring skilled workforce and being flexible and responsive. Depending on the complexity of the product, the production process and the stability (volume, timing & quality) of the product returns, remanufacturers should use the appropriate operation strategies in planning and control. Being flexible in production is important for companies that deal with low complex well available products or companies that are confronted with high investments in case of expansion needs. A strategic focus on cost minimization is required when products are complex and well available. Moreover remanufacturers should manage stocks of return products based on pull-disposal strategy, provided that the value of stocks of returns is lower than already produced finished product stocks. Furthermore OEMs can benefit from remanufacturing strategies because of their position of being the producer of both new and remanufactured products provided that they follow a hybrid and vertically integrated product recovery system. Finally cooperative strategies for stakeholders within the closed-loop supply chain are needed in order to come to integral value based on opportunity creation and risk reduction.

Remarketing strategies

Remarketing strategies stand for creating secondary markets for recovered products (Blackburn et al, 2004). This is needed as purchase intentions towards remanufactured products in close-loop supply chain are different from new products. Despite the fact of often lower pricing than new products, there continuous to be a reluctance towards buying remanufactured products. The reasons for the lack of purchase intention of customers for remanufactured products can be found in the purchase attitude which is influenced by the product knowledge of the customer, perceived benefits and perceived risks. Remanufacturers should therefore base their marketing strategies on promoting the purchase intention of customers by focusing on the three mentioned factors that influence the purchase attitude instead (Wang et al. 2013). Furthermore pricing strategies for remanufactured products should be linked to the customer value perception of remanufactured products. When customers value remanufactured products higher than new products because of their environmental attributes, a high pricing strategy should be used. In case customers value remanufactured products low, a low price strategy is needed to capture these low value customer segments (Atasu et al, 2008). Nevertheless according to research dynamic pricing strategies for remanufactured products renders

greater profits during the whole product lifecycle. Pricing should therefore depend on the type of market (lifecycle phase of the product), the possible cost-savings of the remanufactured product compared to a new product and the substitutability ratio between a remanufactured and a new product (Chen & Chang, 2013). Moreover remanufacturing products is more profitable in markets with strong competition because it captures green segments. However product life-cycle effects need to be taken into account before introducing remanufactured products. Therefore the optimal market growth rate is about a sufficiently low market size in order to match supply with demand and sufficiently high size to maximize sales and profits for the remanufacturer (Atasu et al, 2008).

Furthermore OEMs can be hesitating to start remanufacturing activities as they are concerned about the potential of cannibalization of their primary market by remanufactured products (Chen, 2014). Therefore OEMs should assess the profit potential for remanufactured products by knowing the customers' valuation of the new and the remanufactured products and the potential market size. Firms that add reverse logistics activities to the standard forward logistics need to coordinate pricing of new and remanufactured products. It is crucial to identify different market segments. Cannibalization can therefore even be profitable, but a manufacturer should only involve in remanufacturing at the moment remanufacturing costs are sufficiently low to overcome the negative cannibalization effects.

Finally in reducing surplus supply through remanufacturing; internal marketing of process changes within a firm and external marketing targeted at customers play a critical role. Marketing in remanufacturing should therefore concentrate on ownership, promoting that customers can take a new and/or a remanufactured product and on lowering lifetime costs (Sharma et al., 2009).

Summarizing: remarketing strategies are needed for remanufacturing firms because customer purchase intentions for remanufactured products are influenced by product knowledge of the customer, perceived benefits and perceived risks. Pricing strategies of remanufactured products should be dynamic and aligned with the life-cycle phase of the product, the potential cost saving in relation to new products and the change a new product will be substituted by a remanufactured product. Furthermore selling remanufactured products is more profitable under competition provided that there is an optimal market growth rate being sufficiently low market size in order to match supply with demand and being sufficiently high to maximize sales and profits for the remanufacturer. OEMs should only engage in remanufacturing if the costs of remanufacturing are

low enough to compensate cannibalization effects. Finally marketing should focus on ownership and lowering costs.

2.2.3 Sustainable competitive advantage

The ability of a firm to make profit depends on two factors: the attractiveness of the industry and its establishment of competitive advantage over rivals (Grant, 1991). Firms competitive strategies can lead to competitive advantage. According to Porter competitive advantage depends on the strategic position (generic strategies) the firm defines within the industry and the scope of activities a firm seeks to achieve. Nevertheless competitive advantage can also be reached from firms resources and capabilities. A firm can be seen as a bundle of resources. Resources can be the basis for profitability provided that they generate a cost advantage, differentiation advantage, a barrier for market entry, a monopoly or a vertical bargaining power. In general six categories of resources are available: financial resources, physical resources, human resources, technological resources, reputation and organizational resources (Grant, 1991). Resources can also be made up of factor networks holding specific interfactor- or inter-resource relationships forming certain characteristics that lead to sustainable competitive advantage (Black & Boal, 1994). From this four different types of factors known: tradeable asset flows, non-tradeable asset flows, tradeable asset stocks and non-tradeable asset stocks. Asset flows can be obtained or adjusted immediately, asset stocks cannot as these are build up over time from asset flows. Tradability is about whether a factor can be clearly identified and monetarily be valued. The strategic resource factor relationships hold: network type, available substitutes and cogency relationships. The relationships between factors can be compensatory, enhancing and/or suppressing. Moreover a resource itself can either be a contained or a system resource. A contained resource can only lead to competitive advantage when being hidden for or overlooked by competition or by being one factor in a complex network as a whole that creates a certain competency resulting in sustainable competitive advantage. System resource consists of a complex network that makes unknown contribution to a capability that itself may be part of a network of capabilities leading to a set of competitive advantages (Black & Boal, 1994). Ultimately the ability of resources to generate rent is the key issue. Furthermore a capability of a firm can be described as the capacity for a team of resources to perform some task or activity. Resources are therefore seen as the basics of the capabilities of firms and the most important source for competitive advantage (Grant, 1991). A firm should possess clear ownership and control over its resources and capabilities. This can be explained as the ability of firms to appropriate the returns coming from resources and the capabilities and their ability to upgrade current resources and

capabilities in order to stay ahead of competition (Grant, 1991; Aragon-Correa & Sharma, 2003). However resources and capabilities also need to possess certain properties like they must be valuable, non-substitutional, tacit (causally ambiguous), socially complex, rare or difficult to imitate (Hart, 1995; Barney, 1991, Grant, 1991). At last competitive advantage can also be described as the ability of companies to generate and appropriate more value than its competitors by exploiting their internal resources and capabilities (Chaharbaghi & Lynch, 1999).

A sustainable advantage can be achieved if the competitive advantage resists erosion from behavior from competition (e.g. duplication attempts) or industry evolution. Therefore companies need to raise barriers in order to prevent competition to copy (Porter, 1985; Barney, 1991). Sustainable advantage coming from resources and capabilities depend on four important factors: durability, transparency, transferability and replicability (Grant, 1991). First durability means the rate at which resources and capabilities depreciate or become obsolete. The slower the depreciation the more sustainable the advantage can be. Second transparency stands for the visibility for competition of which capabilities underlie the competitive advantage of a firm and which resources are needed to replicate these capabilities, the less visible the more opportunity for advantage. Third transferability is about how freely resources and capabilities can be transferred from one firm to the other. The more difficult to transfer the more chance to gain sustainable competitive advantage. Fourth replicability defines how easy resources and capabilities can be imitated by competition. The less easy to imitate the more possibility for sustainable advantage. Furthermore sustainable competitive advantage from dynamic capabilities is linked to common features across firms and firm-specific processes. The three main component factors of dynamic capabilities are therefore: adaptive capability, absorptive capability and innovative capability. The underlying firm –specific processes are explained as integration, reconfiguration, renewal and recreation. However only when the development of firms capabilities is aligned with the strategy of the firm, capabilities will lead to better performance and sustained competitive advantage (Wang & Ahmed, 2007). Thus firms can derive sustainable competitive advantage from their strategic positioning, their resources and capabilities and/or the value they create. How sustainable competitive advantage in remanufacturing evolves will be explained in the following section.

2.2.3 Sustainable competitive advantage in remanufacturing

Before starting a remanufacturing business companies should first investigate the relationship between the economic and environmental supply loop performance. Competitive advantage from

remanufacturing can only be obtained in case environmental and economic performance exceeds the performance of the primary supply chain (Geyer & Jackson, 2004). Firms can differentiate themselves by offering (green) remanufactured products and can save on production costs by recovering value from re-using returned products (Jayaraman & Luo 2007). A closed-loop supply chain can therefore be used as a barrier that helps remanufacturers to enhance differentiation, reduce costs to serve and own, generate new revenue and reduce risk (Guide & van Wassenhove, 2009). Thereby in remanufacturing three points are of great importance for creating advantage. First returned products should not be kept on stock for a long time but should be processed quickly as value will reduce over time. Secondly aggressive product acquisition strategies are needed to secure timing, quality and quantity. Finally establishment of value chain partnerships is crucial to secure returns and reuse processes (Jayaraman & Luo 2007).

Remanufacturers need to define their strategic positioning in order to achieve a better performance than competitors. Having a focus on minimizing strategic costs is herewith essential. Strategic costs are costs for remanufacturing equipment, costs of labor for managing reverse logistics, costs of additional warehousing, costs for producing high quality remanufactured products, costs for fulfilling customer service requirements taking into account environmental and legislative aspects (Dowlatshahi, 2000). Remanufacturing firms should therefore be excellent in wringing productivity out of materials, resources and labor.

However supply uncertainty in quantity, timing and quality creates a difference between product recovery network and a traditional production-distribution network, make product recovery (like remanufacturing) more complex (Fleischmann et al, 2000). In order to: cope with uncertainties, generate value and create competitive advantage, companies need to exploit their CLSC-resources and develop CLSC-capabilities (Table 3.). CLSC-resources exist of: stocks of used products, production tools, workforce, relationships in the supply chains, integrated processes, remanufacture ability of products, information on supply & demand, collection and IT systems. Closed-loop supply chain capabilities arise when a firm develops processes and routines related to effective management and integration of forward and reverse flows connected to closed-loop supply chains. Therefore dealing with reverse supply chain issues and challenges can be an important strategic capability provided that it is aligned with the primary and supporting value chain systems, organizational dynamics, product characteristics and consumer's utility functions (Jayaraman & Luo, 2007). Through this a closed-loop supply chain can evolve as a non-tradeable asset flow leading to sustainable competitive advantage (Black & Boal, 1994).

Table 3: Closed-loop supply chain resources and capabilities

CLSC-resources	CLSC-capabilities
-access to stocks of used products	-used product acquisition management skills
-adequate remanufacturing production tools	-robust stock control management for used and remanufactured products
-skilled remanufacturing workforce	-remanufacturing production planning & control competences
-forward and reverse supply chain network relationships	-developing partnerships in the forward & reverse supply chain
-integrated reverse & forward supply chain processes	-understanding and monitoring the product-life cycle of remanufactured products
-remanufacture ability of the design of the OEM product	-issue a marketing approach based on influencing the lack of purchase intentions for remanufactured products
-information on supply of used products and demand for remanufactured products	-ability to issue dynamic pricing for remanufactured products
-indirect collection systems in place	-influencing the willingness of end-users to return products through advertising and buy-back programs
-a grading system for returned products	-ability to develop appropriate reciprocal relationships with customers and eco-non-profit organizations
- internal and external IT systems that reduce uncertainty	-having a flexible and responsive production organization
	-being able to adjust the planning and control based on returns volume, timing, quality, product and process complexity
	-OEM's being able to use hybrid facilities for new and remanufactured products
	-ability to create and appropriate integrated value from a closed-loop supply chain

Subsequently sustainable competitive advantage can also occur when remanufacturers are able to generate more value over a long period of time from the closed-loop supply chain than others. The value creation via closed-loop supply chains can be identified in four different types (Table 4.): sourcing (economic), environmental & social, customer and informational value (Koppius et al., 2014). Sourcing value refers to the direct costs advantages, savings (reduce of land filling and waste treatment costs), new market opportunities (revenue generation) and risk reduction (Schenkel et al., 2015a); environmental & social value relates to being compliant with environmental legislation, to improving the green image of the firm and to green processes and products (Schenkel et al, 2015a); customer value creation refers to increased customer satisfaction (better serving the customer by improved offering), loyalty, brand and know-how protection; finally informational value stands for the data collected through the CLSC-activities which could lead to improved product design or optimized processes and provide information on consumer complaints, product life cycles, consumer usage patterns and behavior (Koppius et al., 2014).

Table 4: Closed-loop supply chain values

CLSC Value Matrix

Sourcing Value	**Environmental/social value**
- Cheaper sourcing - Market extention	-Market leader through proactive compliance -Social impact -Green image
Customer Value	**Informational value**
-Customer loyalty -Customer satisfaction	-Product design improvement -Supply chain process optimization

Source: Koppius et al., 2014 (adapted)

Moreover information technology (IT) is an important enabler for the creation of each mentioned value. Next informational value can only be created by means of cooperation with external stakeholders such as customers and supply chain partners. Developing these relationships and possible external systems also require IT systems to be in place. Through these relationships and IT systems companies can differentiate themselves from competition (Koppius et al., 2014).

More specific the value adding concepts known for closed-loop supply chains can be summarized in the following six main categories: partnership & collaboration, product design characteristics, service concepts, IT solutions, supply chain processes and organizational characteristics (Schenkel et al., 2015a). Partnership & collaboration is defined as vertical coordination, horizontal coordination, inter-firm networks and/or cooperation with third party service providers. Product design characteristics are focused on modularity and are based on design principles like: eco-design, design for disassembly and design for re-use. Service and IT concepts can add value through information collection & coordination in the integrated forward and reverse supply chain. Finally also the way how internal supply chain processes and activities are organized to facilitate CLSC can influence value creation. Besides the individual values, a combination of addressing several values at once (integral approach) can generate competitive advantage. Nevertheless remanufacturing primarily aims at high value recovering at product level hence focusing on economic (sourcing) value creation (Schenkel et al, 2015a).

Thus a CLSC strategy can lead to the generation of additional values from existing resources, the creation of competitive advantage through the physical and the informational side of the reverse

supply chain and it can be seen as a firms distinctive capability or rent-earning competence that is difficult to copy or substitute. Tangible and intangible competitive advantage can be generated from a closed-loop supply chain. Herewith it is not only important to develop capabilities to create value, firms should also be able to appropriate the values created. At last a well prepared strategy is needed in order to guarantee that the advantage and the revenues generated from a closed-loop supply chain overtake the costs associated with such a chain (Jayaraman & Luo, 2007).

Summarizing: sustainable competitive advantage can be derived from a closed-loop strategy provided that it creates a barrier helping companies to enhance differentiation, reduce costs to serve and own, generate new revenue and/or reduce risk. Furthermore remanufacturers with a CLSC can create capabilities when effectively integrating the forward and the reverse supply chain. Thus dealing with the issues and challenges of a closed-loop supply chain can be a differentiator. As a result a closed-loop supply chain can become a non-tradeable asset (resource) flow. The exploitation of CLSC-resources and the development of CLSC-capabilities can therefore lead to value creation and sustainable competitive advantage. However minimizing strategic costs is also essential within a closed-loop supply chain. In order to gain competitive advantage remanufacturers should focus on robust stock control of returned products, strong product acquisition and the establishment of effective supply chain partnerships. Furthermore only remanufacturers that create more value from their closed-loop supply chain than competitors will gain competitive advantage. Different factors like partnership & collaboration, supply chain processes and IT solutions influence value creation in CLSC's. Mainly integral value creation can lead to sustainable competitive advantage this stands for opportunity creation and risk reduction for several different stakeholders within the closed-loop supply chain. It is therefore crucial for remanufacturers to develop relationships with supply chain partners including customers and invest in internal and external IT systems. Nevertheless remanufacturers should not only be able to create values but should also be able to capture these values generated from a CLSC. A solid strategy is therefore needed in order to secure that the advantages outperform the additional costs linked to CLSC's.

2.3 Conceptual model

From the literature it is concluded that the most important CLSC strategies are based on used product acquisition, remanufacturing and remarketing. First, proper product acquisition strategies should enable firms to better predict the volume, timing and quality of product returns as well as to forecast remanufacturing volumes through a product life cycle perspective; IT systems play an

important role in this regard. Furthermore, remanufacturing firms should develop indirect collection strategies through partnerships. A pro-active attitude is required and firms can benefit by building strong relationships within the supply chain as well as with customers and non-profit environmental organizations. Firms can positively influence their customers' willingness to return products by following a dynamic pricing strategy for used product returns; nevertheless, they should know the optimal acquisition quantity in order to minimize costs. Returned products should therefore be pulled from the market only when needed. Finally, in order to stay competitive a remanufacturing firm should know the breakpoint at which the supply of used products exceeds the demand for remanufactured products.

Second, remanufacturing strategies should focus on lowering costs in combination with staying flexible and responsive; a skilled workforce is additionally required. In relation to production planning and control, remanufacturing firms need to appropriate the right product-positioning strategies. The strategy to be implemented will depend on the volume, timing and quality of product returns combined with the degree of complexity of the product and production processes. The stock management of used products should be based on pull techniques that entail products being consumed when needed for production and disposed of immediately if they are obsolete. Finally, cooperation with all stakeholders in the CLSC is needed to facilitate collaboration in the design of an integrated remanufacturing system that is beneficial.

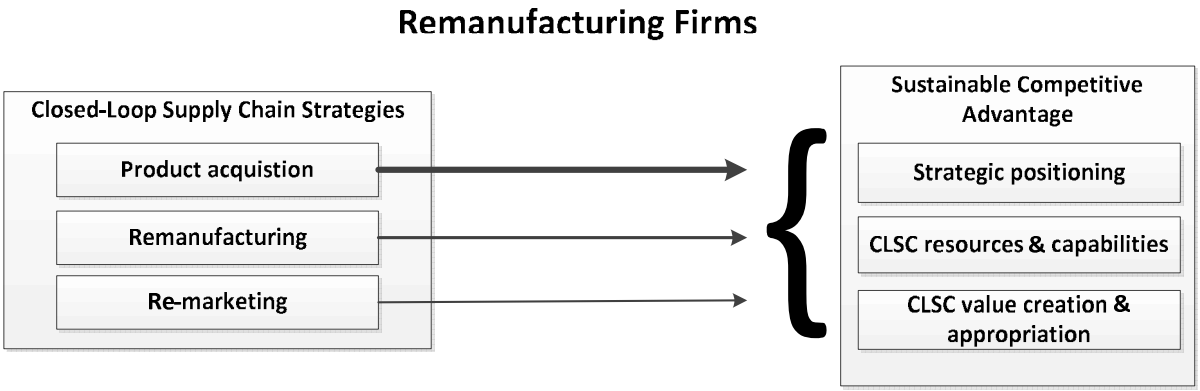
Third, a remanufacturing firm's marketing strategy should focus on promoting customers' purchase intentions by influencing their attitudes toward remanufactured products. A dynamic pricing strategy related to remanufactured products and the monitoring of product life cycle effects are called for in this regard. Marketing should therefore focus on ownership and lowering product lifetime costs. Moreover, OEMs could benefit from coordinating the pricing of new and remanufactured products paired with pro-actively designing new products.

A remanufacturing firm can gain sustainable competitive advantage from developing the above-outlined strategies in the following ways: by focusing on and aligning with their strategic positioning in the market, by exploiting and adding CLSC resources and capabilities or by creating and appropriating additional value from the CLSC.

The introduction to this study's research question and the existing theoretical background leads to the conceptual model shown in Figure 1. The thickness of the arrow defines the extent to which this

strategy is expected to influence a remanufacturing firm's sustainable competitive advantage; the thicker the arrow, the more influence is expected.

Figure 1: Conceptual model



3. Empirical Research Design

This chapter discusses the research strategy and methods chosen for this study. It explains why the methods used are appropriate for this research, elaborates the context of the research and explains how data was collected and analyzed.

3.1 Type of research

This was a practice-oriented research (Dul & Hak, 2008) with the purpose of better understanding how the competitive strategies based on CLSCs could lead to sustainable competitive advantage for remanufacturing firms; its outcomes identify the linkages among the variables considered (Stuart et al., 2002). The study contributes to the knowledge of managers in remanufacturing firms; its outcomes should in particular enable research managers to better understand which CLSC strategies deliver sustainable competitive advantage in a remanufacturing context.

Much research has already been undertaken on CLSC strategies and sustainable competitive advantage. As such, a deductive approach (Bryman & Bell, 2015) was suitable for identifying the constructs related to CLSC strategies and sustainable competitive advantage in the literature. This approach also entailed using literature to specify the contextual determinants of CLSC strategies and sustainable competitive advantage. However, as little theory exists in relation to which CLSC strategies could lead to sustained competitive advantage for remanufacturing firms, a more inductive method was required in order to observe the strategies used within remanufacturing firms and analyze how these strategies could lead to sustainable competitive advantage in practice..

As noted above, this study provides more insights into how value is created and which strategies could lead to sustained competitive advantage by closing the supply chain loop within remanufacturing firms. Although value creation and sustainable competitive advantage could be measured quantitatively, the complexity of strategies related to closed supply chains and sustained competitive advantage require close process examinations; as a result, a detailed qualitative research approach was chosen. This approach provided an opportunity to collect data that presents a thorough understanding of the remanufacturing industry's context as well as the relationships and events within this sector (Yin, 2009).

The research strategy entailed looking at multiple cases. Case study research is a useful research strategy when the topic is broad and highly complex, when not much theory is available and when context is important (Dul & Hak, 2008).

The data collection method chosen was a semi-structured in-depth interview (Bryman & Bell, 2015), and a total of 17 remanufacturing companies were interviewed. This method provided rich data and a better understanding of the complex processes and causal relationships (Bryman & Bell, 2015) among CLSC strategies and sustainable competitive advantage within remanufacturing firms.

3.2 Unit of analysis

As this research looked at the creation of sustainable competitive advantage through CLSC strategies within remanufacturing firms, the analytic unit was a company–more specifically a remanufacturing firm. Although many functions are involved in CLSC activities within remanufacturing firms, this study focused on the strategic elements of CLSCs. It was therefore appropriate to particularly involve individuals responsible for strategy building in the research. As a consequence, mainly CEOs, general managers and directors of remanufacturing firms were interviewed. These participants provided an overall understanding of the CLSC strategies that their firms use and how these strategies lead to sustained competitive advantage.

3.3 Data collection

The literature revealed that CLSC strategies are based on three main activities: product returns management, remanufacturing and remanufactured products market development (Guide & Van Wassenhove, 2009). Moreover remanufacturers can gain sustainable competitive advantage through strategic positioning, CLSC resources and capabilities, and/or through CLSC value creation and appropriation. These observations formed the constructs of this study's conceptual model, which were in turn operationalized through a conversion table (Table 4). The interview questions were based on these constructs in order to guarantee that all required subjects were discussed during each interview (Bryman & Bell, 2015).

Table 4: Conversion table

Construct	Subconstruct	Operationalization
Sustainable competitive advantage	Strategic positioning	-being cost leader and/or diffentiate from competition
		-develop and configure activities different from competition or perform in a different way
		-create barriers that can withstand copying and/or erosion from competition
	CLSC Resources & capabilities	-find returns to the resources & capabilities which provides competitive advantage above costs
		-create resources and capabilities that are valuable, durable, non-transparent (tacit), non-transferable and/or non-replicable
		-be responsive and fast in product innovation combined with a management capability to renew or re-assign internal and external competences
		-being able to appropriate the returns of resources & capabilities
		-create more value by exploiting resources and capabilities
		-being able to upgrade current resources & capabilities
		-develop dynamic capabilities that are adaptive, absorptive, innovative and aligned with strategy
	CLSC Value creation & appropriation	-being able to generate and appropriate more value than competition
Closed-loop supply chain strategies	Product acquisition	-being able to predict volume, timing & quality of product returns
		-forecast remanufacturing volumes through a product life cycle perspective
		-use of information technologies to reduce uncertainties in forward and reverse chains
		-develop indirect collection systems by forming partnerships
		-being pro-active in returns acquisition management
		-develop strong relationships in the supply chain including with customers
		-forming alliances with eco-non-profit organizations
		-stimulate the willingness to return products through dynamic pricing of product returns
		-define the optimal acquisition quantity to minimize costs
		-develop a pull model related to product returns
		-knowing the breakpoint where supply of used products exceed demand for remanufactured products
	Remanufacturing	-lowering costs of production
		-having skilled workforce
		-having a responsive and flexible production
		-following the appropriate production planning & control methods
		-pull stocks of returned products at the moment needed and dispose of stocks not needed
		-develop an integrated design of a remanufacturing system
		-closely cooperate with all stakeholders in the closed loop supply chain
	Re-marketing	-promoting purchase intentions of customers by influencing the customer attitude towards remanufactured products
		-issue dynamic pricing for remanufactured products
		-monitor product life-cycle effects
		-coordinate pricing between OEM and remanufactured products
		-pro-activity in product design
		-focuss marketing on ownership and lowering life time costs

Using purposive sampling (Bryman & Bell, 2015) ensured that individual remanufacturing companies were selected in a strategic manner. As purposive sampling is considered a non-probability sampling approach, it does not allow for generalization to a population. The participants were found through desk research on the internet, predominately via a Google search using specific terms such as “remanufacturing,” “closed-loop” or “remanufactured.” Individuals from the researcher’s own network were also contacted. In total, 29 remanufacturing firms were reached by email and/or

telephone. Although 18 firms ultimately agreed to participate in the research, time restrictions led to only 17 being interviewed. An anonymized list of respondents is presented in annex II.

The data in this field research was collected through semi-structured in-depth interviews. Eleven interviews were conducted in person while six were conducted via Skype. To simulate a face-to-face approach during the Skype interviews, the program's voice and camera (view) features were both used in most instances. Doing so enabled the interviewer to establish rapport with the participant (Bryman & Bell, 2015).

Finally, all interviews were audio recorded in order to make transcribing and analyzing the results easier and improve the accuracy of the transcripts (Tulder, 2012); each participant's permission to do so was requested prior to his or her interview. Data triangulation (Bryman & Bell, 2015) was achieved through an interview with a customer of one of the participating remanufacturers in the printer cartridge group.

3.4 Data Analysis

The data analysis was undertaken in three steps. First, all interviews were transcribed verbatim. All transcripts were then read through a paradigm of social constructivism; during this reading, statements relevant to the research topic were labeled by case with an emphasis on finding links with the research constructs. Additional labels were also created for new subjects that were not related to the existing constructs but nonetheless relevant to the research topic. In order to identify relationships, open-coding techniques were then used to code the data (Strauss & Corbin, 1998). The second step focused on aggregating the data from all cases by construct or newly created label. Statements relevant to each case were categorized by construct or newly created label within an Excel table. Sub-labels were created within the categorizations in order to further converge the data. In the third step, the statements obtained from each case were compared to each other (Dul & Hak, 2008); this is known as the comparative case study (Yin, 2013). Finally, refined relationships were established between categories, consequences and patterns using an axial-coding process (Strauss & Corbin, 1998). Finally relationships between categories were validated.

Validity and reliability

Validity ensures that research results are true and that conclusions are correct by eliminating sources of bias (Easterby-Smith et al., 2012). This study's internal validity was improved through data

triangulation, while it's external validity—or generalizability—was improved by always interviewing people at the same hierarchical level (Bryman & Bell, 2015). However, the validity of this research could have been influenced by the limited time available for each interview. Moreover, while recording the interviews resulted in an accurate record of what was said, it could have also affected the discussion as it is a known that people tend to be more careful about what they say when an interview is being recorded (Tulder, 2012). New strategies and competitive advantage are sensitive subjects as they are linked to a firm's (future) profitability; as such, interview participants may have been more reluctant to provide complete and accurate information. To counter this, the interviewer assured each participant before the interview that all provided data would be treated confidentially and processed anonymously; only the interviewer and the university are aware of the companies and names behind the cases.

The study's conceptual validity, which determines whether what was intended to be measured was actually measured, was guaranteed through a conversion table. This conversion table was created based on the variables sustainable competitive advantage and CLSC strategies, which were enhanced through further specifications of these constructs that were obtained from the literature. The table was then used to formulate seven interview questions about the variables and the relationship between them. Doing so enabled the researcher to link the literature research with the interview questions and consequently empirical components of the study.

The semi-structured interview method was used In order to improve internal reliability. In this regard, a certain amount of both consistency and fine-tuning was applied in relation to how the questions were posed. This approach limited the interviewer's subjectivity and the possible transfer of his subjectivity to the respondent. Furthermore, each participant's permission was sought to audio record the interview and fully transcribe the data. Having these records meant the research could be reviewed and the reliability of both the data collection and analytic work could be checked. Nevertheless, data collection could only be undertaken within the study's restricted time frame, which influenced the number of interviews conducted and therefore the reliability of the research.

4. Empirical Results

The study's empirical results are discussed in this chapter. Focus is first given to the remanufacturers that participated in this research. These remanufacturers can be categorized into the following three main groups: companies that remanufacture printer cartridges (namely toner- and/or inkjet-cartridges), companies that are active in IT asset recovery and companies that focus on remanufacturing machinery components (mainly for OEMs). An analysis of both findings related to each of the conceptual model's sub-constructs and findings that cannot directly be linked to any construct of the research is subsequently provided. Furthermore, the relationships identified between the sub-constructs of CLSC strategies and sustainable competitive advantage are also explained. The sub-constructs discussed under sustainable competitive advantage are strategic positioning, CLSC resources and capabilities, and CLSC value creation and appropriation; the sub-constructs explored as part of CLSC strategies are product acquisition, remanufacturing and remarketing. The chapter concludes with examples of additional findings from the research.

4.1. The cases

In total, 16 remanufacturing companies and 1 retailer (selling remanufactured products) were interviewed. Of these companies, 12 are active in the printer cartridge business, 2 are active in IT asset (e.g. PC, laptops and servers) recovery and 3 are focused on the remanufacturing of OEM machinery parts (e.g. gear units, drivers, starter motors and generators). While the companies are located in different countries, most are in the Netherlands, France or China.

Group 1 Printer cartridges

Printer cartridge remanufacturing companies remanufacture used (i.e. empty) toner and/or inkjet cartridges for printers, photocopiers and fax machines of the following OEM brands: HP, Epson, Canon, Brother, Kyocera, Dell, Oki, Samsung, Lexmark and Dell. Remanufactured toner cartridges are predominately used in corporate (or office) environments, while remanufactured inkjet cartridges are principally utilized by consumers at home. All of the companies that participated in the research have been active in the remanufacturing industry for at least 10 years. Three of the companies are headquartered in China, three are headquartered in France and two are headquartered in the Netherlands; the remaining remanufacturers are located in Belgium, Finland, Romania and Poland.

In total, five companies remanufacture both used toner and inkjet cartridges, three companies focus on remanufacturing used toner cartridges and four companies only remanufacture used inkjet cartridges. Two remanufacturers acquire used products only through their own direct collection schemes for end-users or retail partners. Three companies have fully outsourced their collection activities to a specialized collection company and five companies have a hybrid model that entails used products being supplied either by their own collection systems or through external partners. Seven companies sell remanufactured cartridges to resellers (remanufacturer's brand or reseller's brand). One remanufacturer produces more than 35 different private labels, while the other five remanufacturers only sell their own branded products directly to corporate or home end-users. Only one company noted that it is experimenting with selling remanufactured products to both resellers and end-users. The smallest remanufacturer employs 10 people; the largest company employs more than 1,000. Two of the interviewed companies also manufacture other products, such as new-build inkjet and toner cartridges, thermal printer supplies, cartridge components, 3D printers and 3D printer supplies.

Group 2 IT assets

Two large IT asset recovery companies participated in this research. Both companies refurbish or remanufacture used PCs, laptops and servers and are currently expanding their product range to mobile devices. Moreover, both companies are also globally active and have a physical presence on several continents. The acquisition of used products is arranged through the direct collection of used products with large corporate end-users, data centers and leasing companies or through cooperation with OEM producers of PCs, laptops and servers. Both companies also work with charity organizations. Refurbished or remanufactured products are mainly sold either in bulk to resellers and retail shops/chains or straight to corporate end-users. One company offers in-house recycling solutions for devices that cannot be remanufactured, while the other outsources these activities to a partner. In addition to refurbishing, remanufacturing and recycling products, one of the companies also services new devices for corporate end-users. Each company employs more than 4,000 people worldwide.

Group 3 Machinery parts

The machinery parts group includes three companies, all of which are active in the remanufacturing of OEM machinery parts (such as gear units, drivers, injectors, starter motors, generators and other

machinery components). Two companies act as multinationals and also produce OEM products; they each employ more than 16,000 people. Nevertheless, the remanufacturing businesses of these companies reflect only a small portion of their total activities. One of the two multinationals is currently replacing part of its repair department with a remanufacturing department, while the other was forced to get involved in remanufacturing by one of its major customers (a Japanese car manufacturer). The third organization is smaller and mainly acts locally. However, this company is linked to a large multinational that decided to outsources the remanufacturing activities. With all of these companies the acquisition of used products is completely arranged through contracts with customers. Most of the remanufacturing taking place in this group occurs only on customer demand.

4.2 Sustainable competitive advantage

This section analyses the interview data related to the sub-constructs of sustainable competitive advantage for remanufacturing firms, namely strategic positioning, CLSC resources and capabilities, and value creation and appropriation. The analysis reveals that when explaining sustainable competitive advantage, remanufacturers mention their CLSC resources and capabilities the most, followed by their strategic positioning and finally by value creation and appropriation.

Table 5: Quotations from the interviews, sustainable competitive advantage

Sustainable Competitive Advantage		
Strategic positioning	**Resources & capabilities**	**Value creation & appropriation**
Second most mentioned	*Most mentioned*	*Least mentioned*

Strategic positioning

The results of this empirical research reveal that having a specific strategic positioning is important for remanufacturers in relation to sustainable competitive advantage. The majority of respondents point out that only offering a low price for a remanufactured product is not sufficient to attract customers. The data analyses reveal that 14 of the 16 remanufacturers use a strategic position that is based on delivering a quality product that can compete with OEM products in the market. Differentiation therefore focuses on quality, additional service and price. Moreover, 11 of the 17

respondents confirm that being able to offer the full package of quality products and additional services generates competitive advantage; 3 also mention a low price positioning as "the" differentiating factor. Nevertheless, low pricing is often mentioned as the third most important aspect (after mentioning quality and service first).

In this regard, the CEO from case 1 notes: *" 'X' has always been obsessive about the quality. Not only of the product, but also the service, the whole package. The whole offer."* The CEO from case 8 states: *"We position ourselves not as being a 'price' company. We position ourselves as a quality company that cares about the environment."* He continues: *"Our customers choose for quality. They choose for simplicity. And also certain reactivity. So it's really an image that goes with the product."* The director of case 15 comments: *"I think our advantage is that we sell to the end-user directly. Besides that our customers value the service we offer and of course the quality of our products."* The CEO from case 9 notes: *"The first thing is quality. The technology, the quality control, we believe that we can provide very good products and technology to our customers, especially compared to the competitors in China."* The general manager of case 3 states: "*First is the reputation. Because the market knows 'Y' for a long time. It's the first thing. And of course quality. Definitely the winning factor."* On this issue the CEO of case 8 adds: *"The strategy is to add more services in our offering. It's the collect services. It's the reports that we provide, but it's also the breadth of the products."* The remanufacturing manager of case 14 notes: "*The quality of 'Z' is very high. The price is also slightly higher, so the customer pays a little bit more for the name 'Z.' We are known as a Japanese quality company."* The services most mentioned are product and printer guarantees, a product stocking service for resellers, sustainability reports, fast deliveries, a free collection service for used products, sharing information coming from the collection, and responsive and customer-oriented service.

Five respondents consider remanufacturing a service. The country manager of case 12 notes: *"What they buy from us is a kind of support service. Data security is very important for a lot companies, unfortunately many companies do not process their used products in a safe way. We are a leader in the market and want to provide knowledge."* The vice president of case 6 states: "Q*uality, price, data and environment. Those are the most relevant aspects for our customers. For certain customers the sequence of importance runs from 1 until 4, for others it runs from 4 to 1."* The director of case 4 says: *"It seems that remanufacturing is more a service than a product. You do not really want to sell a remanufactured product but a complete service."* The support manager of case 16 states: "*Our brand name is very important, but remanufacturing is our pragmatic answer to service. Therefore the determining factor is quality."* Two companies indicate that a global positioning is required in order

to be able to win global contracts and guarantee local service levels. In this regard, the director of case 6 comments: *"I think you can only form a barrier by being a global player. Locally it is important to offer the services like data wiping, secured logistics and reporting to the end-user."*

Finally, three respondents consider being competitive on pricing most important. As the CEO of case 8 notes: *"So the price is very important, we have to be competitive. At least at the same level as our competitors.*" The CEO of case 11 remarks: *"People buy our product especially because it's cheaper, not because it is cheap, but because it is cheaper and of course also because of the good quality."*

Closed-Loop Supply Chain Resources and Capabilities

From the analyses it appears that having the right CLSC resources and capabilities is crucial for remanufacturers to develop competitive advantage. In this context, respondents mention being knowledgeable about products, flexible and controlled production processes, intellectual property and markets as well as having resources and capabilities based on active used product acquisition, access to components, responsive customer support and recycling solutions.

On this topic, the CEO of case 5 says: *"The insights of the market and the insight of the…I need to find it the right way…the complete eco system."* He adds: *"You need knowledge in production, in supply chains and buying systems. It is all about knowledge."* Furthermore, the general manager of case 3 states: *" 'Y' has a lot of resources on the engineering and the manufacturing side. Our R&D, the product development is very important in order to catch the right moment for product development."* The CEO of case 1 asserts: *"We have our own R&D, product development and market monitoring teams. We have great engineers in our R&D labs."* The CEO of case 8 notes: "W*e have a very knowledgeable team that does the engineering that looks at how we can remanufacture products. What we should do to respect our values and to really say we create a responsible product for the lowest cost possible*." The CEO of case 8 states: *"What has value is how to create processes in an industrial way. But if you look at the particularity of the remanufacturing business, it's not an industrial process, therefore you need to be very inventive."* The CEO of case 2 notes: *"The process flows need to be very logical and clear to staff members. They need to be able to take the full responsibility from A to Z."* The CEO of case 11 further states: *"I think we have started to use our experience. So experience is the first thing, experience and competence."* The CEO of case 5 remarks: *"You need to have a flexible organization. In the past we were never the first in releasing new products, now we are."* The supply chain manager of case 10 notes: *"You need flexible logistics and*

knowledge of the quality of our products." The CEO of case 9 confirms: *"We try to understand the products and we do a lot of tests. Our remanufacturing and re-filing technology is always in-house. Only the chip knowledge is taken from external partners."* The CEO of case 6 comments: *"It is about knowledge of remanufacturing processes, return marketing, secured logistics and excellent production processes in our factories. Besides this customers want guarantees on data protection and environment."* The CEO of case 4 suggests: *"We need to have good technicians, however they do not all need to have been highly educated. We have this knowhow available, it is good that we have this as this is something that cannot be taken away easily."* The remanufacturing manager of case 14 states: *"We have highly trained people and we receive all tooling from Japan, straight from the source. Therefore I think we can work more efficiently."* He adds: *"As we have the original specifications of the products, this give us an advantage."* The way in which processes are defined and responsiveness towards customers are important elements for staying competitive. These comments also reveal that flexibility is crucial in this regard. As CEO of case 4 remarks: *"We are in a world where we need to act quickly. We can easily insert a certain badge into our current production processes. We have that flexibility."* The support manager of case 16 notes: "*I think we gain competitive advantage through our flexibility and speediness. Within a reasonably short time schedule we can arrange things to help a customer."*

Data analyses reveal that knowledge on intellectual property can also be an important resource. The general manager of case 3 says: *"We have a strong belief in IP [intellectual property]. We are putting a lot of effort and investment in IP. We are always prepared for the OEM."* The CEO of case 1 suggests: *" 'X' is very much following all the legal requirements to be able to remanufacture or implement into the market products that do not interfere with patents and the legal requirements coming up from OEM."*

Furthermore respondents also note that the ability to source used products and components is an important capability for remanufacturing firms. This because having a good access to used products and components is considered as a source for improved competitiveness. In this connection, the CEO of case 2 asserts: *"To have your own collection systems is a very important element. Each customer where we collect can also be a future customer."* The CEO of case 8 notes: *"We create barriers for competition by doing the collection. You have to connect the collect information to the sales, so that you can sell with more predictability."* The CEO of case 1 says: *"We provide collection of our own used products without any charge, so we cover the recycling charge and we buy the OEM used products."* The CEO of case 9 confirms: *"We spend big amounts of time and resources to collect empties in*

China. This is, I think is our advantage." The CEO of case 11 states: "*The best way is to control completely all, so from the collection to the sales to the final customer."* Acquiring used products through the company's own collection systems is thus seen as an important resource or capability for gaining advantage. However, other firms focus on creating partnerships with specialized collectors. As the CEO of case 9 comments: *"We have created a small network of partners, smaller collectors, from whom we take all what they collect."* The ability to have access to product components is mentioned by six respondents. Remanufacturers sometimes produce components in-house and sometimes form strategic partnerships with key component suppliers. The general manager of case 3 states: *"The limitation of the suppliers chain is getting worse. We therefore produce components like ink, toner, OPC drum, blades and some gears ourselves."* The CEO of case 8 notes: *" 'Z' is a very integrated model. We produce our own ink and we produce some other components.*" The support manager of case 16 remarks: *"We replace components with new original components for 'X.' We are therefore able to produce a product as good as new."*

Respondents also mention offering local recycling services for products that cannot be remanufactured. As the CEO of case 6 notes: "*You need to be able offer a local recycling solution for items that cannot be remanufactured."* The country manager of case 12 remarks: *"We try to close the loop as much as possible by remanufacturing, parts harvesting or even in-house recycling."*

Nine respondents consider offering the right customer support and having the ability to be responsive to customer requests as important. The CEO of case 1 comments: *"We provide technical support to both end-users and resellers. We have our own specialists in service and technical advisory, as well as the software that we provide. These are quite unique properties that 'X' has."* The general manager of case 3 remarks: *"It is important to offer a tailor-made service for our customers. We will provide constant updates on the status of a shipment, for example. We also run special projects for certain customers."* The supply chain manager of case 10 states: *"Our competitor has the same quality product. Logistics are therefore very important. In France, we have a good level for that—we can deliver within 24 hours."*

Closed-loop value creation and appropriation

Value creation through remanufacturing arises mainly from a product's lower cost price. Nevertheless, respondents also mention product quality, reliability (or stability) and durability as important aspects of value. Moreover, the majority of remanufacturers intend to increase customer

value by adding service to their offering. The services frequently mentioned relate to guarantees on a product's quality and security, collection, and customer responsiveness and focus. Remanufacturers are able to appropriate value by selling remanufactured products against relatively high margins.

The director of remanufacturing for case 13 states: *"There is a savings for the customer. We sell the remanufactured cartridges cheaper than the original products, but we offer the same quality as OEM. On top of that we provide four years of product guarantee and a full guarantee for the printer."* The support manager of case 16 notes: *"We work with fixed pricing. We know the prices of original drivers. The sales price of a remanufactured version is between 40 and 60% of the value of a new product. It is therefore very attractive to buy a remanufactured version of the product."* In relation to the quality aspect, he adds: *"We replace worn out or damaged parts and then reassemble them to recreate products which are as good as, if not better than, the original."* Discussing the offering for remanufactured products with the remanufacturing manager of case 14 results in the following statement: *"The value for the end-users is inside the lower total cost of ownership. It is the price/quality ratio that makes is interesting."* Furthermore, in relation to why customers buy his products, the vice president of case 6 suggests: "*In the first place it is the quality of the product. Products have been extensively tested, data wiped and upgraded with new software. Besides this, we provide a guarantee. I think it is all about the right price/quality ratio."* On the topic of value creation for customers, the CEO of case 9 comments: *"In my business we use the expression 'quality recycle.' Quality is what we breathe. This quality recycle has two meanings: good remanufactured products and excellent service. This is what we offer our customers."*

In addition to establishing an appropriate quality and price for a remanufactured product, nine of the respondents create additional value for customers by implementing collection systems. In this regard, the country manager of case 12 notes: *"In 70% of the cases, customers receive a reimbursement for the used products. That is pure added value for the customer."* The CEO of case 5 says: *"We have helped distributors to start collecting used products. These distributors now sell their used products to us."* The vice president of case 6 comments: "*The value is also in the revenue for collected used products. It is a financial value."* Beyond generating financial value, collection systems can also produce informational value. In this connection, the CEO of case 2 notes: *"The collect is an important element. The feedback from the collect is also shared with customers. A customer can compare data on what has been collected and what has been purchased."*

Other values identified by respondents relate to guarantees and other services. Here the country manager of case 12 remarks: "*We guarantee data security—the customer pays a service fee for this. Besides this, we offer knowledge on international transport and we include a recycling solution in our offerings."* The director of case 15 notes: *"The value we create for our customers is based on the price, our reliability, low defect rates and the fact that we have our own repair and maintenance service. These are the most important aspects."* The director of case 2 states: *"It is all about selling the whole package."* Finally, the director of case 4 says: *"I am really prepared to provide more guarantee on a remanufactured product than on an original product. If the customer asks for that."*

The appropriation of value by remanufacturers is derived mainly from a sales price for a remanufactured product that is interesting in comparison to the product's cost price. The margin made on the sales of the remanufactured products remains substantial. The CEO of case 2 states: *"We do not want to sell the products too cheap. We have to prevent ourselves from going into a price war."* The director of remanufacturing for case 13 notes: *"Our sales team generates a very good margin on remanufactured products, especially compared to the OEM products that we sell. In this way we are also able to offer an advantage to the customer—here we create a win-win situation."* The director of case 17 remarks: *"We try to convince and secure the customer. For this convenience they are willing to pay a little bit more."* However, one respondent is less positive about the ability to appropriate value; the CEO of case 8 shares: *"Now it becomes more and more difficult to charge the customer for additional values."*

4.3 Closed-Loop Supply Chain Strategies

This section analyses the interview data related to the sub-constructs of remanufacturing firms' CLSC strategies that are mentioned in the study's conceptual model. This analysis reveals that strategies related to used product acquisition are important for obtaining sustainable competitive advantage and that the majority of the remanufacturers derive advantage from developing their own collect systems. Furthermore, remanufacturing firms mention that strategies related to remanufacturing provide even more opportunities for advantage. For the majority of the remanufacturing firms included in this study, strategies based on remarketing play a less dominant role in relation to achieving sustainable competitive advantage. Nevertheless, respondents who focus their efforts on end-users refer to creating advantage from remarketing.

Table 6: Quotations from the interviews, CLSCs

Closed-loop supply chain strategies		
Product acquisition	**Remanufacturing**	**Remarketing**
Second most mentioned	*Most mentioned*	*Least mentioned*

Product acquisition strategies

All respondents confirmed that used product acquisition is crucial for remanufacturing firms. Without securing the flow of used products firms are not able to remanufacture products. However used product acquisition can be managed in different ways. Remanufacturers develop direct collect activities with end-users, develop collect partnerships in the retail channel or outsource the used product acquisition to specialized collectors (including OEMs). Findings from the research reveal that one third of the remanufacturers principally deal with specialized collectors while others developed a hybrid structure by focusing on own collect activities in combinations with sourcing used products from specialized collectors. The majority of the respondents affirm that own collect systems bring more advantage to the firm than purchasing used products from specialized collect companies.

Eleven of the fourteen European remanufacturing firms have put up their own collection systems targeted at the end-user and/or the retail channel. Nine of them also source used products from specialized collect companies. None of the interviewed remanufacturers from China set up own used product collection systems targeted at end-users or retail channels. However these remanufacturers established partnerships with a large number of specialized collect companies in either China, Europa and/or the USA in order to secure the flow of used-products. Four remanufacturing firms also derive used-products through contract arrangements with OEMs. Only two remanufacturers mentioned to be self-supporting through their own collection systems focused at end-users and/or the retail channel.

Table 7: Product acquisition strategies per case.

Case number	Country	Company size	Collect directly with end-users	Collect via retail channel	Outsource to specialized collect companies*
1	Poland	Mid-sized	X	X	X
2	France	Small	X		X
3	China	Large			X
4	the Netherlands	Small			X
5	China	Large			X
6	the Netherlands	Large	X		X
7	Finland	Small		X	
8	France	Large	X	X	X
9	China	Large			X
10	France	Large	X	X	X
11	Romania	Small	X	X	X
12	the Netherlands	Large	X		X
13	the Netherlands	Mid-sized	X		X
14	the Netherlands	Large			X
15	Belgium	Small	X		
16	the Netherlands	Large	X		X
17	the Netherlands	Large		X	

** Include OEM producers & system integrators*

Approximately one-third of the respondents indicate that developing the company's own collection systems does not necessarily bring competitive advantage. The general manager of case 3 states: *"Setting up our own collection systems was not effective for us. What came out of that was not covering our needs. It is also difficult to collect in Europe and the USA and send back used products to China for remanufacturing."* He continues: *"Actually, we are not doing the collection ourselves. So there's a lot of collectors in the market and they do the collection for us. Of course, buying from them is more expensive."* The CEO of case 5 comments: *"We buy from collectors and we help our customers to start collecting."* The director of remanufacturing for case 13 has another view on collection systems: "*We never have actively collected ourselves. If you collect you get back all kind of products you do not want. That is not our purpose, collect is not our core business. Buying from a broker is maybe more expensive, but what are the costs if you have to do it all by yourself?"* The remanufacturing manager of case 14 states: *"The advantage for us is that 'X' [a large car*

manufacturer] has already put in place a core return system. All used cores are centralized in Belgium and then shipped to us. Besides that, customers can only order remanufactured products when they provide us a used product first." The CEO of the remanufacturer in case 4 comments*: "We have a contract with 'Y' [a large OEM of photocopiers and printing machines], they deliver us each week standard quantities of used products. We therefore do not need to develop aggressive acquisition strategies*."

Nevertheless, approximately two-thirds of the respondents emphasize the importance of the company having its own collection systems and indicate that these systems bring them competitive advantage. As the supply chain director of case 10 notes: *"If we did not have our own collect systems, we would not be able to sell at a good price."* The director of case 9 emphasizes the importance of collection: "*It is all about availability. Therefore, the core question is your collect system. If you have a safe and very healthy collect system, you can provide availability to your customers."* The director of case 1 also says collecting is strategic: *"We have two different companies within our group to deal with used products. One takes care of the brokering, the other one focuses on collect activities with end-users and retailers. We will absolutely further develop our own collection activities."* The director of case 6 states: "*The return channels are focused on different segments—it can be large end-users where we deal directly or via OEMs."* The country manager of case 12 says: "*We are very active in the tertiary sector. That is a sector where they change IT assets rapidly. You have to focus on sectors that use products that can be remanufactured. We would like to increase the inflow of used products as much as possible."* The director of case 6 adds another fact*: "We offer a one-stop shop. This means that we do not only collect valuable used notebooks, but we will also take care of your old servers. I think offering a one-stop shop is very important."*

Finally, the CEO of case 8 mentions the additional complexity of utilizing all of the different used product acquisition strategies simultaneously: "*Of course we have created barriers against competition through our own collect systems, but by means of that we are also in competition with the specialized collectors we work with.*" He continues: "*We are a little bit in the middle. I think that creates a difficult positioning as we are not self-supportive—we should be able to rely on our own collect."*

Remanufacturing strategies

There are different remanufacturing strategies available. Some focus on lowering production costs, others on improving flexibility and responsiveness in production. Further there are also strategies required for planning and control activities in production. Finally remanufacturers need to make use of strategies related the cooperation with different stakeholders in the closed-loop supply chain.

First, the research demonstrates that most companies follow a focus strategy by only remanufacturing two or three different product categories. Second, remanufacturing strategies that respondents mention most frequently are based on quality focus through production processes, techniques and control and test activities combined with the replacement of worn out components of used products. Strategies based on increasing the success rate in production are also noted, and seven respondents specifically mention remanufacturing strategies that focus on securing access to product components.

The country manager of case 12 states: *"We constantly try to improve the quality of what we are doing through continued improvement processes and efforts to increase efficiency. We actually would like to target 100% reuse of all product returns."* The CEO of case 8 mentions*: "The quality of our products is the result of our engineering and manufacturing processes. We have industrialized the remanufacturing processes."* The CEO of case 1 notes: *"In production there is a very strict control on all technological aspects for each product. Each product has complete technological documentation on how it should be produced and how it should be tested."* The CEO of case 9 also stresses the importance of the processes: *"I think the design of the work art [production processes], the machines and devices, the quality of your management systems are very important."* The CEO of case 11 remarks: *"We are trying to reach the best possible success rate in production, because if you do not do this you have too high costs."* He continues: *"Very often small changes—small interventions in production—can give very good results. Remanufacturing is not an industrial process and therefore it should not be considered like that in production."* Related to control and testing, the director of remanufacturing for case 13 says: *"We conduct a 100% check in production. This means that we test all products in order to guarantee our quality standards."* The CEO of case 5 points to the possibilities and advantages of automation in remanufacturing production: *"We are going to build automated production lines in order to keep a stable quality and to lower the failure rates in production. I think that we already create a better yield from used products than [our] competition."* The CEO of case 3 focuses on a product's disassembly process: *"We are fully disassembling each used product. That is*

why our quality is different from others in the market." The CEO of case 1 states: *"I would say that the most important control point is at the design of the product, where we evaluate all components and plan how the product will be made and which components will be exchanged."*

The CEO of case 8 also focuses on optimizing production processes and the components used: *"Every time you try to optimize that process to even do it better or give alternatives, look for new products, new sourcing of components that you could use—so it's a continuous improvement process."* He continues: *"For certain components (like chips), you need to develop strategic alliances with suppliers."* The CEO of case 9 also confirms this: *"First of all, follow the OEM—but try to share your R&D with component suppliers as early as possible."* The CEO of case 15 also shares insights in relation to components: *"We are always looking for new components and new component suppliers. We are currently depending too much on only a few suppliers."*

Remarketing strategies

Remarketing strategies focus on promoting the purchase intentions of customers by influencing the customer attitude towards remanufactured products. Most mentioned tools are related to: issuing dynamic pricing for remanufactured products, coordinating prices between remanufactured and OEM products and concentrating on ownership and lowering life time costs for the final customer. Most remanufacturers included in this research sell to resellers instead of directly to end-users. Moreover, the marketing of remanufactured products is predominately targeted at customers who use OEM products. Nevertheless, respondents note that targeting the right customer or customer channel is vital. The majority of the respondents mention that marketing support is needed for the sales channel. According to 5 of the respondents competitive advantage is reached by marketing support to resellers combined with marketing activities focused on informing and persuading end-users. The environmental aspects of remanufactured products are seldom stressed by remanufacturers or considered as advantageous for customers. Finally a strategy focused on pricing only brings advantages when prices are compared to OEM products in the market.

In this regard, the CEO of case 1 notes: *"We do not sell directly to end-users. We position ourselves next to the OEM products, because the choice is then obvious through quality and pricing."* The CEO of case 2 states: *"Everybody that uses OEM products is our prospect. We sell to resellers but we work together with the end-users of our products. You always need to convince the end-user first."* The supply chain director of case 10 remarks: "To make sure that the distributors buy our products and

sell our products, we have to first convince the final customer to buy our product." He continues: *"We have a special prescription team [a team that is specialized in contacting and convincing end-users] to do that."* Related to the marketing of a product's quality, the CEO of case 10 states: *"Customers must feel the reliability and the guarantee. In case there is still a problem with a remanufactured product, fast solutions are needed."* Regarding environmental aspects being used when marketing remanufactured products, the CEO of case 4 says: *"It is still an environmental and sustainable story. Nevertheless, I do not want to play that card too much. More important is the fact that remanufacturing should be economically viable and of a good quality."* Finally the CEO of case 10 states strongly: *"Customers do not care about the ecology. The product just needs to be cheap."*

4.4 CLSC-strategies influencing sustainable competitive advantage

In this section the influence of CLSC strategies on each sub-construct of sustainable competitive advantage is explained. The analyses reveal that remanufacturing strategies are regularly mentioned as an opportunity for creating sustainable competitive advantage. Also strategies related to used product acquisition are important in this manner. However the majority of remanufacturing firms stated that strategies based on remarketing play a less dominant role. The sub-constructs and the relationships to CLSC strategies discussed now are: strategic positioning, CLSC resources and capabilities and value creation & appropriation.

Strategic positioning

Strategic positioning in remanufacturing is all about being a cost leader and differentiate from competition. Some companies develop and configure activities different from competition or perform these activities in a different manner. Furthermore companies intend to create barriers that can withstand erosion from competition through their knowledge and collect systems. The empirical results reveal that the strategic positioning of remanufacturing firms is influenced mainly by strategies based on remanufacturing and product acquisition. The data analyses reveal that fourteen of the sixteen remanufacturers strategically position themselves against OEM players on the market. Differentiation focusses on quality, additional services and price. According to the respondents of the research a quality strategy in remanufacturing relates to efficient production processes and technics, control and test activities combined with the replacement of worn out components of used products. The CEO of case 3 focuses on the disassembly process of the product and says: *"We are fully disassembling each used product. That is why our quality is different from others in the market".* The

CEO of case 1: *"All the new products are extensively tested. You know, to fulfil not only external requirements, but also our own internal requirements which are much tighter and much more sophisticated than the ones that OEMs are using".* He continues: *"Due to the fact that we test our products like that, we are able to objectively support our customers to choose for the best. I think that is a real big advantage, because that is what customers value".* The CEO of case 2 states: *"Used product acquisition and producing a good product are equally important".* The support manager of case 16*: "Customers can choose to have their products completely be remanufactured by us, we provide them as good as new products that customers can use for many years again".* The CEO of case 8 emphasizes the importance of production and engineering processes for the quality of the product: *"The quality of our products is the result of our engineering and manufacturing processes".*

The cost price a product highly influenced by the efficiency in production and the price paid for a used product. Respondents therefore often follow a remanufacturing strategy with a focus on increasing the yield (output) in production. Through this production costs can be lowered . The CEO of case 6: *"We try to make as much used products as possible suitable for remanufacturing".* The CEO of case 5 quotes: *"Because of our remanufacturing knowledge we have a better yield from raw materials and therefore an advantage above competition"*. Furthermore there is a high influence of product acquisition strategies on the strategic positioning of a remanufacturing firm. Developing own collect systems is mentioned by two-thirds of the respondents as a manner to improve the positioning of the company. The general manager of case 3 states: *"The disadvantage is that we do not have our own collection, we are buying empties from brokers, professional brokers. Therefore the price of used products is higher".* He continues: *"Companies that have their own collect schemes are more competitive on price".*

According to the respondents of the research remarketing activities only partly influence the strategic positioning of remanufacturers. Remarketing activities should predominantly be targeted at end-users. The CEO of case 2*: "You always need to manipulate the end-user*". The CEO of case 8: *"The marketing aspect is much more focused on how we can educate our end-customer about re-manufactured products. And that is, in fact, the first objective".*

CLSC-resources and capabilities

Remanufacturing firms that find returns on their resources and capabilities above costs can obtain a competitive advantage. However the sustainability of the advantage depends on whether resources

and capabilities are valuable, durable, non-transparent, non-transferable or non-replicable. Competitive advantage also occurs when remanufacturers can create more value by exploiting their resources and capabilities. The data analyses reveal that having the right CLSC resources and capabilities is crucial for remanufacturers to develop competitive advantage. Respondents mentioned closed-loop resources and capabilities most frequently in relation to sustainable competitive advantage. Strategies to exploit and develop the CLSC resources and capabilities are predominately based on remanufacturing and product acquisition. In this regard there is a high influence of remanufacturing and product acquisition strategies on CLSC resources and capabilities. Being knowledgeable about products , flexible and controlled production processes, intellectual property and markets are mentioned, as well as focus on used-product acquisition, access to components, responsive customer support and recycling solutions. Fifteen of the seventeen respondents mentioned knowledge related to production processes as one of the key determinants for creating sustainable competitive advantage. The ability to guarantee the quality of the products through production processes combined with the capability of being flexible were key in this matter. The CEO of case 4: *"We need to have good technicians however they do not all need to be highly educated. We have this knowhow available, it is good that we have this as this is something that cannot be taken away easily".* The CEO of case 5 points at the possibilities and advantages of automation in remanufacturing production: *"We are going to build automated production lines in order to keep a stable quality and to lower the failure rates in production. I think that we already create a better yield from used-products than competition".* The remanufacturing manager of case 14 states: *"We have highly trained people and we receive all tooling from Japan, straight from the source. Therefore I think we can work more efficiently."* He adds to this: *"As we have the original specifications of the products, this give us an advantage."* The CEO of case 9*:"We buy used products from China and put a different chip on it to convert the item from a Chinese to an European product, that's why we can keep a stable supply."* The country manager of case 12 notes: *"The professionality and knowledge on ITAD [IT Asset Disposition] that we have, including the knowledge of migrations. It is the total package we can offer that makes a difference."*

Four companies emphasize the importance of having a strategy on intellectual property. Developing knowledge on intellectual property is seen as an important remanufacturing strategy that can create competitive advantage. The general manager of case 3 says: *"We have a strong belief in IP [intellectual property]. We are putting a lot of effort and investment in IP. We are always prepared for the OEM."*

Furthermore related to product acquisition strategies and generating advantage the CEO of case 2 says: *"We always have two-three months stock of used-products. This provides us more flexibility".* He adds to this *"Of course having your own collect system is also important, as every supplier where you collect is also a customer for OEM products".* The CEO of case 5: *"We have capacity as we have four million pieces of used products on stock, this means that we have a good availability"*. The CEO of case 8 notes: *"We create barriers for competition by doing collection. You have to connect the collect information to the sales, so that you can sell with more predictability".* Acquiring used products through own collection systems is seen as an important resource or capability for gaining advantage. However depending on where the remanufacturing unit is located some only focus on creating partnerships with specialized collectors. The CEO of case 9: *"We have created a small network of partners, smaller collectors, from whom we take all what they collect".* The CEO of case 10: *"We have created a network of partners, small collectors, from whom we take all the collect, this is an important resource".* The director of case 15 notes: "*We have our own collection programs, we are therefore self-supporting. The cost price of the finished product is therefore low. We even have enough inflow for future expansion of our business."* Finally the CEO of case 7: *"We are actively collecting used products in Finland, this is unique".*

Respondents revealed that having access to components does influence the competitiveness of the remanufacturer. Component sourcing is therefore considered as an important capability. The data analyses revealed that six remanufacturers developed strategies for guaranteeing access to product components. Some of these remanufacturers integrated the production of components inside their own business activities others formed strategic alliances with key component suppliers. Both strategies are seen as important manners to generate advantage above competition. The general manager of case 3 states: *"The limitation of the suppliers chain is getting worse. We therefore produce components like ink, toner, OPC drum, blades and some gears ourselves".* The CEO of case 8: *"'Z' is a very integrated model. We produce our own ink and we produce some other components*". The CEO of case 5:*"We do not have the chip technology ourselves, but we walk closely with some big chip suppliers".*

Remarketing as a strategy influencing sustainable competitive advantage is mentioned mainly in relation to targeting the right customer segments with the right products. The country managers of case 12 notes: *"We need to find out which product is useful for which sales channel. It can be that product quality in one channel is more important than other channels. For sure everything needs to be perfect when selling directly to end-users."*

Value creation & appropriation

A firm can reach sustainable competitive advantage when being able to generate more value than competition. Respondents link strategies related to remanufacturing, product acquisition and remarketing to value creation. Value through remanufacturing mainly arises from a low cost price and a high quality of the remanufactured product. The data analyses reveal that strategies based on remanufacturing processes and used product acquisition activities are most often mentioned. This is related to the fact that both the cost price and the quality of a remanufactured product are mainly being influenced by the manner how remanufacturing process are put in place and whether own collect systems have been developed. Besides this data analyses reveal that collecting used products with customers is financially attractive for customers. The country manager of case 12:*"In 70% of the cases customers receive a reimbursement for the used products. That is pure added value for the customer."* Besides financial value also informational value can be generated through collection systems. The CEO of case 2 says about this: *"The collect is an important element. The feedback from the collect is also shared with customers. A customer can compare data on what has been collected and what has been purchased".*

Moreover the majority of the respondents improve customer value by adding service to their offerings. Eleven of the seventeen respondents confirm that being able to offer the full package of a quality product and additional services is required in order to have competitive advantage. Most mentioned services are: full product guarantees, product stocking services for resellers, fast deliveries of products and a responsive customer support. Furthermore free collection of used products, sustainability reports and sharing information from the collect, are services that are linked to product acquisition or remarketing. The CEO of case 8 notes: *"The strategy is to add more services in our offering. It's the collect services. It's the reports that we provide, but it's also the breadth of the products".* The CEO of case 9 about the value creation for customers: *"In my business we use the expression 'quality recycle'. Quality is what we breathe. This quality recycle has two meanings: good remanufactured products and excellent service. This is what we offer our customers."* On the remarketing side the CEO of case 8 mentions: *"We are going to help the reseller to sell our product to the end customer. To really explain what is our product is about, what re-manufacturing is about and what collection is about. That is where we make our products the first choice of the customer."* Remanufacturing and product acquisition strategies therefore have a high influence on value creation and remarketing strategies an average influence.

Summary

The empiric results reveal that sustainable competitive advantage is highly influenced by remanufacturing strategies and product acquisition strategies of remanufacturing firms. A strategic positioning and the CLSC resources and capabilities are most important in this regard. Remarketing strategies predominantly influence the value creation of the firm. The results of the empiric research are summarized in table 8.

Most frequently mentioned are remanufacturing strategies related to improving the product quality, the output and flexibility of production and the sourcing of components. Production acquisition strategies are most often mentioned in relation to increasing availability of used products and lowering the costs of used products by developing own collect systems. Finally remarketing has a medium impact on value creation. Value is mainly created by targeting the right customer with the right product offering and delivering marketing support to resellers combined with marketing activities focused on end-users.

Table 8: The influence of CLSC strategies on sustainable competitive advantage.

Influence of CLSC strategies on Sustainable competitive advantage					
		Sustainable competitive advantage			
		Strategic positioning	**CLSC resources & capabilities**	**Value creation & appropriation**	**Total**
CLSC strategies	**Product acquisition**	Medium	Medium	High	Medium
	Remanufacturing	High	High	High	High
	Remarketing	Low	Low	Medium	Low

4.5 Additional findings

This research also gave rise to some findings that go beyond those linked to the constructs from the conceptual model. First, five interviewed remanufacturers in the printer cartridge group stipulate that knowledge on intellectual property (which is not mentioned in the literature) is an important resource for gaining competitive advantage. The CEO of case 1 states: *"One of the arguments is patent safety. 'X' very much follows all the legal requirements to be able to remanufacture products that do not interfere with the patents from OEMs."*

Another finding from the research relates to remanufacturers cooperating with competitors. Three respondents have mentioned the outsourcing of certain products to competition in a manner to improve competitiveness. As the CEO of case 13 explains: *"We will absolutely outsource more remanufactured products to partners and cooperate more with competition."*

Finally obtaining official licenses and certificates is also mentioned as an increasingly important manner in which remanufacturers could differentiate themselves. The country manager of case 12 notes: *"We need to keep high quality standards—therefore we acquired the following ISO certificates: ISO 9001, 14001, 18001 and 27001."* In relation to certificates and licenses, the CEO of case 13 says: "*Is the product green and recycled? Do your products cope with certain norms? This is especially important for government tenders in Germany. Competition from Asia does not have these certificates yet."* Finally, the lack of active government support for remanufactured products in Europe is seen by three participants as a threat to the competitiveness of the industry as a whole. Despite European guidelines on the reuse of waste, OEMs are still not forced to reuse more products. According to the CEO of case 2: "We cannot walk alone in this industry. We need strong government support, otherwise new-build products from Asia will replace remanufactured products in our market."

5. Discussions and Conclusions

In this chapter the research results will be discussed. The results from the research will be compared with findings in literature. Subsequently this will lead to conclusions and research question: “What competitive strategies based on closed-loop supply chains will lead to sustainable competitive advantage for a remanufacturing firm?”, will be answered. At last the limitations are discussed and some recommendations for further research and for practitioners will be provided.

5.1 Discussion

According to literature remanufacturers need to define their strategic positioning in order to achieve a better performance than competitors. Having a focus on minimizing strategic costs is herewith essential. The strategic costs mentioned are costs for remanufacturing equipment, costs of labor for managing reverse logistics, costs of additional warehousing, costs for producing high quality remanufactured products, costs for fulfilling customer service requirements taking into account environmental and legislative aspects. The results of this research reveal that remanufactures indeed need to have a focus on costs. However being a costs leader alone is not enough. From this research it can be concluded that remanufacturers attempt a great deal in order to stay ahead of their competition. The data analyses reveal that a majority of the remanufacturers in this research use a strategic position that is based on delivering high quality products that can compete with OEM products in the market. Differentiation therefore focuses on quality, additional service and price. In this matter remanufacturing and used product acquisition strategies are mostly needed. Remanufacturing strategies should predominantly focus on increasing the quality of the product, lowering rejection rates in production and guaranteeing supply of vital components. Used product acquisition strategies should focus on stabilizing availability of used products combined with developing savings by developing own collect systems.

From literature it is known that in order to: cope with uncertainties, generate value and create competitive advantage, companies need to exploit their CLSC-resources and develop CLSC-capabilities. CLSC-resources exist of: stocks of used products, production tools, workforce, relationships in the supply chains, integrated processes, remanufacture ability of products, information on supply & demand, collection and IT systems. However the research revealed that remanufacturers also use their resources and capabilities to generate advantages that go beyond uncertainty, prices or costs. The CLSC resources and capabilities that are most frequently mentioned

by respondents in this research are: being knowledgeable about products , flexible and controlled production processes, intellectual property and markets, as well as focus on used-product acquisition, access to components, responsive customer support and recycling solutions.

Turning to remanufacturing strategies, it can be confirmed that lowering costs and maintaining flexibility in relation to processes helps companies to generate more advantage. However, the empirical findings reveal two other factors that are also important in relation to the competitive advantage of remanufacturers: undertaking thorough testing and control activities before, during and after the production process and maintaining the ability to access the right product components that are being replaced during the remanufacturing process.

From this research is revealed that CLSC strategies based on used product acquisition is indeed important for remanufacturing companies to stay competitive. However, effective collection systems can differ per company; effectiveness depends on the remanufacturing firm's location, cooperation with OEMs and go-to-market strategies. Nevertheless effective product acquisition strategies focused on stabilizing availability not being dependent a small range of suppliers, form the basis for creating sustainable competitive advantage for remanufacturing firms.

Subsequently sustainable competitive advantage can also occur when remanufacturers are able to generate more value over a long period of time from the closed-loop supply chain than others. In literature value creation via closed-loop supply chains were identified in four different types: sourcing (economic), environmental & social, customer and informational value. From this research it reveals that value through remanufacturing mainly arises from a low cost price and a high quality of the remanufactured product. In this matter strategies based on remanufacturing processes and used product acquisition activities are most often mentioned. The majority of the respondents improve customer value by adding service to their offerings. Being able to offer a full package of a quality product and additional services is required. Most mentioned services are: full product guarantees, product stocking services for resellers, maintenance service, fast deliveries of products and a responsive customer support. However customer value is generated through the quality and low price of the remanufactured product. This phenomenon becomes especially visible at the moment when remanufactured products are being positioned against OEM products.

Remanufacturers can appropriate more value than their competitors when the margins they make on their remanufactured products remain at a high level. These margins provide remanufacturers the opportunity to add extra services in order to attract and secure customers.

Finally deploying a good remarketing strategy focused on resellers and end-users is mentioned as an important manner for creating competitive advantage. This combination of remarketing strategies have not been mentioned in literature so far. The findings indicate that remarketing should primarily be about supporting and informing resellers and convincing and supporting end-users. The emphasis with end users should be on offering a good price to quality ratio instead of mentioning all sort of environmental properties.

5.2 Conclusions

The main question of this research: “What competitive strategies based on closed-loop supply chains will lead to sustainable competitive advantage for a remanufacturing firm?” can now be answered. The empiric results reveal that sustainable competitive advantage is highly influenced by remanufacturing strategies and product acquisition strategies of remanufacturing firms. A strategic positioning and the CLSC resources and capabilities are most important in this regard. Remarketing strategies predominantly influence the value creation of the firm.

Most frequently mentioned are remanufacturing strategies related to improving the product quality, the output and flexibility of production and the sourcing of components. Production acquisition strategies are most often mentioned in relation to increasing availability of used products and lowering the costs of used products by developing own collect systems. Finally remarketing has a medium impact on value creation. Value is mainly created by targeting the right customer with the right product offering and delivering marketing support to resellers combined with marketing activities focused on end-users.

CLSC strategies should not only focus on cost reductions. From this research it can be concluded that remanufacturers attempt a great deal in order to stay ahead of their competition. The data analyses reveal that a majority of the remanufacturers in this research use a strategic position that is based on delivering high quality products that can compete with OEM products in the market. Differentiation strategies should therefore focus on quality, additional service and price.

5.3 Limitations

The limitations of this research relate to the fact that only a small group of remanufacturers was interviewed (17 in total). The results can also be influenced by the sample size of the printer cartridge group, as these remanufacturers represent 12 of the 17 participants. As a result, this study's conclusions cannot be seen as representative of other sectors.

Because of time-constraints it was not possible to apply a longitudinal approach to this research. Therefore, the gathered data is gathered within a short timeframe, is more or less instantaneous and does not allow to perform a time-based analysis on the relation between the independent and dependent variable. Future researchers should apply a more longitudinal approach especially to get a better insight in the long term relationship between sustainable competitive advantage and CLSC strategies for remanufacturing firms.

5.4 Recommendations

This research was for 70% focused at remanufactures from the printer cartridge industry. This remanufacturing industry exists already for 30 years. As this market is highly volatile, hypercompetitive and threated by cheap imports of new build products (or clones), printer cartridge remanufactures are in difficult position when only competing on price. This could be an important reason why cartridge remanufacturers are focusing on differentiation. This could have influenced the results of the research. It would therefore be recommended to conduct additional research in other remanufacturing sectors.

For practitioners it is recommended to safeguard the knowledge created through remanufacturing strategies and to work closely together with strategic component suppliers. Furthermore remanufactures should have a focus on developing own collect systems or creating long term partnerships with many different smaller collectors. Offering additional services can attract new customers, however enough margin on the sales of remanufactured products should be made in order to be able to appropriate sufficient value.

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Annex 1: Interview format

General

- Company
- Function

Introduction

Related to my part-time Master in Business Science at the Rotterdam School of Management (Erasmus University) I conduct a research on sustainable competitive advantage within the remanufacturing industry. I therefore interview CEO's, directors and/or managers of 17 different companies from different branches that are active in remanufacturing. I would like to emphasize the fact that I carry out this research independently being a student of the RSM Erasmus University. Though I work in the remanufacturing industry myself I would like to ask you to consider me as a person without having the knowledge on remanufacturing. I also would therefore like to ask you to answer the questions as comprehensive as possible. The data collected will be processed anonymously. There are no correct or wrong answers. I will therefore not judge of the answers provided. Please note that you are free to not answer questions that maybe too sensitive.

- On average an interview takes 45 minutes
- After the finalization of my thesis you will receive a copy of the full report.
- Please note that I would like to record the interview so that I can fully process the data afterwards. Do you agree to that?

Questions

1. Why do you think customers buy your products?

    a. How does your company position itself versus competition?

    b. Which unique resources & capacities of your company are valued most by your customers?

    c. How does your company create value for customers?

2. How do you estimate the market position of your company compared to others in the market?

    a. Can you provide examples of areas where you conclude the position of your company is better than competition?
    b. Can you provide examples of areas where you conclude that the position of your company is worse than competition?

3. In which way does your company close the materials loop?

    a. How do you acquire used products?
    b. How do you reprocess used products?
    c. How do you market used products?

4. How does the way you re-use used products lead to (sustainable) competitive advantage?
    a. Related to product acquisition?
    b. Related to the remanufacturing process?
    c. Related to remarketing activities?
    d. How does the strategic positioning of your company lead to competitive advantage?
    e. What CLSC-resources & capabilities lead to competitive advantage?
    f. How does the way your company creates and appropriates value lead to competitive advantage?

5. Which strategies are most important for your company to establish more advantage than competition?

    a. What strategies do you consider most important in achieving your company goals?
    b. How important is product returns management for establishing competitive advantage? → examples?
    c. How important is the way you remanufacture (remanufacturing process) for establishing competitive advantage? → examples?
    d. How important is marketing for establishing competitive advantage? → examples?

6. How do you accomplish to keep your competitive advantage long lasting (sustainable)?

7. How do you see your company in 5 years from now?

ANNEX 2: Overview of respondents

The below overview anonymously mentions all respondent of this research.

Case number	Company size	Country	Remanufacturer of:	Job function	Interviewed
1	Mid-sized	Poland	Toner- and ink cartridges	CEO	Skype with view
2	Small	France	Toner cartridges	CEO	Skype without view
3	Large	China	Toner- and ink cartridges	General Manager	Skype with view
4	Small	the Netherlands	Electro mechanical components	Director	Face to face
5	Large	China	Toner- and ink cartridges	CEO	Skype with view
6	Large	the Netherlands	IT assets	Vice President	Face to face
7	Small	Finland	Ink cartridges	CEO	Face to face
8	Large	France	Toner- and ink cartridges	Managing Director	Face to face
9	Large	China	Ink cartridges	CEO	Skype with view
10	Large	France	Toner- and ink cartridges	Director Supply Chain	Face to face
11	Small	Romania	Ink cartridges	CEO	Skype with view
12	Large	the Netherlands	IT assets	Country manager	Face to face
13	Mid-sized	the Netherlands	Toner cartridges	Director Remanufacturing	Face to face
14	Large	the Netherlands	Car components (also OEM producer)	Director Remanufacturing	Face to face
15	Small	Belgium	Toner cartridges	CEO	Face to face
16	Large	the Netherlands	Drive technology (also OEM producer)	Director Man. Support	Face to face
17	Large	the Netherlands	Distributor/retailer of reman.products	Director	Face to face

ANNEX 3: Coded transcript

Below text comes from a randomly chosen coded transcript from this research.

ME: Which unique capacities are more valued most by the customers?

RM: As I said our…the quality of our products. The quality of our products is the result of our engineering and manufacturing process. So we have a very knowledgeable engineering that look at how we can re-manufacture products. What should we do to respect our values and to really say we create a responsible product for the lowest cost possible. But with the highest quality possible. So this continuity of quality is very important. Because creating a re-manufacturing product that doesn't have the quality standards…you always have the…you never have the benefit of the doubt. They always say, you know, if a product is not working, it's always because of our cartridge. If it's a new product, like our OEM product, it can be probably the problem of the printer. So, I think that is where you have to take a constant image of quality of our products.

Opmerking [PB1]: CLSCS: remanufacturing

Opmerking [PB2]: SCA: resources and capabilities

Opmerking [PB3]: CLSCS: remanufacturing

Opmerking [PB4]: CSLSC: remarketing

ME: You mentioned cost on one side. That's an important part. And on the other side, quality. Can it be a paradox there? A conflicting thing? That you focus too much on quality, that you run out on the cost side? And how do you deal with that?

RM: Yes. Well we see that the tendency in the market is that if you look, compared to inkjet and toner, that inkjet…because you reach a certain cost of the product that quality becomes less an argument. Right? Because, yeah, there is some deviation in quality. But if we talk about a few euros, you know, you can buy a new cartridge. Or does it stop halfway? People are less interested about that. Or you have a toner where the average selling price is much higher…where you…and the impact of a printer not working, or the impact of the quality failure has a big impact on business processes, B to B, where it's much more important. So if you see that we should definitely not over-design our products. We have over-quality. And it's a re-manufactured product so there always can be something wrong. But it's, especially, you should not go over the line…I'd say it like that. And that is difficult to design, I'd say, where that line should be. What should it be. That's with experience. That's what you build during the / over the years and say, well, this is the good way of quality of our product. You could measure it with the returns, you could measure it with the feedback that you have. But as there is a lot of competition, especially of clones, we call that, of new products that are coming from China, your cost is always under pressure. And so it's like with every business. If there is a competitive market you have to look at your cost and still say we position ourselves with these quality standards.

Opmerking [PB5]: SCA: value creation

Opmerking [PB6]: SCA: CLSC resources and capabilities

Opmerking [PB7]: SCA: Strategic positioning

ME: And what does you company do better in that perspective than your direct competition?

RM: Well 'X' is a very integrated model. So we are an ink producer. Where most of our re-manufacturers are not. So we produce the ink. We produce some of the components. So we have strategic alliances with chip manufacturers, for example. We do re-manufacturing and we do new built products. Plus, we have a large distribution centre. So if you look at what our competitors probably don't…I don't think there are a lot of companies that have integrated…so

Opmerking [PB8]: SCA: CLSC resources and capabilities

Opmerking [PB9]: CLSCS: Remanufacturing