WAGENINGEN UNIVERSITY AND RESEARCH CENTRE

MANAGEMENT STUDIES DEPARTMENT

MSc THESIS

APPROACHING CIRCULAR ECONOMY: IMPLICATIONS ON STRATEGIC MANAGEMENT

Case study research on the implications of circular economy on Corporate Social Responsibility, Supply Chain Management, and Innovation

ECTS 36

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WAGENINGEN, JULY 2014

Abstract

Objective

To understand how the adoption of a cradle to cradle/circular economy strategy affects a firm's strategic management and to identify the main drivers behind it.

Methods

In order to assess the grade in which a firm's strategic management was affected by the implementation of a cradle to cradle/circular economy strategy the method of theory building from cases was used. Since this is a phenomenon-driven research and due to the importance of the phenomenon under study which can be summarized in the following; depleting resources, polluting the environment, causing degradation and destruction of natural habitat for other species, decreasing the capacity of the natural life-supporting systems on Earth to keep providing various ecological services that we depend upon for survival, it is believed that this endeavor will cover the gap of viable theory and empirical evidence's existence. The latter was gathered by interviewing corporate actors, conducting a review of the existing literature and using secondary sources such as archival data, corporate social responsibility reports, scientific literature, journals, and newspapers. Finally, the data gathered from the case studies was compared and contrasted with the literature review which led to the formation of propositions.

Results

The results underlined various driving forces for engaging in a cradle to cradle/circular economy strategy within the firm, such as the development of new business models. Additionally, it was stated that the implementation of a cradle to cradle/circular economy strategy can indeed affect the strategic decision making of a firm, and more precisely decisions affecting the supply chain management (SCM), innovation management and corporate social responsibility (CSR). Circular economy requires more transparency and collaboration between the above mentions functions of the firm and in some cases assigns new roles to the firms.

Key words: Cradle to Cradle, circular economy, corporate social responsibility, supply chain management, innovation.

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Acknowledgements

I am proud to present my Master thesis, which brings me one step closer to obtain my MSc in Urban Environmental Management from Wageningen University and Research Centre. This research paper is made possible through the help and support of several people to which I would like to express my gratitude. Firstly, I would like to thank my academic supervisor, Dr. Stefano Pascucci (Assistant Professor – Management Studies Group). This research would not have been possible without his guidance and support. Secondly, I would like to acknowledge Dr. Jacques's Trienekens (Associate Professor – Management Studies Group) contribution and thank him for the constructive feedback that gave me a different insight and allowed me to improve my scientific work. In addition, I would like to thank the respondents from ABN AMRO, LDM Brass, Philips and ROCKWOOL, who have been willing to participate in this research project. By sharing their knowledge and experiences they greatly contributed to the realization of this research. I would like to thank all the people who provided me with tips and access to their network in order to be able to find the right respondents. Finally, I sincerely thank my parents, family, and friends, who provided the advice, the psychological and financial support. The product of this research paper would not be possible without all of them.

Georgios Serefias

Wageningen, July 2014

Acronyms and Abbreviations

C2C Cradle-to-cradle

CEO Chief executive officer

CSR Corporate social responsibility

EICC Electronic industry citizenship coalition

GDP Gross domestic product

GHG Green house gasses

GRI Global reporting initiative

GSRS Global supplier rating system

IPC Integrated Pollution Control

ISO International Organization for Standardization

KPI Key performance indicator

LCA Life cycle analysis

LCD Liquid-crystal display

OEM Original equipment manufacturer

OECD Organization for economic co-operation and development

R&D Research and development

SCM Supply chain management

SME Small and medium sized enterprises

Introduction

What's the issue?

In the past decades, people around the globe were focused on finding solutions to problems[1] that were not the ones that needed solving the most, such as increasing the memory storage on computers or trying to expand the battery life of mobile phones. Too much genius and effort was given into creating new innovative products that would make our lives "better". Too much focus was given on faster, cheaper and newer solutions that we actually have forgotten safer, healthier and more fare (Leonard 2010). Growth for growth, in the name of increasing the gross domestic product (GDP). This way of "cradle to grave" linear system seems like we are trying to get better and better in playing the wrong game. Although, this is a game with very high stakes. As a game, our economy was designed by people to get everyone to play by certain rules. First thing when starting a new game is to read the instructions trying to find what it means to win, which will guide every decision taken throughout the whole game. So, naturally the solutions we have been working on pursues this game's goal, which is more consumption leading to higher GDP. Building more roads, more bridges, and more shopping malls is what economies call nowadays growth (Leonard 2010). However, GDP is calculated by adding all the amount of money spent into stuff that make life better, like building hospitals, and stuff that make life worse, like buying military equipment. The basic problem is that GDP measures the activity per se and not the benefit society gets out of it (Zencey 2009). Therefore, because we are using such a faulty measurement of economic well-being, it is foolish to pursue policies whose primary purpose is to raise it (Zencey 2009). We cannot change a game this dump by adding one rule or one player at a time. The problem is the goal itself. We need solutions that change that. Imagine that we build this game around the goal of better. Better education, better health, better stuff, better chance of surviving in this planet. Changing the goal of the entire economy is a hard task that cannot be achieved at once. But when we focus in game changing solutions we make it possible for a new game to be played (Leonard 2010). To do so, we have to be able to tell the difference between a game changing solution and just a new way to play this game of more. For example, let us look at two solutions to one of the many problems that we face today, the scarcity of raw materials. Too much debate is going on about how many years are left for some materials if we continue consuming in the rates we are currently consuming (Gordon et al. 2006). Such an example is indium, a material used for the manufacturing of liquid-crystal display (LCD) screens. So let us suppose we have two manufacturing companies that have two completely different ideas about solving the scarcity problem. One of the companies thinks that "enough is enough" and they are trying to stop extracting raw indium from the earth. Alternatively, they decide to transit into a circular economy model of manufacturing, in order to be able to get back the indium left from old LCD screens. The other company though, thinks that they should launch gift cards for their customers so they can buy new developed products requiring that they recycle the old ones. However, only one of the above solutions do change the game. The latter solution indeed decreases the pace that indium is extracted but it creates more demand for indium extraction by encouraging

[1] Inspired by the story of stuff project (Story of stuff project 2013)

people to buy more stuff. Even worse it teaches them that more consumption is the reward for being a good citizen, making it even harder to think outside that old game box. The transition into a circular economy model is hard to achieve, but is a game changer. That company has to collaborate with forward thinking companies and stakeholders in order to offer alternatives for extracting raw indium from earth. They have to engage with more people in order to inspire them and question that old game. However, trends such as the collaborative consumption formerly known as sharing already challenge the old game (Botsman 2010). Sharing is a huge challenge to the old game. It gets one off the treadmill of consuming more and more, conserves resources, give people access to stuff they could not afford otherwise and builds community. Without a new goal all the work we are doing to build a better future will be not enough and too hard. Too much genius and focus will continue to solving problems while the problems threating human life get out of control.

Why do we care?

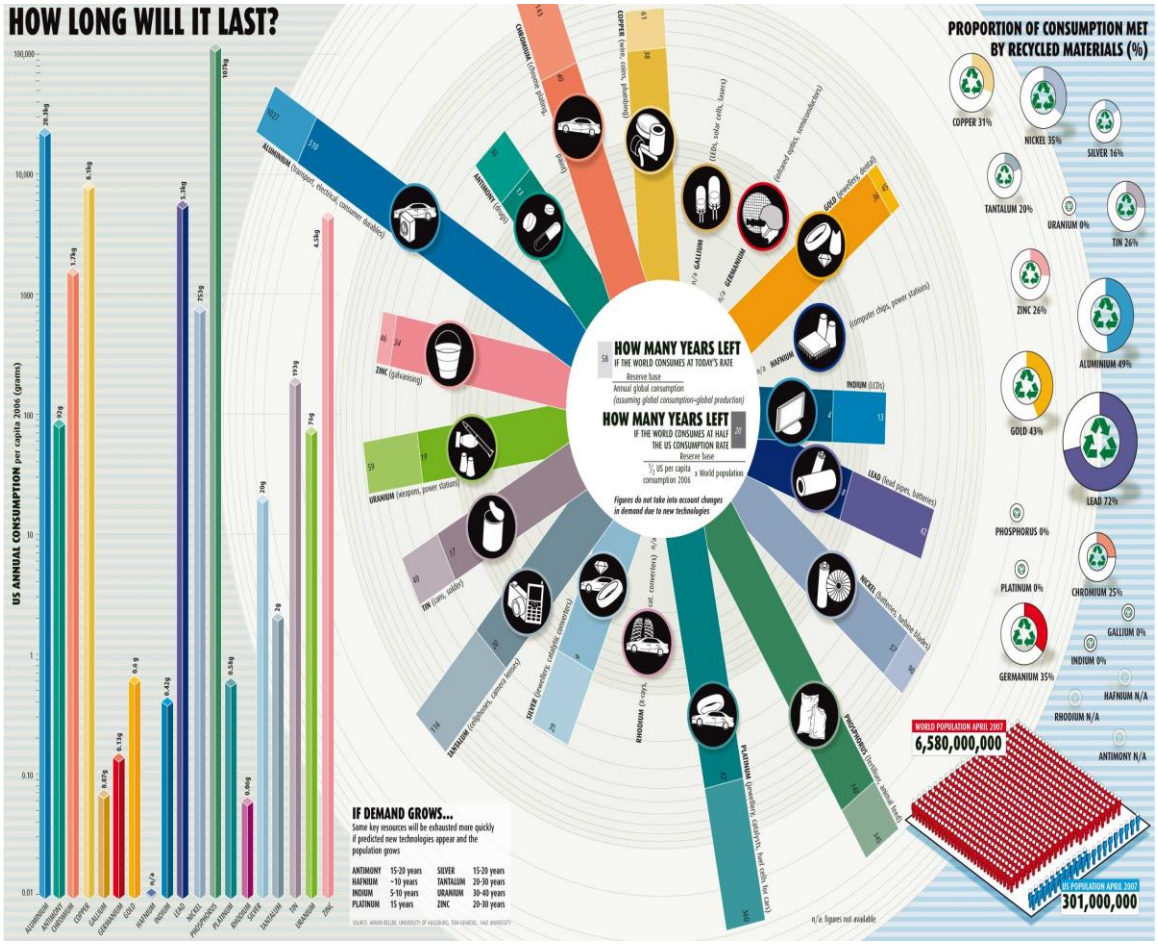
As it has already become clear from the previous paragraph, many of humanity's most urgent environmental problems are caused by the increasing volumes of worldwide production and consumption and the associated use of natural resources, such as raw materials (renewable and non-renewable), energy, water and land (Giljum et al. 2011). Renewable resources, and the ecological services they provide, are at great risk of degradation and collapse (UNEP 2013). "The depletion of these ecological assets is serious, as human society is embedded within the biosphere and depends on ecosystems for a steady supply of the basic requirements for life: food, water, energy, fibers, waste sinks, and other services. At the same time, extraction of many non-renewable resources is already reaching or near a peak; some authors even describe today's situation as "peak everything" (Heinberg 2013).

The global ecological damage that arises by the production and consumption of goods and services has rapidly increased over the past decades (UNEP 2013). "The supply of goods and services is always linked to the use of natural resources, including raw materials (renewable and non-renewable), energy, water and land." (Giljum et al. 2011). A strong growth in resource use was linked to economic growth by many scholars (Giljum et al. 2011). Many of the current key environmental issues (such as climate change, loss of biodiversity, desertification, and the increasing erosion of fertile soils) are caused by the fact that the overall amounts of natural resources used in production and consumption are too large (Giljum et al. 2011).

The central categories of resource use which cause the above mentioned environmental problems are the following namely; consumption of materials, energy consumption, land use and water use. Sustainability issues related to the above mentioned problems may arise in several respects:

- **Scarcity of the resources.** Many resources such as fossil fuels and metals will reach their peaks of extraction and will be available no more in the near future (Giljum et al. 2011), (Tilton 2013), and (Gordon et al. 2006). The infographic below depicts the consumption levels of various materials and relative timelines until we run out of them. "It also shows the impact of American consumption, in particular, and makes the point by showing the even worse spot we'd be in if the world's per capita consumption rate was just half that of the United States" (Armin Reller & Tom Graedel 2014).

Figure 1.1 How long will they last

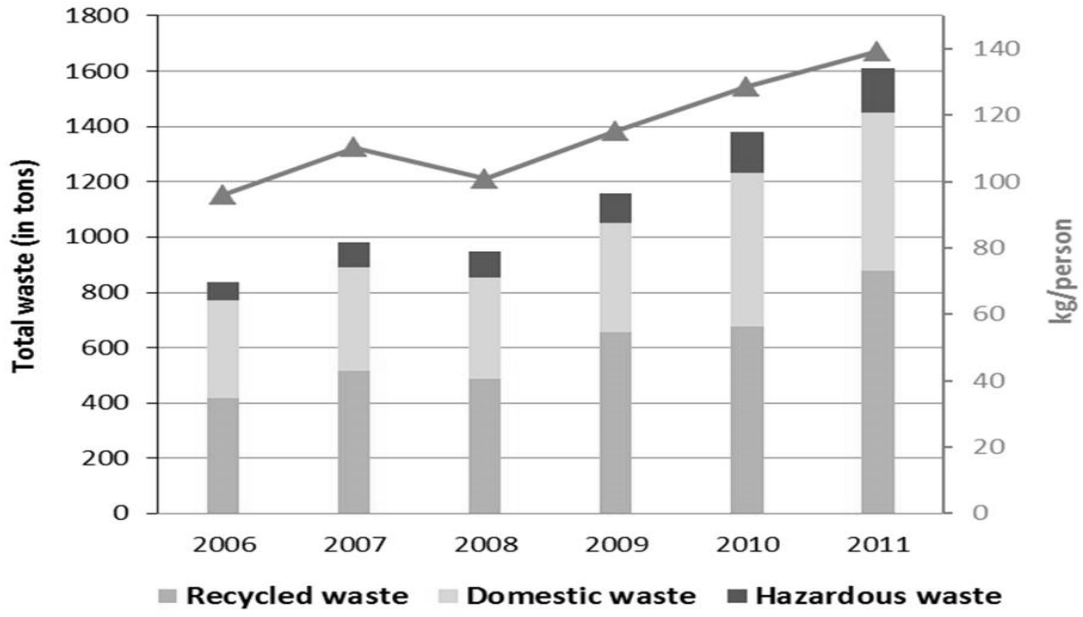


Source: (Ritholtz 2009)

- **Changes in the landscape.** Loss of biodiversity, soil degradation and erosion are some of the impacts caused by the cultivation of biotic resources and the extraction of abiotic resources along with the changes to the countryside and land use (Giljum et al. 2011).
- **Raw materials.** A shift to raw materials can only occur in a sustainable way if the total material demand is reduced. The level of resource used currently cannot be met by renewable materials alone (Giljum et al. 2011).

- **Climate change.** Fossil fuels continue covering the largest part of today's energy use. Their combustion produces greenhouse gases, in particular CO2 (Giljum et al. 2011). As a result, we observe regional changes in temperature that have been associated with observed changes in physical and biological systems (such as: reduction in Arctic sea ice extent and thickness in summer, early flowering and longer growing and breeding season for plants and animals, poleward and upward (altitudinal) migration of plants, birds, fish and insects, higher minimum temperatures - fewer cold days frost days and cold spells over nearly all land areas, increased summer drying over most mid-latitude continental interiors and associated risk of drought). Climate change affects human health since Dr. Cordero's study showed that we are facing increased mortality in old people in urban areas, heat stress on livestock and extended range of pests and diseases (Cordero 2007).
- **Renewable energies.** The points about materials elaborated above are partially true for some forms of renewable energies. As the discussion about the production of biofuels has shown, a large-scale shift to a particular form of renewable energy may even have negative overall consequences for ecological sustainability such as increased greenhouse gases through emissions from land use change (Searchinger et al. 2008).
- **Waste and emissions.** The usage of increasing quantities of raw materials and fossil energy leads to rising amounts of waste and greenhouse gas emissions (Giljum et al. 2011). As the bar chart indicates the total amount of waste in terms of recycled, domestic and hazardous waste increased by almost 400 tons from 2006 to 2007. In 2008 the figure decreased but then from 2009 onwards kept growing until it peaked in 2011.

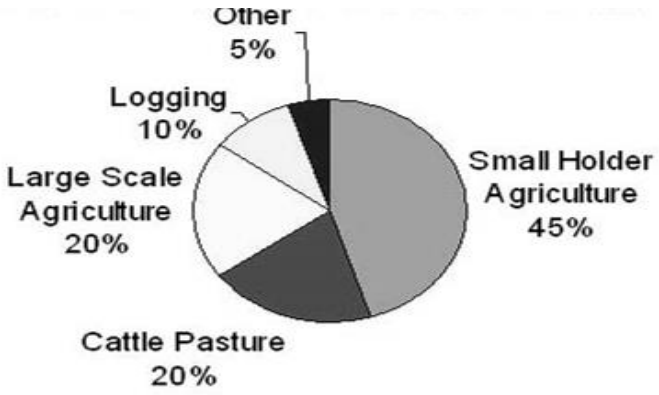
Figure 1.2 Total waste growth



Source: (Ecole Polytechnique Federale de Lausanne 2014)

- **Deforestation.** The forests' loss in many regions around the world as a result of an increase in the amount of land used for the food production, pasture and for the cultivation of biofuels and biomaterial (Giljum et al. 2011). The following pie chart presents the main causes of deforestation. It becomes instantly clear that the major cause of deforestation is small holder agriculture with the figure reaching 45% of the total. Another 40% is equally shared by cattle pasture and large scale agriculture. Logging and other causes did not exceeded 10% of the total.

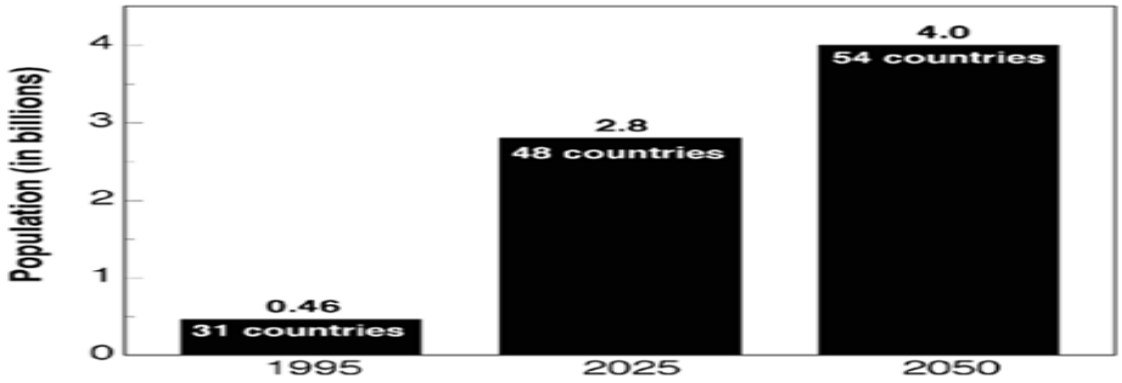
Figure 1.3 Causes of deforastation



Source: (Neil 2014)

- **Water scarcity.** Many countries and regions are already facing water scarcity today due to the excessive use of water for agricultural and industrial purposes. The extraction of water by humans has doubled since 1960 (Loh et al. 1998). As the bar chart implies, 2.8 billion will face water scarcity in 48 countries globally by 2025. The number will increase by 1.3 units by 2050 whereas the number of countries it is likely to be 54.

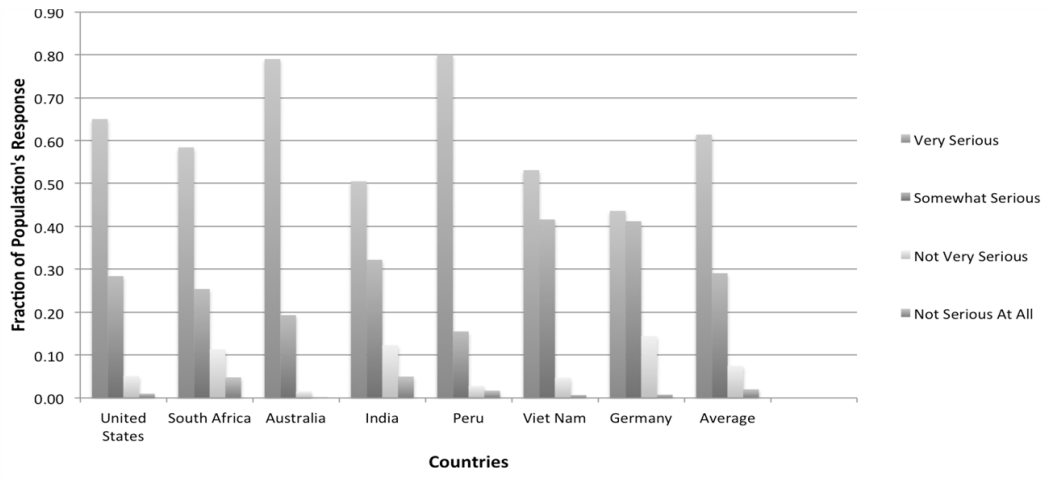
Figure 1.4 Projected Water Scarcity and Stress



Source: (University of Michigan 2014)

- **Water pollution.** The increased water usage for agricultural and industrial purposes also raises the amount of polluted waste water. In agriculture, this is caused by the fertilizers and pesticides into groundwater; in industry by the contamination with heavy metals or chemicals (Giljum et al. 2011). Figure 1.5 stresses the seriousness of water pollution in several countries around the globe while it presents an average figure in the last column. Amongst the respondents' answers Australia and Peru seem to hold the first place as they face the most serious water pollution. 65% of the total responded that the United States face very serious water pollution. Surprisingly, half of that figure claimed that the United States face somewhat serious water pollution. Germany seemed to have the lowest levels of water pollution according to the respondents' perception. Overall, around 60% of the total thinks that water pollution is very serious, while less than 10% of the total responded that is not serious at all.

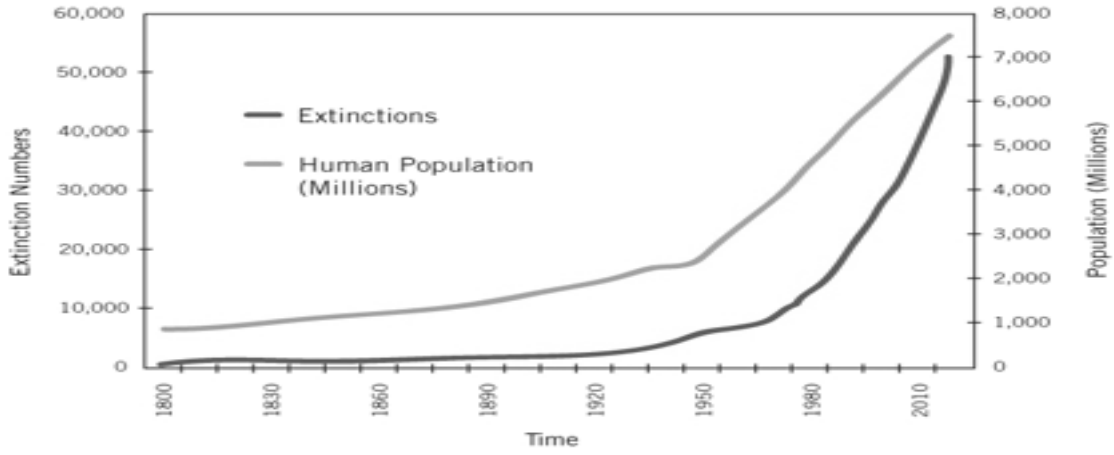
Figure 1.5 Seriousness of water pollution in the world



Source: (Galery Hip 2014)

- **Loss of biodiversity.** Natural habitat's conversion by human activities is the largest single cause of loss of biological diversity. "The balance between natural habitat and human dominated landscapes will determine the future of biological diversity conservation over large areas of the planet" (Hannah et al. 1995). As it is demonstrated in the scheme below species extinction gradually is correlated with human population increase. Since the 19th century both figures were growing gradually. Around the middle of that century human population skyrocketed and subsequently the extinction numbers followed.

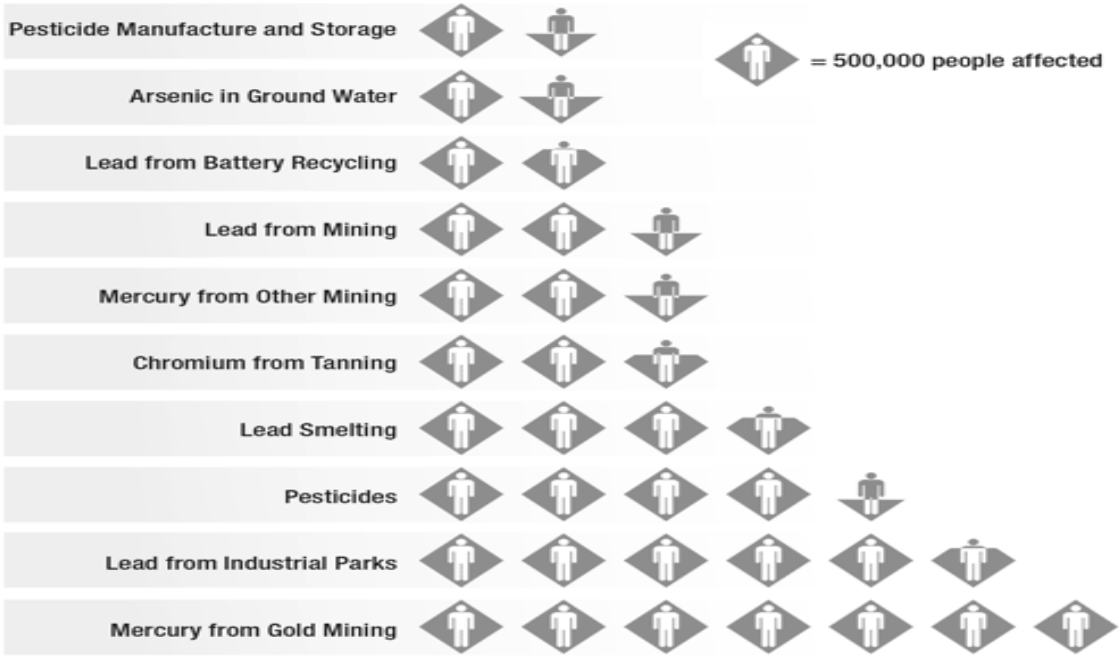
Figure 1.6 Species extinction and human population



Source: (Callahan 2014)

- **Human health.** Heavy metals found in several products of our everyday life can impact human health. Eight common heavy metals are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. These in larger amounts, can be dangerous (Martin & Griswold 2009).

Figure 1.7 What is poisoning us today



Source: (Chris D. Meletis 2013)

As figure 1.7 shows what is poisoning us today, it becomes immediately clear that mercury poisoning from the mines affected more than 3.500.000 people according to the result of the research. Second

most popular source of poisoning is lead with the figure of affected people dropping at 3.000.000 people. However, lead from mining and lead smelting did not affect more than 2 million. Amongst the least popular causes of poisoning appeared to be pesticides manufacture and storage and the presence of arsenic in groundwater.

Summarizing, the current linear approach to the use of natural resources cannot be supported because, through linear use, we are: depleting resources, polluting the environment, causing degradation and destruction of natural habitats, decreasing the capacity of the natural life-supporting systems on Earth to keep providing various ecological services that we depend upon for survival.

Why do companies care?

Since society is still in the initial phase of the transition towards a circular economy, it is assumed that profitable new options to establish circular setups can be identified. It is widely believed that a substantial scale-up from the current starting point is possible and indeed very likely to occur. Although there is still much work to be done, rapid value creation's case is quite strong, especially if we assume that circular business reach a tipping point after which they face more widespread acceptance. Eliminating waste from the industrial chain with methods such as "closing the loop", results in production cost savings and less resource dependency. The consequent benefits do not occur only in the operational level but also in the strategic; not merely for the corporations but also for end users; and not merely a source of efficiency, but also a source of innovation and development. "The potential identified so far represents only a small fraction of what could be possible if circular business models were to be applied at scale" (Macarthur 2013a).

Companies will win by creating new profitable business models and competitive advantage, giving solutions to some of today's most strategic challenges (Macarthur 2013a).

- **Development of new profitable business.** Businesses that provide problem-solving services along the reverse cycle are facing attractive growth opportunities. (Macarthur 2013a).

- **Collection and reverse logistics.** In order to achieve increased material productivity, by ensuring that end of life products can be reintroduced into the business system, collection and reverse logistics are very important. Classical companies that operate in the field of waste management are increasingly diversifying their capacities and divert from landfilling towards more recycling and even refurbishment operations. (Francavilla 2014). Reverse logistics stands an attractive business for logistics service providers which they see not only an opportunity to fill backhaul loads (Macarthur 2013a).

- **Product remarketers and sales platforms.** Two examples that are expanding and growing within short times into valuable enterprises, facilitating products with longer lives or higher utilization, hence utility levels for mass-produced goods. "The term "collaborative consumption", gives a new trendy name into activities such as sharing, bartering, lending,

trading, renting, (re-) gifting, and swapping. The term refers to "usage" contracts rather than "consumption" - but, in any case, the model has proven wildly popular" (Macarthur 2013a). "The wide presence of network technologies and social media is dramatically increasing reach and reducing distribution cost for providers of sales and remarketing services. In the consumer-to-consumer environment, market players like eBay and Craigslist led the way to increasing the amount of second-hand goods traded online (Clausen et al. 2010). Amazon too has created a successful open platform for selling used products - giving suppliers access to almost 150 million customers worldwide and applying a very granular understanding of customers' individual needs and interests. In the business-to-business environment as well, typically more specialized companies are offering a sales platform for used and refurbished products (Macarthur 2013a).

- **Remanufacturing and product refurbishment.** Most of the cases that operate in large scale are subsidiaries of existing manufacturers, although large-scale independent operations exist. They are considered to be the hardest loop to close towards a more circular economy because of the specialized knowledge that is required. Original equipment manufacturers (OEM) do have a number of advantages. For instance by using specific product and process know how or using existing dealer networks to be able to get their products back in their facilities (Statham 2006;Macarthur 2013).
  Product insights passed on from the remanufacturing/refurbishment plant to an OEM's designers and engineers not only add to future remanufacturing margins but can also help to improve the performance of the original cores. Cisco confirms, "Refurbishing various kinds of end-of-life products is not only an economically viable business opportunity, it also provides an excellent means of building relationships with new customer segments" (Macarthur 2013a).

- **Material recycling systems.** Large corporations but also smaller companies develop solutions for taking back their products (Cisco 2014). A standard level, suitable for high-quality recycling processes is required. Consequently, the market has generally developed into regionalized, specialized players with natural barriers to growth beyond their starting footprint. A number of companies have nevertheless started to enlarge the scale and scope of their operations by adding new geographic regions and further material fractions to their portfolio" (Macarthur 2013a). By doing so, companies manage to attain the economic value of their materials all along the life cycle of their products (Macarthur 2013a).

- **Enabling business models that close reverse cycles. "**Closing the reverse cycle may well require yet more new businesses to emerge. For instance, providing users and suppliers with sufficient incentives may be difficult due to higher transaction costs and inability to agree on specific rates. The case of Turntoo, a company with a vision of moving towards product use based on performance contracts rather than on ownership, fills the void by operating and financing schemes that are based on offering products such as office interiors (e.g. lighting) net of their material value" (Macarthur 2013a; Turntoo 2014).

- **Financing.** Corporations and smaller companies will need support in order to swift from the ownership models but also funding for research and development (R&D) and new technologies. As it occurs in the linear economy, the financial sector has a vital role to play in the circular economy, both in transitioning and implementing circular economy. Banks are typically more experienced and therefore better at structuring long-term return models than corporations alone (Macarthur 2013; pers. comm. with Mrs. C. Pessers 2014).

- **Solving strategic challenges and building competitive advantage.** Circular business models could provide solutions to challenges such as an intensified cost-price squeeze, shorter product life cycles, geographic and political supply risks, increased commoditization of products and decreased customer loyalty (Macarthur 2013a). Generation of value within a supply chain can provide the stimulus for organizations to adopt circular economy, sustainable supply chain practices, for competitive reasons (Park et al. 2010).

- **Reducing material bills and warranty risks.** Through reselling and component recovery, a company can significantly reduce its material bill. In addition, "building to last" can also reduce warranty costs (Sherman 2014). A utility provider able to reuse materials that are installed in fixed infrastructure (e.g., overland electric power lines) can reduce the utility's exposure to price hikes and supply risks (Macarthur 2013a).

- **Improved customer interaction and loyalty. "**Instead of one-time transactions, companies can develop life-time service relationships with their customers," says Lauren Anderson, Innovation Director at Collaborative Consumption Labs (Macarthur 2013a). Yesterday's consumers of durable products today become users. Companies will have to change as well. New, long-term customer relationships will be of the essence in order to smooth the processes of providing maintenance, product upgrades, and other product-related services, and persuading customers to return products at the end of their useful life. In addition, with rental or leasing agreements in place, companies can gather more customer feedback (pers. comm. Mr. A. Pheifer). As Cisco puts it: "We think that broadening our focus beyond pure-play manufacturing - to enhance our service offerings as well—will deepen our relationships with our customers and create more value for everyone involved" (Macarthur 2013a). "Providing end-of-life treatment options and incentives to use them could increase the number of customer touch points and help build a technology pioneer's image" (Macarthur 2013a).

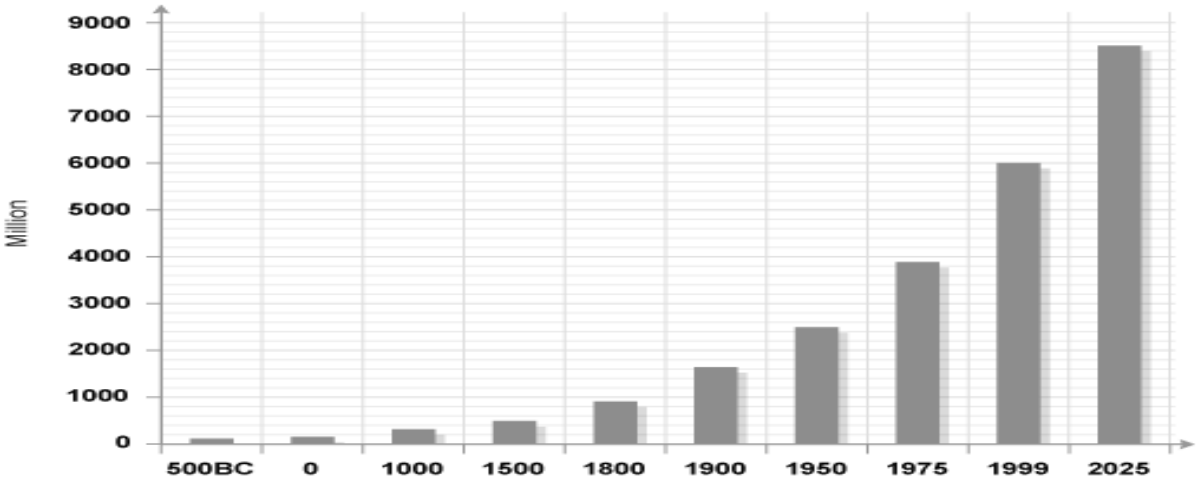
- **Less product complexity and more manageable life cycles.** Providing stable, sometimes re-usable product kernels and treating other parts of the product as add-ons (such as software, casings, or covers) enables companies to master the challenge of ever-shorter product life cycles and to provide highly customized solutions whilst keeping product complexity low (Macarthur 2013; pers. com. with Mr. A. Pheifer 2014).

- **Innovation boost due to system redesign/rethinking. "**Any increase in material productivity is likely to have an important positive influence on economic development beyond the effects of circularity on specific sectors. Circularity as a "rethinking device" has proved to be a powerful new frame, capable of sparking creative solutions and boosting innovation rates" (Macarthur 2013a).

What is known? What is unknown?

Figure 1.8 below represents the global population growth since the beginning of time. By 2030, Earth's population is expected to reach 9 billion - including 3 billion new middle-class consumers (BBC 2014).

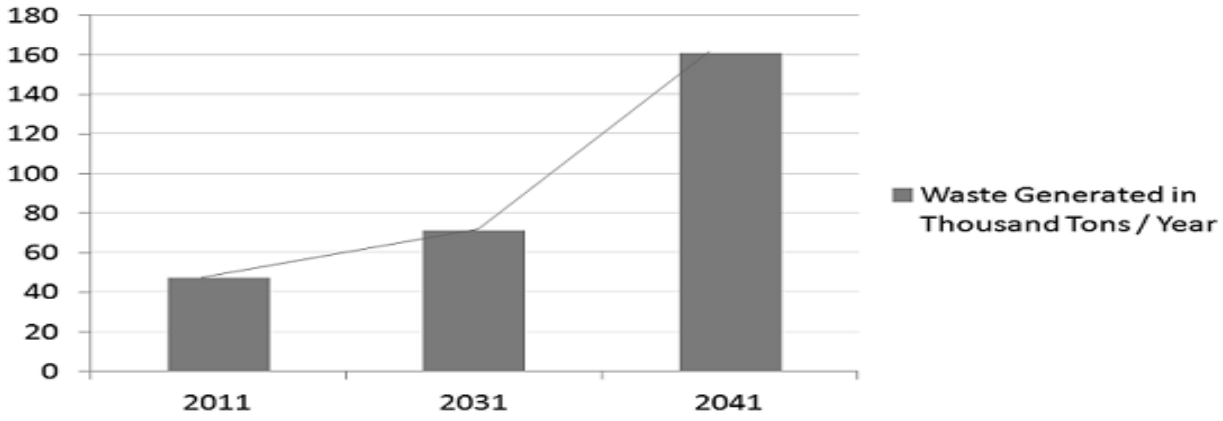
Figure 1.8 Global population growth



Source: (BBC 2014)

Consequently, the challenges of supply's expansion to meet the future demand have not been seen before. The current "take-make-dispose" approach is resulting in massive waste generation, and in the rapidly increasing sector of consumer goods, about 80% of the US$ 3.2 trillion value is lost irrecoverably each year. Change is of grave importance and is needed now (World Economic Forum 2014).

Figure 1.9 Future prediction of waste generation



Source: (Kaushal 2012)

Figure 1.9 shows the future projections of waste generation. It is estimated that by 2031 the waste generation will reach the figure of 70.000 tons per year. In just one decade this figure is likely to double reaching over 140.000 tons generated per year. Relying on efficiency solutions alone will not be substantial to meet global demand: the challenge humanity is facing calls for systemic changes, and in that respect the swift from a linear to a circular economy provides credible and quantified perspectives. Within this economic model, designing goods and services to be restorative will keep components and products in use for longer, while ensuring that materials can re-enter either the biological or the technical cycle at the end of their useful life will contribute to preserve our natural resources. "Ultimately, the circular economy could decouple economic growth from resource consumption - truly a step-change" (World Economic Forum 2014).

The potential for innovation, creation new jobs and economic growth is huge: a trillion dollar opportunity is estimated and numerous global trends are suggesting that the time is right for this change (World Economic Forum 2014).

Table 1.1 Global trends driving transition to the circular economy

TREND	EVIDENCE
Resource constraints	The cost of raw materials and energy has become volatile and we have nearly exhausted our easy-to-access reserves of raw materials that power our economy (the costs of making stuff are becoming unpredictable & expensive)
Increasing demand	3 billion additional middle class consumers will be driving consumer demand in the next 15 years (we will need to be making more stuff to fulfill greater consumer demand, even though it is becoming more expensive to make)
Employment	The growing desire within industrialized economies to manufacturing models to create resilient domestic employment

A new type of consumer	Consumer attitudes are shifting towards 'access over ownership,' leading to the proliferation of new business models. This generation are less concerned about owning (buying) stuff than using (renting, sharing etc.) it. Consumers are becoming users and are driving the proliferation of new business models
Shift in socio-demographics	Increase in urbanization is leading to reduced costs of collection
Enabling technology	These technologies can be used to trace materials through supply chains, identify products and materials, and provide up-to-date and immediate data etc. that can help enable a circular economy to work (we can keep track of precious raw materials as they move across global supply chains)
Investment opportunities	In the future, we predict that companies who can prove they are more resilient to some of these material price shocks and risks will stand a better chance of investment than those who can't (longer-term investment decisions will be considered)
Legislation	Carbon, energy and waste regulation are becoming increasingly common worldwide

Source: *(World Economic Forum 2014),* (Ellen Macarthur Foundation 2014c)

However, there is much work needed in order to achieve a smooth transition towards circularity. What still remains challenging for the corporate word is the implications that will occur at the company level as a result of the implementation of strategies focusing on circular business models. Circular economy principles challenge organizations to change in different levels and within different business functions.

Design out waste. Eliminating waste throughout the whole life cycle of a product by designing intentionally products for disassembly and refurbishment with the ability to return either to the biological or technical materials cycle. The biological nutrients are healthy for both humans and the environment and can be simply composted. The technical nutrients are designed to be used again with minimal energy and highest quality retention (Macarthur 2013a). As it becomes obvious, this very first principle automatically challenges the business function of supply chain management. Challenges such as property rights of materials, safe sourcing, closing the loop so as to get back the finished products in the company's facilities (reverse logistics) needs to be addressed.

Build resilience through diversity. Michael Braungart confirms, "Natural systems support resilient abundance by adapting to their environments with an infinite mix of diversity, uniformity and complexity. The industrial revolution and globalization focused on uniformity so our systems are often unstable. To fix that we can manufacture products with the same flair for resilience by using successful natural systems as models" (Macarthur 2013a). Consequently the department of R&D needs to be involved.

Rely on energy from renewable sources. Systems should ultimately aim to run on renewable sources. Such a swift though it would alter the general investment strategy of a company and could possibly be linked with the corporate social responsibility (CSR) strategy.

Gaps

As with all research, some aspects of the area under study need further investigation. The main gaps that were identified during this endeavor, and constructed the basis of this research, were the absence of relevant literature linking closed loop/circular economy oriented strategies with the business functions of CSR strategy, supply chain management and innovation . More specifically, during the literature review phase, although we came across with several scientific papers about the above mentioned topics, we pointed out that is still under-investigated how CSR, supply chain management, and innovation management are possibly connected with a strategy of closing the loop (Mcdonough & Braungart 2002; Braungart et al. 2007; Macarthur 2013b)

More specifiicaly, the cradle to cradle/circular economy literature to date is mostly concerned explaining the reasons companies have to change in order to achieve a circular economy by closing the loops (Ellen Macarthur Foundation 2014; Giljum et al. 2011; Gordon et al. 2006; Hannah et al. 1995; Martin & Griswold 2009; Heinberg 2013; Story of stuff project 2013). This study examines cradle to cradle/circular economy from an organizational perspective. The aim is to investigate what are the main challenges a company has to deal with in order to move towards a circular economy. The focus is given in the impact of the above mentioned concepts on two major business functions that distinct how a company operates namely supply chain management and innovation management, as far as the general corporate social responsibility strategy of the firm. Furthermore, as it was shown in several research, firms have a new political role (Scherer & Palazzo 2011) which means they engage in social and environmental causes such as evironmental protection, human rights when society cannot deal with them properly or laws are not put in work. Therefore, it is a revevant point for firms to consider how to deal with changes in the above mentioned business functions and strategy (Hayes 2010). At this point it is worth mentioning that this study will not provide a set of guidelines that fits all the business cases. Nonetheless, the relevance of this thesis is merely theoretical but it can also serve a practical purpose. The results can be used by companies who want to adopt cradle to cradle/circular economy and identify their company with one of the business case. In that way they can avoid problems the latter company faced in order to have a smoother transision towrds a circular economy.

In order to reach the goal of this thesis, the following research questions were developed:

General research questions

A) How the adoption of a cradle to cradle/circular economy strategy affects a firm's strategic management, and in particular its CSR, SCM and innovation strategies?

B) What are the main driving forces behind it?

Specific research questions

1. What are the implications on a firm's corporate social responsibility?
2. What are the implications on the supply chain management of a firm?
3. What are the implications on a firm's innovation management?

Reading guide

At first, the existing relevant scientific literature is reviewed and the conceptual framework is delinenated. This is followed by the methodology section, where all the scientific methods used are examined critically. In the next section of this report the empirical data gathered while this research was undertaken is presented and analyzed. Finally, a discussion of the main findings, the limitations as long as the possibilities for further research can be found in the end of this report followed by the reference list and the annexes.

Literature Review and Conceptual Framework

During the last thirty years, corporate social responsibility scholars have addressed the question whether "it pays to be socially responsible" (Scherer & Palazzo 2007). However, these studies did not take into account the intrinsic reason for corporate responsibility (Margolis & Walsh 2003). As already described from some scholars in management studies, the role of the firm until recently was strictly viewed as to gain profit. Social responsibility was perceived as a state task (Levitt, T. 1970, as cited in Meloan et al.) (Taylor W. Meloan, Samuel Van Dyke Smith 1970). However, globalization has led the firms to take charge of social and political responsibilities lately. Studies have shown that more and more firms are not conceived only as economic actors but also as political. Public health, education, social security, and protection of human rights are some of the aspects on which firms engage nowadays (Kinley & Tadaki 2004). Those activities go beyond the traditional perception of corporate social responsibility (Scherer & Palazzo 2007).

Nowadays, concepts such as eco-efficiency, bio-mimicry, cradle to cradle and circular economy have gained popularity amongst the approaches for greening the industrial processes operated by the corporations, as an extension of an integrated corporate social responsibility strategy. The above mentioned concepts apart from eco-efficiency share many common features with each other. In order to understand how cradle to cradle/circular economy can be embedded into a firm's strategy and underline the impacts of the latter, which consists the topic of this thesis, a delineation of two concepts namely eco-efficiency and eco-effectiveness is needed at this point. The definitions for the concepts vary from company to company. For example Nokia group describes eco-efficiency as producing better results from less material and energy which means minimizing energy intensity, minimizing the material intensity of goods and services, extending the poduct durability, increasing the efficiency of processes, minimizing toxic dispersion, promoting recycling, and maximising the use of renewable resources (Braungart et al. 2007). Toshiba Group calculates eco-efficiency by divifing the value of the product by the product's environmental impact. The smaller the environmental impact and the higher the value of the product, the greater is the eco-efficiency (Braungart et al. 2007). The value of the product is calculated based on its functions and performance. The environmental impact of a prodcut is calculated, taking into considerations various environmental impacts throughout its life cycle" (Braungart et al. 2007).

Further the key features of the above mentioned concepts and how these features are related need to be investigated. In the section below, the three concepts are elaborated in more detail, historical facts are presented, and the basic principles are desrcibed. Finally, the realtionship of all the aove concepts is depicted in figure 2.2.

Bio-mimicry

Bio-mimicry or bio-mimetics are both terms originating from ancient Greek. The first part, βίος (bios) means life; the second part μίμησις (mimesis) means to imitate. The idea behind bio-mimicry is that on earth, life has had the past 3.8 billion years to evolve itself through trial and error, therefore creating a substantial amount of solutions to an equal amount of problems posed by the

natural environment. Bio-mimicry uses the experiences of nature (or the natural genius, as it is called by Janine Benyus (Benyus 1997; Benyus 2005; Benyus 2009) to solve current (engineering) problems.

History

Although the term bio-mimicry is around since the introduction of the book by Benyus (1997), the principle of learning by natures goes back to earlier years of humankind. A well-known early example is Leonardo Da Vinci (Arasse 1998) who designed (albeit not tested) flying machines such as the ornithopter (circa 1488), a bird-inspired small hang-gliding plane. In the 1950's, Otto Schmitt (an American academic) used the word Bio-mimetics for transferring biological knowledge into technological concepts (Julian F.V Vincent, Olga A Bogatyreva, Nikolaj R Bogatyrev 2006). According to the Primer on bio-mimicry (Benyus 2012), bio-mimicry is "learning from and then emulating natural forms, processes and ecosystems to create more sustainable designs".

Basic principles

As mentioned previously, the first and foremost principle of bio-mimicry is learning from, rather than about nature (Benyus 2012), with all respect and humility. It is about what to learn from nature more than about what we can extract or "steal" from it. The three basic design elements of bio-mimicry are ethos, (re)connect and emulate (The Biomimicry Institue 2013).

Ethos is the essence of the bio-mimicry philosophy. It "represents the respect for, responsibility to, and gratitude for our fellow species and our home" (Benyus 2012).

(Re)connecting reinforces the fact that people and nature are not as distinctively separated as generally seen. In the view of bio-mimicry people are nature, therefore (re)connecting is a practice that "explores and deepens this relationship between humans and the rest of nature" (The Biomimicry Institue 2013).

Finally, emulating "brings the principles, patterns, functions and strategies found in nature to inform design" (The Biomimicry Institue 2013). It is about actively achieving the vision of humans fitting into a sustainable living environment.

Bio-mimicry is seen as a combination of various ideas; design or science discipline, method of solving problems, ethos, movement and a new way of viewing and valuing biodiversity (Benyus 2012).

There are three basic levels on which bio-mimicry can be incorporated into a design: the natural form, natural process and natural ecosystem (Benyus 2012).

Mimicking the natural form is the first level, where one looks into function and the corresponding form as occurring in nature. A famous example is Velcro, where a plant was first seen to have the properties, after which the product was re-created as Velcro. Similarly, the bumps on humpback whale fins lead to reduced drag in wind turbines creating more efficient technologies (The Biomimicry Institue 2013).

Mimicking natural processes is the second level, deeper into bio-mimicry (Benyus 2012): making a steel cable requires high temperatures, whilst a spider can make material with similar tensile strength at room temperature. Studying and mimicking processes of making material, green benign chemistry is what is considered as natural process-bio-mimicry.

The third and deepest level of bio-mimicry is looking at natural ecosystems. One needs not only to emulate nature on small scale, of the large scale is not adapted to this (Benyus, 2012). The example given by Benyus (2012) is the owl: the owl's feathers are created with frayed edges so that it gives the owl silent flight (natural form). These feathers are assembled at body temperature, without toxic compounds or high pressures (natural process). For the third level, it is considered that the feathers are part of the owl, which in its turn is part of the forest (natural ecosystem) which is part of an even bigger ecosystem (biome). If the first steps (form and process) are bio-inspired, but the rest of the production chain ("ecosystem") is still the traditional way, one can question the usefulness of the product as a whole (Benyus 2012).

Bio-mimicry versus bio-approaches

Bio-mimicry clearly distinguishes different approaches: bio-mimicking (mimicking nature), bio-utilizing (harvesting nature; i.e. using wooden floorboards in a house, using natural materials) and bio-assistance (domesticating nature; i.e. wastewater treatment with bacteria, cows producing milk etc.). Bio-mimics do not harvest or domesticate nature, they try to learn from nature (Benyus 2012).

Cradle to cradle

'Design is the first signal of human intention.' Those are the words of William McDonough in his book cradle to cradle: remaking the way we make things (McDonough & Braungart 2009). "The cradle to cradle design is a bio-mimetic approach to the design of products and systems. It models human industry on nature's processes viewing materials as nutrients circulating in healthy, safe metabolisms. It suggests that industry must protect and enrich ecosystems and nature's biological metabolism while simultaneously maintain a safe, productive technical metabolism for the high-quality use and circulation of organic and technical nutrients" (McDonough & Braungart 2009). Lovins describes it as "a holistic economic, industrial and social framework that seeks to create systems that are not only efficient but also essentially waste free" (Lovins 2008).

Principles of cradle to cradle

The concept of cradle to cradle is characterized by three main principles, as described in William McDonough's book (2009). The first concept's principle he mentions is waste equals food. One of the fundamental laws of nature holds that waste of one organism is food for another. In an economy based on this cradle to cradle principle, all materials that we consider to be waste serve as input (nutrient, food) for a new cycle of production, time and again. cradle to cradle eliminates the concept of waste by design, as waste equals food (McDonough & Braungart 2009). The second principle, according to McDonough (2009), imposes the use of the current solar power income. In other words, for energy, rely on renewable sources (McDonough & Braungart 2009). Various

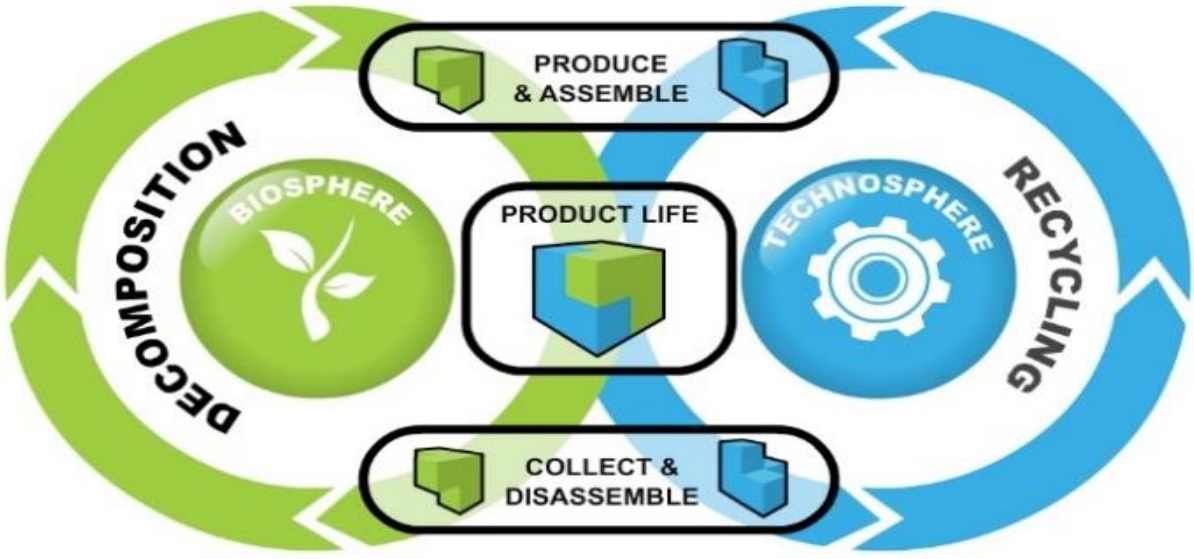
technologies are currently available, but there is still potential for further innovation and development. For instance, it is widely known that photovoltaic panels contain cadmium, a chemical substance proven harmful for human health. According to Transition Network (2012), scientists, engineers and landscape architects are working on this. The participation of governments can provide favorable conditions to promote such developments. Furthermore, citizens' initiatives on local scale have been taken to stop the dependency on oil (Transition Network 2012).

Finally, the third principle urges to celebrate diversity. This last principle is the most difficult to apply, because it advocates respecting diversity in all forms: biodiversity, cultural, innovation, ideas and insights (McDonough & Braungart 2009).

Structure

According to cradle to cradle, all materials return either as biological or technical nutrients (McDonough & Braungart 2009). Products can fall into two distinct categories. They can be consumption products, which are made out of biological nutrients that can safely be consumed or worn off, and, if anything is left, can safely return to the natural environment. At that, materials (e.g., wood) may be used in predefined 'cascades', where the quality deteriorates from one application to the next, but, both along the way and at the end, the material can be fully returned to the biological cycle, with no harm to human health and the environment. The second category is service products, which are made out of materials considered to be technical nutrients that should be returned to the technical cycle, where they will be used to make new products again and again (McDonough & Braungart 2009). The worst designs are called monstrous hybrids, which are made of materials from the two different categories that cannot be separated (McDonough & Braungart 2009).

Figure 2.1 Overview of Cradle to Cradle structure



Source: (Silbey 2012)

Implementation

The cradle to cradle model can be implemented to almost any system in modern society. In order to do so, five steps are outlined in cradle to cradle – Remaking the way we make things (McDonough & Braungart 2009):

1. Get "free of" known culprits.
   During this first step the substances that are known as harmful should be excluded from the products design. Alternatives should be identified immediately.
2. Follow informed personal preferences. Information about which substances can be substituted can be obtained from online catalogues.
3. Create a "passive positive" list.
   Enlist materials according to their safety level. On the X List are substances that must be phased out, such as teratogens, mutagens or carcinogens. On the Grey List are the problematic substances that are not so urgently in need of phasing out. Finally, the P List; the "positive" list, which contains substances actively defined as safe for use.
4. Activate the positive list.
   Choose materials which do not pose risk neither to environment nor to human health.
5. Reinvent.
   Redesign of the former system.

Certification

Some firms that implement the concept tend to apply for a certification. This depends mostly on the corporate culture. The cradle to cradle Certified Products Standard is a multi-variable, continuous improvement methodology that assesses products across five categories of human and environmental health. It is operated by the cradle to cradle Products Innovation Institute. Products can fall into five categories of certification, namely; basic, bronze, silver, gold, and platinum, with the expectation that an applicant will optimize each aspect of their product in the future. The goal is to encourage product's innovation and design in order to have a positive impact on people and the environment. In order to achieve certification in one of the levels, a product must meet the requirements for that specific level in all five following categories (The Cradle to Cradle Products Innovation Institute 2013):

1. Material Health - Products are made with materials that are safe and healthy for humans and the environment.
2. Material Reutilization - Products are designed so all ingredients can be reused safely by nature or industry.
3. Renewable Energy and Carbon Management - Products are assembled and manufactured with renewable, non-polluting energy.
4. Water Stewardship - Products are made in ways that protect and enrich water supplies.
5. Social Fairness - Products are made in ways that advance social and environmental justice.

Circular Economy

The circular or closed-loop economy model is introduced as an alternative to the linear 'take-make-dispose' model of consumption (Macarthur 2013a). When it comes to the exact definition of this model, scholars and people in the field have not reached consensus yet. For example, in China Circular Economy (CE) is defined in legislation as "a generic term for reducing, reusing and recycling activities conducted in the process of production, circulation and consumption" (Preston 2012). The Ellen McArthur foundation states that it is "a generic term for an industrial economy that is, by design or intention, restorative and in which materials flows are of two types, biological nutrients, designed to re-enter the biosphere safely, and technical nutrients, which are designed to circulate at high quality without entering the biosphere". The complexity in formulating one definition is most likely that CE is influenced by at least five different theories and is based on various underlying principles. As a consequence, there is much room for different focus.

History

The notion of CE has emerged from the discipline of industrial ecology in which the functioning of ecosystems has been used as an example for industrial processes and systems (Brennan 2013). This theory was first developed by environmental scientists in the 1970s and is still used today (Preston 2012). The use of this idea at economic level has gained popularity since 2012 World Economic Forum (WEF) where the Ellen McArthur Foundation launched its 2012 report Towards a Circular Economy (Brennan 2013).

Main influences

Regarding CE, six main influences can be distinguished. The first important school of thought is regenerative design (Ellen Macarthur Foundation 2013). The main difference between regenerative and sustainable is that in a regenerative system, lost ecological systems would find their way back by "regenerating" into to the system (Wikipedia 2013). Secondly, another basis for CE is the idea of performance economy, which originates from the late 1970s (Ellen Macarthur Foundation 2013). The four focus points of performance economy are product-life extension, long-life goods, reconditioning activities and waste prevention. In addition, it advocates selling services rather than products (Stahel 2010). A third influence is the cradle to cradle framework (Ellen Macarthur Foundation 2013). The fourth school of thought that has impacted CE is bio-mimicry (Ellen Macarthur Foundation 2013). The fifth important idea is industrial ecology (Clift & Allwood 2011). According to Clift & Allwood (2011), industrial ecology can point the way to an economy that can work long-term by applying chemical engineering thinking to the management of material flows in the economy. The sixth and final main idea is the notion of Blue Economy (Ellen Macarthur Foundation 2013). This school of thought advocates a local system of production and consumption that works with the locally available means, working with competitive and innovative business models (Pauli 2013). As a result, people would create their life necessities in an economical way which would be best for their health and environment (Pauli 2013).

The circular economy as viewed by the Ellen MacArthur foundation

In the western world, and particular in Europe, the concept of the circular economy has been given life by the Ellen MacArthur foundation in 2010. The Ellen McArthur foundation is an organization set up for the purpose of accelerating the transition of a linear to a circular economy. The foundation is also stressing the economic gains of transitioning into a circular economy. To accelerate the transition there are, to this day, three reports published which contain evidence in the form of case studies and calculations that show there is a large economic opportunity. In the first report 'Towards the circular economy: Economic and business rationale for an accelerated transition' (2012) the conclusion is that an amount of up to $ 630 billion in materials costs can be saved towards 2025 by a subset of manufacturing companies (automotive, machinery and electrical machinery mostly) in the EU alone. This is the advanced scenario (or completely transitioned to the circular economy) if this subset of EU manufacturing companies adopts the circular economy. In the transition scenario there is still a net materials costs saving of up to $ 380 billion to the subset of EU manufacturing companies (Macarthur 2013a). Additionally there is the second report "Towards the circular economy: Opportunities for the consumer goods sector" (2013) shows that there is a possibility for materials savings in the consumer goods sector of up to $ 700 billion. This includes food, textiles, packaging etc. Finally, the third report "Towards the Circular Economy vol.3: accelerating the scale-up across global supply chains, nds that over US$1 trillion a year could be generated by 2025 for the global economy and 100,000 new jobs created for the next five years if companies focused on encouraging the build-up of circular supply chains to increase the rate of recycling, reuse and remanufacture. This would maximize the value of materials when products approach the end of their use" (Ellen Macarthur Foundation 2014b).

The linear economy is limited in that it cannot sustain economic growth because it follows a 'take-make-dispose' pattern in which a lot of materials are lost. This causes the loss of value and negative effects along the material chain. The circular economy, on the other hand, creates value by taking into account all the materials in the production process and the production process itself. If less (or no) waste is created there is a cost saving. The waste that is created in one company could be a valuable input material for another company. Furthermore, another company could have a waste product that is of value as an input for the first company. If multiple manufacturing companies connect with each other (create a network) and share information on what input stream and output streams they have there is an opportunity to connect all the streams of companies within the network. Consequently, creating a circular flow where outputs can serve as inputs for new processes (Macarthur 2013a). For linking output flows with input flows the concept of the circular economy also uses the cradle to cradle concept in that it looks at the biological and the technical cycle of materials. The circular economy takes into account that the two must be kept separate (Macarthur 2013b).

The concept of the circular economy shows that value can be created once current business models are shifted to circular business models. It particularly shows the economic opportunity of moving to circular business models by explaining early successes of implemented circular business models and the net materials savings it creates. Furthermore, it systematically shows companies how to move to circular business models and thus production themselves with case studies that show the benefits of doing so. Next to the company level, the circular economy also focusses on the macroeconomic level. It shows the benefits of transitioning to the circular economy on a large international and

global scale, as discussed in section 5. It gives examples of how market participants can benefit from this macroeconomic shift and gives option to bring the circular economy into mainstream business. To summarize, the circular economy concept is not just a theory but it is a solution that is intended for implementation into business models (Macarthur 2013a).

Four principles or 'clear-cut sources of value creation', as the 2012 report calls them, are key in moving from a linear to a circular economy:

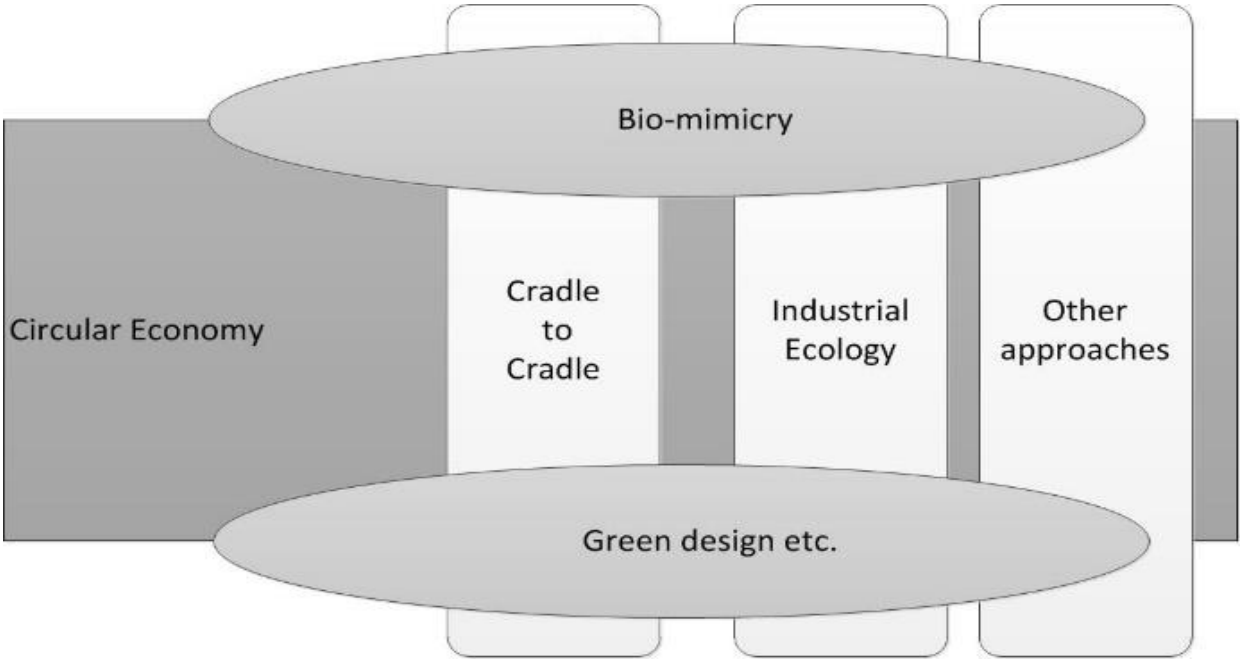
1. The power of the inner circle: The less types of materials used for a product the easier it is to reuse, refurbish, remanufacture or recycle and the lower energy use, GHG emissions, water use and toxicity. The tighter the circle the more value it creates;
2. The power of circling longer: maximize the number of times a product can circle (reuse, remanufactured or recycled) and maximize the time in the circle;
3. The power of cascaded use: a product (or material of it), at the end of its life cycle, needs to be used as a product with a lower added value as much times as possible before being returned to the biosphere. For example, new clothes → second hand clothes → filling for furniture → stone wool;
4. The power of pure circles: materials need to be minimally contaminated in order to keep a high quality. This results in a material that stays in a circle longer and increases material productivity .

This again illustrates that the concept of the circular economy is using the cradle to cradle concept because it looks at closing material cycles as much as possible as is shown in the second report (Macarthur 2013a).

Links with Industrial Ecology

As described in the previous sections, the three approaches show more similarities than differences. In fact, it can be stated that circular economy is a framework that draws upon and encompasses principles from (Ellen Macarthur Foundation 2012) the other two theories. Bio-mimicry's three generally used key principles; namely "Nature as model", "Nature as measure" and "Nature as mentor" (The Biomimicry Institue 2013) describe models and emulates these forms, processes, systems, and strategies to solve human problems. It is clear that cradle to cradle and bio-mimicry are related, since one of the significant factors for the success of the former is also eco design. Besides that, the cradle to cradle design model considers that all material involved in industrial and commercial processes can be seen as nutrients, which return in two main cycles: the technical and the biological (McDonough 1993). Similarly, industrial ecology studies material and energy flows through industrial systems. Focusing on connections between operators within the "industrial ecosystem", this approach aims at creating closed loop processes in which waste is seen as input, thereby eliminating the notion of undesirable by-product. Like cradle to cradle design, industrial ecology adopts a holistic point of view by designing production processes while taking into account their global impact. With an emphasis on natural capital restoration, Industrial Ecology also focuses on social wellbeing (The International Society for Industrial Ecology 2013) which can be linked with the third principle of cradle to cradle: celebrate diversity. The relationship of the four concepts can be illustrated in Figure 2.2.

Figure 2.2 Overview of relationship four concepts



Source: (De Jong 2013)

Summarizing, circular economy can be perceived as a common denominator all concepts have. In order to achieve circular economy, businesses have to adopt strategies like cradle to cradle or get involved in industrial ecology, for example by joining an eco-industrial parks. In these kinds of strategies bio-mimicry is a common design principle. Other design strategies and principles to achieve sustainable design can also be applied here, denoted as "green design etc." in figure 2.2.

What is apparent from the description of the three approaches of bio-mimicry, cradle to cradle and circular economy, is that they all consist of a set of principles that is based on utilization of materials and the production of goods in a more ecofriendly way. They all look at it from a little different perspective but in the end the approaches are aiming for the same result, just on a different scale. The main difference between cradle to cradle and industrial ecology is that cradle to cradle focusses on eco-effectiveness, the total recycling or up cycling of products and materials, whereas industrial ecology focusses on eco-efficiency, minimizing environmental damage by dematerialization and linking of (material) flows.

All approaches consider waste streams to be valuable input streams, all look at nature to learn how to design and come up with more ecofriendly products and solutions, and all try to create added value where usually only costs were seen (waste streams, recycling and separating waste). Circular economy, as the name suggests, has a business point of view, industrial ecology a technical point of view, cradle to cradle a design point of view, and bio-mimicry a nature point of view. Nevertheless,

in the end, the aim of the approaches is comparable: all aim at more efficient production, more natural products, a cleaner environment and economic prosperity.

Regarding a future trend, we found another similarity between the different concepts which could be promising. This similarity is that the implementation of the concepts involves various actors in society. Especially in the case of circular economy, which draws upon principles of cradle to cradle, bio-mimicry and industrial ecology, society has to go through a transition period during which various actors have to cooperate and start learning to work together in new ways. This shows that innovation is at the core of circular economy. On top of these innovations resulting from particular cooperation's, a society-wide change in behavior and technology could occur when the idea of thinking in closed loops would disseminate. Following this line of reasoning, we could expect that the term circular economy will be replaced or complemented by "circular society" in the future. This new term would show more clearly that it is not only the economy that needs to change in order to fully close the loops, but the way society as a whole is organized. In addition, this complementing 'economy' by 'society' would communicate clearly that circular economy builds upon principles from other disciplines than economy, such as design, thereby clarifying its interdisciplinary character.

As it is understood from the above mentioned statements eco-efficiency starts with the assumption of a cradle to grave linear approach. Some materials are recycled after the end of the product's useful life, but due to its design they are in fact downcycled, which means they give products of lower quality. Alternatively, eco-effectivness proposes a transformation of products that create cradle to cradle cyclical metabolisms that have a positive impact in the environment (upcycling) (Braungart et al. 2007).

Studies have shown that "eco-efficiency lacks in addressing the need for fundamental redesign of industrial material flows. Furthermore, it is at odds with long term economic growth and innovation and finally does not effectively address the issue of toxicity" (Braungart et al. 2007). In addition, "the eco-efficiency concept involves no long-term vision or strategy, the links between resource consumption and waste emissions are not well related to the sustainability state, and increases in eco-efficiency may lead to increases in consumption levels and hence overall impact" (Bjørn & Hauschild 2013).

As it already have become clear, companies that adopt cradle to cradle/circular economy need to shift from eco-efficiency to eco-effectivness, therefore a fundamental redesign of their products is needed. "Sourcing and procurement can be one of the best starting points for launching a green initiative" (Turner & Houston 2009). Brangaurt and McDonough have defined a five step strategy in order to achieve that. In shorth, the five step process starts with excluding the harmfull substances from the manufacturing process and moving towards the positive definition of the desirable ones. Finally, reinvention of products is necessary in order to fulfill the customers' needs and have a postitive impact on the environment and society (Braungart et al. 2007).

The starting point for justifying this research has been the evidence that relevant literature linking cradle to cradle/circular economy strategy at company level is still very limited. More specifically this research investigates how corporate social responsibility, supply chain management, and innovation

management are possibly interlinked in a strategic change towards a cradle to cradle/circular economy approach. Promoting change is a complex issue for any company. As it is mentioned in John Hayes' book "The theory and practice of change management" a company under change usually disrupts normal work practices and undermine existing systems of management (Hayes 2010).

Consequently, this report will identify what are the adjustments a company has to make in order to adopt a cradle to cradle/circular economy strategy. The possible impacts of these concepts implementation with the corporate social responsibility, supply chain, and innovation management are underlined.

Triggers for CSR, SCM and innovation?

Sustainable supply chain management

Currently, most companies are forced to be sustainable by their employees, customers, consumers, and supply chain partners. The functions of sourcing and procurement can be one of the best starting points for introducing a green initiative (Turner & Houston 2009). But in that endeavor, one has to remember that ultimately no green initiative will succeed unless it has a proven value: better economics for the company, benefit to the customer, or a marketing advantage (Turner & Houston 2009).

At the same time, the social responsibility agenda is gaining popularity in an increasing number of organizations and global supply chains. Following this market demand, the International Organization for Standardization (ISO) has initiated the development of the ISO 26000 international standard on social responsibility. Castka and Balzarova (2008) provide an insight into the arena of the social responsibility initiative by ISO and set the path for the future empirical investigation in this emerging and important area (Piplani et al. 2008). ISO 26000, widen the description and knowledge of supply chain management by giving a more complex supply web approach. This contains extended upstream and downstream involvement and integration as well as environmental approaches such as recycling or life-cycle assessment (Castka & Balzarova 2008). The triggers for sustainable supply chain management are identified by Seuring and Muller (Seuring & Müller 2008). The initial points are external pressure and incentives set by various groups. While stakeholders create the widest possible description, two groups are of particular relevance. On the one hand, customers are of great importance, as operating the supply chain is only justified if the products and services are finally accepted by the end customers. On the other hand, all modes of governmental control, be it from local municipalities, national or multi-national governments, are of great relevance (Seuring & Müller 2008). Kleindorfer argued more on the individual elements constituting the urgency for sustainable supply chain operations (Kleindorfer 2005). Pressure is usually passed to the suppliers, when the focal company is under pressure. Here, one distinctive feature of sustainable supply chain management emerges. Looking at the overall supply chain (or life-cycle) of the product, the focal company quite often has to take a longer part of the supply chain into account than needed for "pure" economic reasons (Handfield & Walton 1997; Kogg n.d.; Preuss 2005; Seuring 2004). Lamming and Hampson (1996) related this with barriers and supporting factors, which support or hinder the collaboartion with suppliers (Lamming & Hampson

1996; Carter & Dresner 2001; Bowen et al. 2001; Carter & Jennings 2002; Gunther & Scheibe 2005). "This holds true for having information on the environmental and social performance at the single production stages, as well as on improving the performance of main suppliers. Based on these factors, a range of strategies can be identified regarding how companies deal with such issues. To put it more simply, two different strategies can be used to summarize them. Bowen (Bowen et al. 2001) distinguish between "greening the supply process" and "product based green supply" (see also (Handfield & Walton 1997)). Building on this, the two strategies are labelled as "supplier management for risks and performance" and "supply chain management for sustainable products" (Seuring & Müller 2008).

In addition, more and more manufacturers and retailers face numerous challenging issues regarding the sustainability of their businesses, including: the assurance of fair standards of pay and equitable working conditions within their supply chains, which are commonly located in developing countries (Claudio 2007); growing demand to use more environmentally-sustainable materials (Filus, 2008 as it quoted in Dargusch & Ward 2010); pressures to improve water and energy use efficiency; and growing demand for less wasteful packaging (Gupta, 2008 as it is quoted in Dargusch & Ward 2010).

Corporate Social Responsibility in Theories

Corporate social responsibility summarizes many of the above mentioned initiatives. CSR is often referred to as a concept that contains good corporate citizenship, corporate social investment and the due recognition of a business' social obligations to its stakeholders (Porter & Kramer 2006; Auld et al. 2008; Dahlsrud 2008; Keating et al. 2008; Andersen & Skjoett-Larsen 2009; Pedersen 2009). Blyth acknowledged that, "there is no single definition of what it takes to be a responsible corporate…the key is to have a rigorous process for identifying those responsibilities and fulfilling them" (Blyth 2005). Porter and Kramer described CSR as simply that businesses need to "do the right thing" (Porter & Kramer 2006). Outdoor apparel manufacturer Patagonia publicly reported CSR as "a broad-based movement in business that encourages companies to take responsibility for the impact their activities have on customers, employees, communities and the environment" (Patagonia 2008). The various definitions of CSR still existing in the literature demonstrate many different understandings of the concept, understandings that typically include not only social issues but also issues of financial and environmental sustainability (Seuring & Müller 2008).

A key question that occurs then is; how does a firm put its CSR principles into practice (and in the case of our research, how do firms put their circular economy strategy into their CSR principles, into sustainable supply chain management practices and innovation)? Matten and Moon introduced a conceptual framework of CSR wherein it was described as either "explicit" or "implicit" (Matten & Moon 2008). Explicit CSR referred to "corporate policies that assume and articulate responsibility for some societal interests. They normally consist of voluntary programs and strategies by corporations that combine social and business value and address issues perceived as being part of the social responsibility of the company" (Matten & Moon 2008). Implicit CSR referred to "corporations" role within the wider formal and informal institutions for society's interests and

concerns. "Implicit CSR normally consists of values, norms, and rules that result in (mandatory and customary) requirements for corporations to address stakeholder issues and that define proper obligations of corporate actors in collective rather than individual terms" (Matten & Moon 2008). Matten and Moon (2008) proposed that "firms lately were adopting an explicit approach to CSR, and that this involved more industry-driven CSR practices, such as codes of conduct prescribed by industry and independently audited CSR reports that were based on informal standards and principles accepted by industry" (Matten & Moon 2008).
Benn et al. suggested "an integrated phase model for how corporations make the transition from a primary concern with compliance to the attainment of strategic sustainability and beyond to the 'ideal' of a sustaining organization" (Benn et al. 2006). According to this model, "CSR practices would transition from practices that are primarily concerned with compliance (for example, compliance with employment laws) to practices that are concerned with strategic positioning (for example, the declaration of CSR policies) to practices that effectively exercise the CSR principles espoused by the firm (for example, certification of sustainable supply chain management practices against a respected standard)" (Benn et al. 2006). Auld et al. (2008) described CSR in terms of "old" and "new" CSR, wherein old or traditional modes of CSR were largely focused on philanthropic activity not directly linked to a firm's core business practices, and new CSR was concerned with internalizing the externalities produced by a firm's core business (Auld et al. 2008).

Despite the increasing research attention, less attention has been given to how the benefits of firm-level CSR strategies and actions may be delivered through the whole supply chain to the end consumer (De Brito et al. 2008). It is known that firm-level CSR results in sustainability improvements whose benefits occur primarily to the organization itself (Moore & Manring 2009), but those same improvements may also attract customers who seek to work with suppliers with strong sustainability credentials (Eltantawy et al. 2009; Lee & Kim 2009). Replicating this pattern along an entire supply chain by linking suppliers and customers who jointly recognize the value of sustainability initiatives, and delivering these benefits to consumers, gives rise to what Carter and Rogers (2008) refer to as 'sustainable supply chain management' (Carter & Rogers 2008). Seuring and Muller (2008) asserted that a substantial gap in the current research was that, 'an integrated perspective is required for future research where social issues in particular and the interrelation of the three dimensions (financial, social and environmental) need to be investigated much further' (Seuring & Müller 2008).

Table 1.2 Summary of CSR theories

Corporate Social Responsibility	
Old	**New**
• Largely focused on philanthropic activity. • Not directly linked to a firm's core business practices.	• Concerned with internalizing the externalities produced by a firm's core business

Explicit	Implicit
• Corporate policies that assume responsibility for some societal interests. • Combine social and business value. • Address issues perceived as being part of the social responsibility of the company.	• "Corporations" role for society's interests and concerns. • Consists of values, norms, and rules that result in requirements for corporations to address stakeholder issues. • Define proper obligations of corporate actors in collective rather than individual terms.
Defensive	**Offensive**
• CSR as a risk-management tool. • To manage company reputation. • Avoid legal disputes.	• Set the right goals and improve competences. • To innovate and reshape company strategies. • To set-up partnerships.

Source: (Auld et al. 2008; Matten & Moon 2008; Porter & Kramer 2006)

Innovation and Environmental Innovation

"Innovation provides the means to create a new reality. It involves converting knowledge, learning, capabilities, and insights into valuable and creative new perspectives, products, and productive outcomes. Innovation is more than change; it is making incremental and/or radical improvements to systems, technologies, products, processes, and practices" (Rainey 2006).

"Sustainable innovation or eco-innovation has been broadly defined as the process of developing new ideas, behavior, products and processes that contribute to a reduction in environmental burdens or to ecologically specified sustainability targets" (Rennings 2000). "Furthermore, innovation towards a sustainable society may be conceived on three broad levels: technological, social and institutional" (Hellström 2007). "It is commonly held that technological eco-innovation must be supported by a corresponding evolution of social arrangements and institutional support structures" (Freeman 1996). So in order to be successful, eco-innovation must also build be based on relevant social structures and in some cases the innovation should also be able to effect these structures (Hellström 2007). However, the existing innovation literature clearly states that only a minority of all technological development is geared towards a change of this type (Hellström 2007). So far, it has been mentioned that in order to accomplish the emissions targets implied in truly sustainable development, it will not be enough to improve existing technologies gradually (Hellström 2007). "Rather, technological products and systems must be significantly reconstructed – that is, radical innovation is necessary" (Huesemann 2003). "However, most innovation takes place in the incremental mode, and eco-innovation is no exception" (Hellström 2007). In this section we are looking at the structure of eco-innovation i.e. whether an innovation is incremental or radical and if it represents a new component of a system or a new architecture for that system. In addition, eco-innovation is analyzed from the perspective of the 'target' for innovation, i.e. a new product, new

process, new market, new way of organizing the business or new sources of supply (Schumpeter 1934)(Schumpeter 1934).

Hines and Marin point out that most innovation appears to build on "repurposing, improving or renewing existing ideas and practices" (Hines & Marin 2004). This suggestion is aligned with Joseph Schumpeter's key notion that innovation is the result of novel combinations created by the entrepreneur. Schumpeter's concept of combinations in turn is built up around five "type cases" of innovation: "(1) The introduction of a new good – that is one with which consumers are not yet familiar – or of a new quality of a good. (2) The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially. (3) The opening of a new market that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before. (4) The conquest of a new source of supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created. (5) The carrying out of the new organization of any industry, like the creation of a monopoly position (for example through fructification) or the breaking up of a monopoly position" (Schumpeter 1934, p. 66).

This classification allows us to focus on the eco-innovation concept and propose possible areas of application. "Schumpeter's typology includes the now well-known separation of innovation into product ('new good') or process ('new method of production'), which can be usefully applied on environmental innovation. The area of environmental innovation has been strongly influenced by eco-efficiency thinking, i.e. innovation in the way that firms improve the efficiency of their production processes, in order to reduce environmental impacts, as opposed to a product innovation, where environmental value is embodied in the commercial output of the firm" (Hellström 2007).

"These basic, Schumpeterian categories may in turn be sub-divided in a number of ways. A useful distinction can for example be made between incremental and radical innovation, referring to the newness of the offering, i.e. a technology or process can be significantly or only marginally different from its predecessors/alternatives" (Freeman 1996). "The emphasis on process innovation and efficiency gains has led to an orientation towards incremental rather than radical innovation. At the same time it has been argued that an industry will face decreasing marginal returns on its incremental eco-efficiency efforts, in terms of sustainability and financial improvements, and that it is therefore pertinent to regularly generate radical eco-innovation in order to push the technological system up to a new equilibrium" (Murphy & Gouldson 2000). "Thus in the long run incremental eco-innovation cannot be sustained without radical innovation. A third distinction that is useful for understanding eco-innovation is that between architectural and component innovation, sometimes referred to as systemic and modular innovation" (Henderson & Clark 1990). "Component innovation takes place when one or more modules nested within a larger system are replaced, while the system itself stays intact. An architectural innovation on the other hand entails changing the overall system design and hence the way that the parts interact with each other" (Hellström 2007). Literature also refers to environmental or eco-innovation as simply reducing environmental impacts through waste minimization (Norberg-Bohm 1999). Blättel-Mink pointed that eco-innovations may contain the

development and introduction of new products (environmental technologies), new markets and new systems (e.g. of transportation) as well as very broadly the introduction of ecological dimensions in economic strategies (Blättel-Mink 1998). "These types of improvement clearly allow for a creative and thorough transformation of the innovation space – i.e. radical innovation – rather than just replacement or incremental/process innovation. It is, however, an empirical question to what extent such innovation actually takes place" (Hellström 2007). "Murphy and Gouldson, in a study on the implementation of Integrated Pollution Control (IPC) in England and Wales, reflect that most firms are hard put to integrate environmental concerns into their corporate strategy, and that this is an impediment to the development of radical eco-innovation" (Murphy & Gouldson 2000; Hellström 2007).

Table 1.3 Summary of innovation division

Classification	Innovation
1st grade	Technological, Social, Institutional
2nd grade	Product, Process, Market, New business, New supply
3rd grade	Incremental, Radical
4th grade	Architectural, Component

Source: (Hellström 2007; Schumpeter 1934; Henderson & Clark 1990)

Table 1.4 already identifies which of the propositions later desrcibed in this report step out from the litererature review.

Table 1.4 Summary of key concepts

Key Concepts	References
1. Circular economy is calling for more political CSR from companies.	(Scherer & Palazzo 2007; Scherer & Palazzo 2011).
2. Partners amongst a circular economy have various driving forces for engaging, such as development of new business models.	(Macarthur 2013b; Francavilla 2014; Clausen et al. 2010; Park et al. 2010; Turntoo 2014; Cisco 2014; Statham 2006; Sherman 2014).
3. Management of social and environmental externalities along the supply chain is considered a strategic necessity in a circular economy.	(Scherer & Palazzo 2011).
4. A circular business model will not succeed unless it has a proven value: better economics for the company, benefit for the customer, or a marketing advantage.	(Turner & Houston 2009).
5. Innovation gives new roles to companies due to system redesign.	(Macarthur 2013b).

Source: own ellaboration

Methodology

While this research was undertaken, the relationship between the adoption of a cradle to cradle/circular economy strategy and a firm's strategic management was put under study. The main drivers for implementing a cradle to cradle/circular economy strategy were identified. More specifically, in this endeavor the focus was given on the business function of CSR, supply chain management, and innovation. The main objective of this study was to understand how adopting a cradle to cradle/circular economy strategy affects a firm's CSR, SCM and innovation regarding the strategic planning. For this reason, four more detailed objectives were developed, and namely:

1. To ascertain the effects of the adoption of a cradle to cradle/circular economy strategy on the overall firm's strategic management
2. To underline the implications on the firm's corporate social responsibility
3. To underline the implications on the supply chain management of the firm
4. To underline the implications on the firm's innovation management

In order to assess the grade in which a firm's strategic management was affected by the implementation of a cradle to cradle/circular economy strategy the method of theory building from cases was used (Eisenhardt & Graebner 2007a). A major reason this particular method was chosen lies upon the fact that spans rich qualitative evidence and mainstream deductive research. It emphasizes on propositions development, which makes inductive case study research consistent with testable theory within the mainstream deductive research (Eisenhardt & Graebner 2007a). In addition, the potential for innovation and economic growth makes the research questions of this study rather significant for the corporate environment. However, existing research does not address the research questions.

Furthermore, since this is a phenomenon-driven research and due to its importance (which can be summarized in the following; depleting resources, polluting the environment, causing degradation and destruction of natural habitat for other species, decreasing the capacity of the natural life-supporting systems on earth to keep providing various ecological services that we depend upon for survival), the use of theory building research from cases was suitable for giving answers of how and why the companies should change towards a circular business model (Edmondson & McManus 2007).

Since the purpose of this research was to further develop a conceptual framework and to eventually contribute to a theory building rather than testing process, the theoretical sampling of the participant businesses was deemed appropriate (Eisenhardt & Graebner 2007b;Baxter & Jack 2008). The cases were selected because they were particularly suitable for underlining and indicating possible links with the concepts under study. In order to make the base of the research stronger a multiple case study research was performed (Yin 2009).

Another justification can be the fact that the methodology used enabled the close collaboration with the participants, and allowed them to tell their stories (Creswell 2013). Through teir stories they were able to describe their views whicj allowed the beter understanding of the participants actions (Lather 1992).

Next to that, a cross case analysis was performed where a comparing/contrasting approach was used in order to analyze the data gathered. The collected data were compared, contrasted and a link with the literature was made so as to construct the propositions about circular economy.

Conduction case studies – collecting evidence

The aim of the execution of multiple case studies is to develop a basis for organization theory development. Within the context of this research, based on changes on the CSR strategy (from instrumental to political), SCM (i.e. sustainability supplier involvement programs), and innovation (i.e. from close to open innovation) as a result of the implementation of a circular economy strategy, it is attempted to establish a relationship between the above mentioned concepts by constructing propositions. A list of potential, contacted and participating companies is presented in the annexes (see annex B).

When selecting potential cases for participation, one could decide between a minimum and a maximum number of differences among the cases. Since this research project is partly explorative, it is desirable to select cases that are similar to each other, meaning a minimum number of differences, in order to generate generally descriptive statements (Verschuren et al. 2010). However, that was criteria was purposely overlooked in the case of LDM Brass, since we wanted to investigate the reasons the company abandoned the concept of Cradle to Cradle. All the cases have been selected in the Netherlands. The study have been undertaken in companies that are based in different sociocultural settings (such as institutions, customs, traditions, value systems, lifestyles, etc.) should therefore be taken into account (Bryman & Bell 2011). The selection criteria will be shortly described below:

Table 2.1 Selection criteria case studies

Subject	Criteria
Business growth	The companies have experienced or are experiencing a period of business growth (increase in turnover/employees) and have at least entered the growth stage of the venture life-cycle process.
Sustainability-driven purpose	The companies should still follow their sustainability-driven purpose (Parrish 2010). This means that CSR-practices should be integrated to their core business objectives.

Engaging with either Cradle to Cradle or Circular Economy	The companies have experienced either the concept of cradle to cradle or circular economy.
Company age/size	The companies should be old enough to have entered at least the growth stage of the venture life-cycle process. These companies often fit the criteria of small and medium sized enterprises (SMEs), which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro' (European Commission., 2005). However, the number of employees is not considered as upper limit.
Location	The companies are based in The Netherlands and the all have international presence.

During the execution of case study research at the four selected companies (see annex C), interviews were conducted. The interviews have been semi-structured; taking into account the limited time span per interview of one hour, open-ended pre-formulated questions have been used to make sure all themes of relevance were discussed. However, depending on the answers of the respondent, certain themes were analyzed more in depth. The semi structured interview format can be found in the annexes (see annex E). Besides interviews, documentation and archival records have been collected when accessible. The field procedures are documented in annexes (see annex F), including an overview of the collected data per participating company and a time schedule for conducting interviews, writing transcripts and analyzing data.

Reliability and Validity

To substantiate the quality of this case study research design, three tests have been applied. Those refer to the construct validity, the external validity and the reliability tests (Yin 2009). The construct validity is increased because multiple sources of evidence have been used during the execution of case study research. Next to interviews with company informants, the website of the company, and published articles by others and company documents (if accessible) have been studied and included in the case study results. Besides, comparing data within and across case studies increases to validity of multiple case study as well (Eisenhardt & Graebner 2007b). The external validity is determined by the extent to which the scientific findings can be generalized (Yin 2009). One of the aims of case study research is to analytically generalize a particular set of results to some broader theory (ibid.). To improve the external validity, multiple case studies are executed. Although multiple cases are

investigated, the generalization of the results of this case study research could be considered as relative low due to the limited number of cases that have been explored. However, a limited number of cases is required to realize depth. This research is explorative, meaning that resulting statements could be tested in future research.

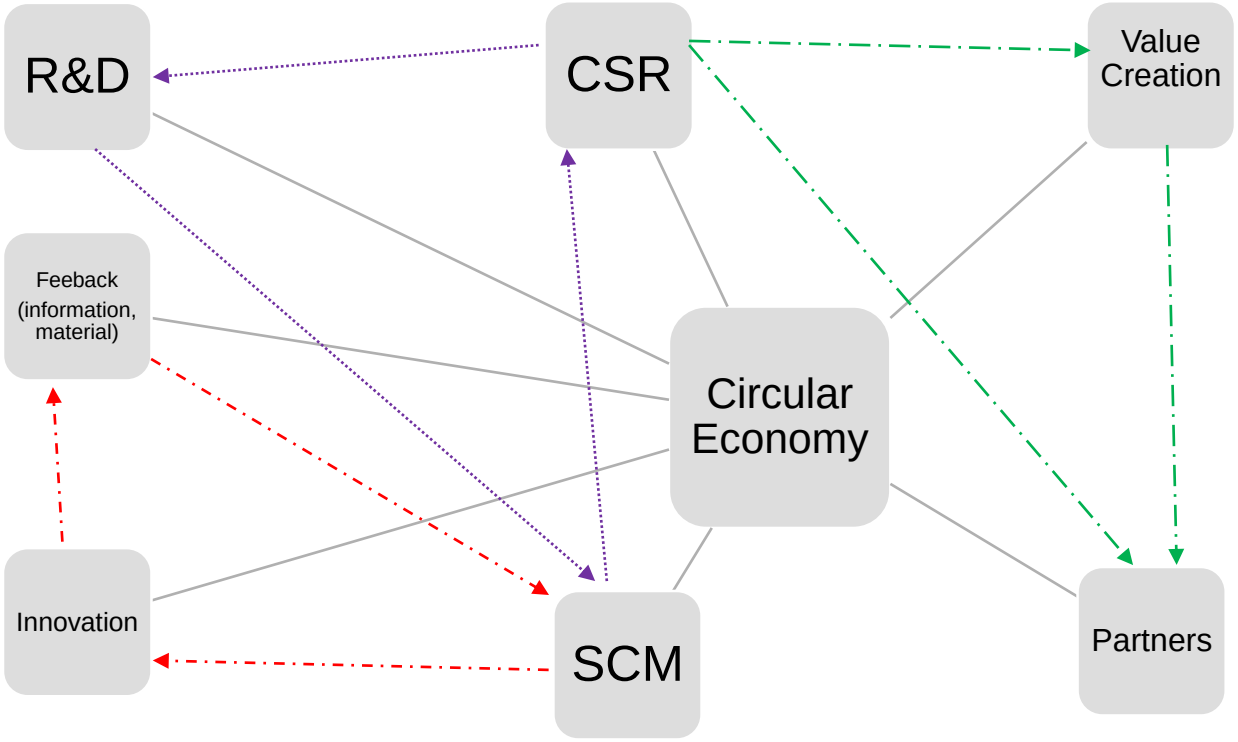
Finally in order to increase the reliability of this research, and to create the possibility to replicate the study, a research protocol has been defined and used (see annex A), Moreover a case study database has been created and maintained in order to structure all data that has been collected and processed during the period of case study research. This database can be requested to the research team.

Data/Analysis/Results

The aim of this research is to discuss the results of case study analysis in four companies (see Annex A) that engaged with a cradle to cradle/circular economy strategy. In this section the propositions about circular economy are constructed, the cross case analysis is presented and then the results are compared to the literature research when possible.

As it is depicted in the schematic approach below, the relationship with circular economy and the other concepts is complex. Therefore the propositions will try to underline some major points in order to give a more clear insight. The links depicted in figure 4.1 will be analyzed below.

Figure 4.1 Links between circular economy, CSR, SCM and innovation (R&D).



Source: own ellaboration

During the last thirty years, corporate social responsibility scholars have addressed the question whether "it pays to be socially responsible" (Scherer & Palazzo 2007). However, these studies did not take into account the intrinsic reason for corporate responsibility (Margolis & Walsh 2003). As already described from some scholars in management studies, the role of the firm until recently was strictly viewed as to gain profit. Social responsibility was perceived as a state task (Levitt, T. 1970, as cited in Meloan et al.) (Taylor W. Meloan, Samuel Van Dyke Smith 1970). However, globalization has led the firms to take charge of social and political responsibilities lately. Studies have shown that more and more firms are not conceived only as economic actors but also as political. Public health, education, social security, and protection of human rights are some of the aspects on which firms

engage nowadays (Kinley & Tadaki 2004). Those activities go beyond the traditional perception of corporate social responsibility (Scherer & Palazzo 2007).

Three out of four companies confirm that they experienced the shift in their CSR strategies. However that was not the case for LDM Brass which argued that CSR is a major issue but unfortunately largely in the shadows in the market they operate because companies are mostly price driven.

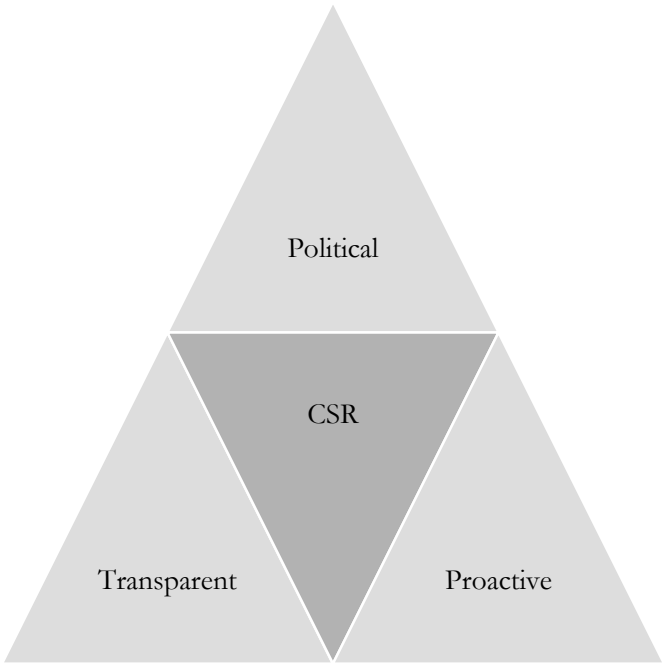
[ABN AMRO] "Corporate social responsibility has shifted over the last few years. Major impact does not occur from the cups that we drink but mostly from what we finance and what we don't. It all ends up that the bank is serving society again. We shift from just being philanthropic to internalize our externalities. Moving from externally driven towards an intrinsic motivation long term benefit for the bank if we focus on the long term of the society we are focusing. Being not just reactive but proactive" (pers. comm. with Ms. C. Pessers 2014).

[Philips] "CSR is an integral part of Philips sustainability efforts. Apart from being an innovator, Philips believes in fostering relationships and according high priority to the interest of community in which it operates. Corporate Social Responsibility is about reaching out to the underprivileged and connecting with the heart. Building on our rich heritage of involvement in social issues, we have established our own approach of supporting the communities where we live and work. A dedicated team of over hundred employees form the Community Involvement Team (CIT) which cares, involves and touches lives through its activities in healthcare, employability and education. Be it donating blood, painting schools or teaching children in slums, they work with the same passion and commitment" (Philips 2014; pers. comm. with Mr. A. Pheifer 2014).

[Rockwool] "We want to create a better life for people internally by being a responsible employer and externally by contributing with products that have a positive impact on life. We also commit to contribute to the society (Rockwool Foundation). Quarter of the dividend goes to the foundation to support themes as poverty, all kinds of societal debates. Independent, it is about raising political awareness" (pers. com. With Ms. H. Stappers 2014).

As a result of the above analysis we conclude in the formation of the proposition 1: "**CSR is more political and proactive in a circular business model than in a traditional linear one".** The proposition is depicted in figure 4.1 below.

Figure 4.1 Characteristics of CSR in a circular economy



Source: own elaboration

Further, LDM Brass argues in their corporate website that is a friendly and safe company to work for, and their business have a positive effect on their supply chain. They also claim to enjoy the reputation of an honest and ethically minded partner, an excellent employer and a responsible neighbor. In addition their production site is ISO 18001 certified (LDM Brass 2014b). However, this argument is not enough to support the second proposition. Nevertheless, the rest of the participants confirmed that transparency is needed throughout the company in order to achieve a successful transition into a circular business model.

[ABN AMRO] Amongst their efforts is to maximize transparency in all their communication. As part of their drive to pursue sustainable business operations, they rebuilt their sustainability reporting systems in 2013 so that they can provide greater transparency about their progress on several fronts. An external auditor has provided assurance on an elected set of performance indicators. This means that they have taken an important step in living up to the first element of their long-term strategy (ABN AMRO 2013).

[Philips] Philips has a long tradition of sustainability reporting, beginning in 1999 when they published their first environmental annual report. In 2003, they expanded their reporting with the launch of their first sustainability annual report, which provided details of their social and economic performance in addition to their environmental results. Based on ongoing trend analysis and stakeholder input, they identify the key material issues for their company from a sustainability perspective. They have mapped the issues, taking into account the: level of concern to society at large and stakeholders, versus impact on Philips, and the level of control or influence they can have on an issue through their operations and products/solutions. This is a dynamic process, as they continuously monitor the world around them. They develop their policies and programs based on their findings (Philips 2012a).

[Rockwool] In order to facilitate transparency, in 2013 for the first time the ROCKWOOL Group's Sustainability Report was published according to the international standard for sustainability reporting, Global Reporting Initiative (GRI). Three are the main pillars of Rockwool's CSR namely; Transparency – net positive impact of the products. Awareness – create a better life for people internal by being a responsible employer and external by contributing with products that have a positive impact on life. In the Rockwool case that means next to be energy efficient at the same time the material used also protects against noise (noise absorbent) / protects life and property (fire safe) and life time performance of the product, furthermore it is a fully natural product made out of rock and is recyclable (Rockwool Group 2013; pers. comm. with Ms. H. Stappers 2014).

As a result of the above analysis proposition 2 underlines that: "**Corporate social responsibility needs more transparency in a circular economy society."** Proposition 2 is depicted in figure 4.1 "Characteristics of CSR in a circular economy".

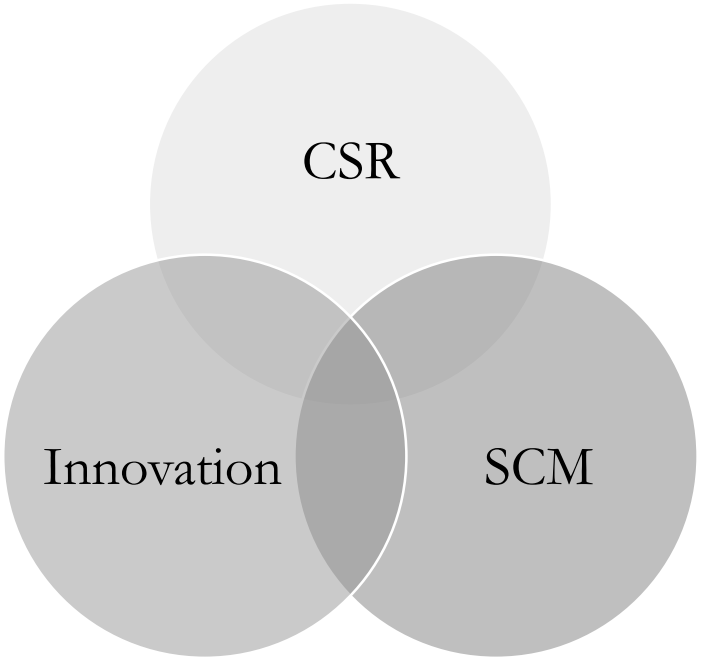
In addition, the relationship between the functions of supply chain management, R&D/Business Development, corporate social responsibility and circular economy is poorly supported by literature. Therefore it consisted the stimulus for this research. Three out of four respondents argued that more collaboration is needed in order to achieve a smoother transition towards a circular economy:

[ABN AMRO] "In order to create new financial products to source circular economy we brainstorm with Turntoo, colleagues from the lease department, risk analysts and financial experts" (pers. comm. with Ms. C. Pessers 2014).

[Philips] "Collaboration between the R&D, marketing and sales is needed between the departments because the transition towards a circular economy needs constant feedback" (pers. comm. with Mr. A. Pheifer 2014).

[Rockwool] "We now do see that CSR issues are becoming integrated, so we organize ourselves horizontally. We have a team consisted of members from several departments that meets occasionally" (pers. comm. with Ms. H. Stappers 2014).

Figure 4.2 Circular economy links with the functions of SCM, R&D and the CSR strategy. The schematic approach depicts the closer collaboration which is needed between the business functions of R&D and SCM along with the CSR strategy in order to achieve the smoother transition in a circular economy.



Source: own elaboration

The above analysis results in proposition 3**: "Closer collaboration is needed between the functions of supply chain management, R&D/Business Development and the corporate social responsibility."**

Although innovation boost due to system redesign/rethinking (Macarthur 2013a) was one of the driving forces mentioned in the literature research none of the respondents mentioned it in their answers.

[ABN AMRO] "We want to be able to give more sustainable advice to our business clients by providing tools like the circular scan (i.e. scan part of the industry or an individual client). This aims to help our clients become aware of their footprint and enable possibilities to shift towards more circular models" (pers. comm. with Ms. C. Pessers 2014).

"We aim to raise our clients' awareness by collaborating with others through the circle economy platform in order to achieve a smoother transition towards a circular economy (pers. comm. with Ms. C. Pessers 2014)."

"In ABN AMRO we see the need for re-invention and the development of new business models" (pers. comm. with Ms. C. Pessers 2014).

[Philips]

Since Philips was founded in 1891, it has worked to improve social equity and environmental quality, proving that responsible business is good business. With its tradition of integrating economic, environmental and social issues, Philips understands that sustainable development is one of the most challenging issues facing the world (Philips 2012a).

"Phillips's large focus on circular economy comes inherently from the organization that is Phillips. If you go further, when realized that we needed to take care of our people. It is very attached to our identity. Specifically in a circular economy, sustainability it is a nice to have" (pers. comm. with Mr. A. Pheifer 2014).

"Circular economy creates business models that customers will ask for in the future (brand reputation). Circular economy is the logical thing to do next because of resource scarcity, growing population etc. They already have enough cradle to cradle examples. Circular economy is focused on service" (pers. comm. with Mr. A. Pheifer 2014).

"It's our opportunity to change the business into a true sustainable business on the long time. We add value to our customers/suppliers/society" (pers. comm. with Mr. A. Pheifer 2014).

Amongst other drivers are: improving people's lives: 2015 Target: 2 billion lives a year by 2015. 3 billion lives by 2025 (Philips 2014b), improving energy efficiency of Philips products. 2015 Target: 50% improvement for the average total product portfolio compared to 2009 (Philips 2014b), and closing the materials loop. 2015 Targets: Double global collection, recycling amounts and recycled materials in products compared to 2009 (Philips 2014b).

[Rockwool]

"Rockwool wants to be a sustainable company. We did not adopt C2C but we adopted the vision. We have the largest stone wool factory in the world, where we perform LCA analysis, we exactly know the indicators of all our products. We want to be transparent with the whole LCA. Amongst our drivers is being good at what we do, get an insight on the improvement of our business processes, lower our co2 and energy bill, create business models,

lower our environmental impact, generate the demand on the market for products on true environmental performance" (pers. comm. with Ms. H. Stappers 2014).

[LDM Brass] "I was impressed by the initiative of Braungart and McDonough. I came back to the office and proposed to my colleagues to join the group promoted by the Dutch Ministry of Economics at the time in order to find people of the same mindset and speed up the cradle to cradle principles" (pers. comm. with Mr. H. van Dugteren 2014).

"I wanted to find a way to make cradle to cradle productive in the metal industry" (pers. comm. with Mr. H. van Dugteren 2014).

Table 4.1 Driving forces for engaging in a circular economy

Concepts	**Empirical Data**			
	Philips	ABN AMRO	Rockwool	LD Brass
Drivers	ID, brand reputation, true sustainability, new business models	Re-invention, new business models	Improvement business processes, lowers CO2, energy bill, business models, generate demand	Explore the potentials of the concept in the metal industry

Source: personal communication with Philips, ABN AMRO, Rockwool and LDM Brass

Summarizing proposition 4 argues that: "**Partners has various driving forces for engaging with circular economy such as development of new business models and true sustainability."**

In addition, defining sustainability has been a hard task for many scholars along the years. The same rule stands for the corporate world. In order to achieve a successful collaboration trust needs to be built between all the parties. However, trust is not always enough. In addition to that, the respondents argued that sharing the same sustainability vision and principles is also very important. As it is also mentioned in the literature: "Management of social and environmental externalities along the supply chain is considered a strategic necessity" (Scherer & Palazzo 2011). Whenever that was not the case the engaging companies tried to support, educate and help their partners in order to achieve the same levels.

[ABN AMRO] ABN AMRO believes that their responsibility in the field of sustainability extends beyond their own internal business operations. They also scrutinize

their partners and suppliers within their purchasing policy, assessing them on the transparency and sustainability of their own operations. ABN AMRO encourages its suppliers to apply the FIRA Rating system, so they can make a properly founded assessment. FIRA records and monitors suppliers' sustainability performance and processes. The FIRA system ties in closely with international guidelines for socially responsible business, such as ISO 26000 and the GRI. A substantial proportion of newly contracted expenditure was placed in 2012 with suppliers offering this transparency. Their ambition is to raise the percentage of total annual expenditure to which this applies significantly in the year ahead, so that they can set, measure and achieve targets together with their suppliers (ABN AMRO 2012). The performance indicators that are used to reassure sustainability in ABN AMRO's supply chain are listed below namely; 1) percentage and total number of significant investment agreements and contracts that include clauses incorporating human rights concerns, or that have undergone human rights screening, 2) percentage of significant suppliers, contractors and other business partners that have undergone human rights screening, and actions taken, 3) operations and significant suppliers identified in which the right to exercise freedom of association and collective bargaining may be violated or at significant risk, and actions taken to support these rights, 4) operations and significant suppliers identified as having significant risk for incidents of child labor, and measures taken to contribute to the effective abolition of child labor, 5) operations and significant suppliers identified as having significant risk for incidents of forced or compulsory labor, and measures to contribute to the elimination of all forms of forced or compulsory labor (ABN AMRO 2012).

[Philips] More and more, their products are being created and manufactured in close cooperation with a wide range of business partners, both in the electronics industry and other industries. Philips needs suppliers to share their commitment to sustainability, and not just in the development and manufacturing of products but also in the way they conduct their business. They require suppliers to provide a safe working environment for their workers, to treat workers with respect, and to work in an environmentally sound way. Their programs are designed to engage and support their suppliers on a shared journey towards continuous improvement in supply chain sustainability. As a leading company in sustainability, Philips acts as a catalyst and support their suppliers in their pursuit of continuous improvement of social and environmental performance. They recognize that this is a huge challenge requiring an industry-wide effort in collaboration with other societal stakeholders. Therefore, they remain active, together with peers in the industry, in the Electronic Industry Citizenship Coalition (EICC) and

encourage their strategic suppliers to join the EICC too. They also continuously seeking active cooperation and dialogue with other societal stakeholders including governments and civil society organizations, either directly or through institutions like the EICC, the multi-stakeholder program of the Sustainable Trade Initiative IDH, and the OECD (Philips 2012a). They monitor supplier compliance with the Declaration through a system of regular audits (Philips 2012a). The Global Supplier Rating System (GSRS) gives Philips insight into their suppliers' performance throughout the company's businesses. It allows them to identify 'best fit' suppliers who add the most value, using objective, measurable criteria. Supplier rating also provides a way for their suppliers to check their own performance, anywhere and at any time. Data and benchmarks are visible to both parties. The system supports supplier relationship management, as well as supplier development and quality management. Philips and suppliers can work together effectively on problem solving and improvements based on objective performance measurement and feedback (Philips 2012b).

The Philips Supplier Sustainability Involvement Program is their overarching program to help improve the sustainability performance of their suppliers. They create commitment from their suppliers by requiring them to comply with their Regulated Substances List and the Philips Supplier Sustainability Declaration, which they include in all purchasing contracts. The Declaration is based on the EICC code of conduct and we added requirements on Freedom of Association and Collective Bargaining. The topics covered in the Declaration are namely: labor, health and safety, environmental, ethics and management system (Philips 2012a).

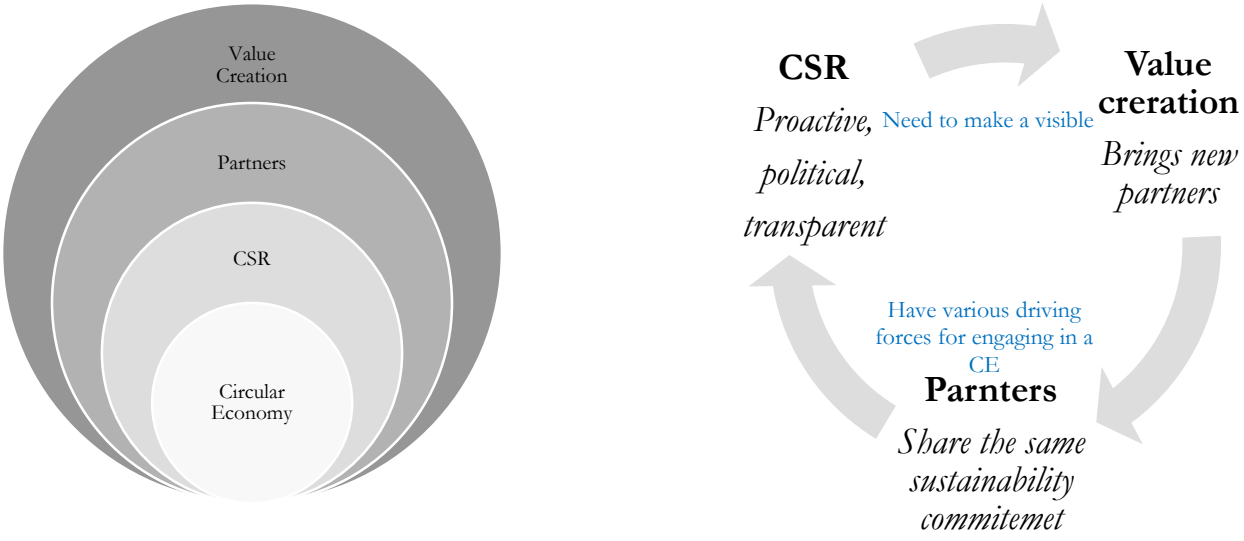
[Rockwool] **"**ISO14001 is really important" confirms Ms. H. Stappers. They have started discussions with suppliers who do not have the certification. Rockwool aims to create value by showing how they are supplying their customers, by making it visible. Therefore cooperation and shared commitment between suppliers is essential. "It is a matter of educating the supply chain, let them see the business models as well. Tell them about their future compliance – being ready for the future which starts today" (pers. com. With Ms. H. Stappers 2014).

[LDM Brass] "As humans, our activities have a tremendous impact on our surroundings. We at LDM are acutely aware of this fact. We fully understand that we are dependent on limited resources in our line of work. Consequently, as a manufacturer of brass and bronze semi-finished products, we have set a goal for ourselves to continue reducing the environmental effect of our activities in the years to come. Ultimately, the result of our efforts should actually make

a positive contribution to the environment. This is a remarkably ambitious and innovative goal. Of course we cannot achieve it overnight, and we certainly cannot do it on our own. To do so, we need help from our suppliers, our employees, our surroundings and our customers" (LDM Brass 2014b).

So, proposition 5 highlights that: **"Partners should share the same sustainability commitment in a circular economy."** The relationship is depicted in figure 4.3 below.

Figure 4.3 Value creation amongst partners that share the same sustainability commitment in a circular economy.



Source: own elaboration

Next, all the respondents are practicing CSR. Literature suggested that a circular business model will not succeed unless it has a proven value: better economics for the company, benefit for the customer, or a marketing advantage (Turner & Houston 2009). Although the value creation was not mentioned as extensively as we would expect. In ABN AMRO's and LDM's case the term was not used during the interviews. In the Philips case the following statement is mentioned among the core principles of the company:

[Philips] **"**We manage our portfolio with clearly defined strategies and allocate resources to maximize value creation" (Philips 2012b).

[Rockwool] **"**In favor of transparency we need to find out the true environmental performance and take it out in public. We need to show what is really benefiting the society by raising awareness and enabling people to require

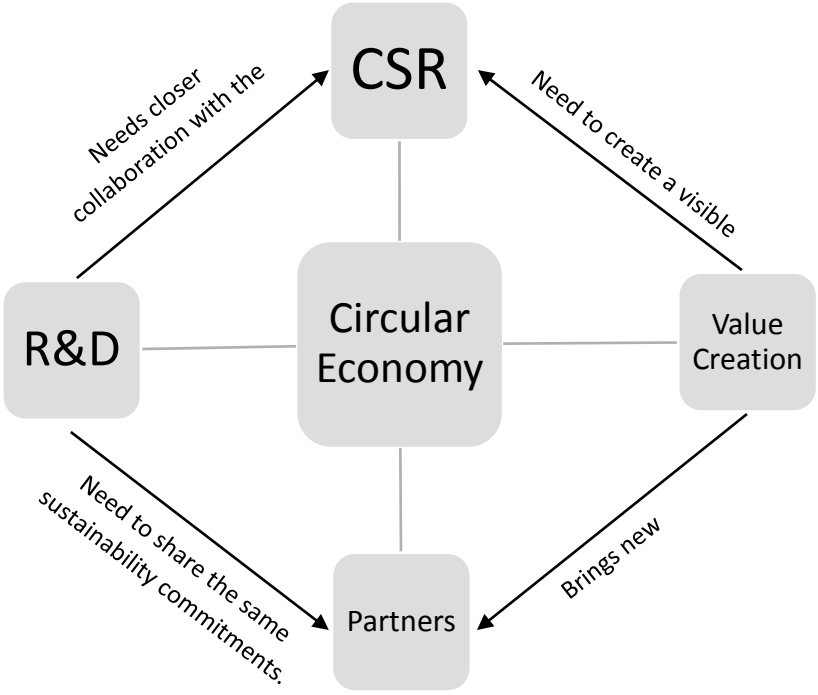
other companies to ask for the true environmental performance" (pers. comm. with Ms. Hannie Stappers 2014).

"All the business units, the factory as the organization of Sales, Business Development, Marketing etc. had their KPI's They had to create a common understanding to align KPI's, to live up to the expectations of the market and how that reflect in creating value, so how to have a business model. Now our mission is to make it visible and tangible. Our LCA data base is very tangible and visible. So questions like what is happening to CO2 when we invent new technologies can be answered. By making the environmental impact visible to our customers, such as Unilever, they can for instance calculate their CO2 footprint. The market needs to help our customers profiling on sustainability; to make our value creation visible" (pers. comm. with Ms. Hannie Stappers 2014).

As a result we conclude in proposition 6: **"CSR needs to make a visible value creation in a circular economic business model."**

Although three out of four respondents mentioned that they work together with their partners and they offer programs to educate them only Rockwool made clear that by showing them the business models of the future they will help them engage with the circular economy (pers. comm. with Ms. H. Stappers 2014) and like that create the first loop depicted in the scheme below.

Figure 4.4 The success of a circular economy depends on a visible value creation.



Source: own elaboration

As it is depicted in figure 4.4 CSR and R&D are interlinked in a circular economy. More collaboration is needed between the two. Further. R&D creates a visible value which consequently brings more partners in the circular economic business model. However, the new partners need to share the same sustainability commitments in order to close the loop successfully.

Consequently we conclude in proposition 7: **"A visible value creation brings new partners in the circular economy."**

Additionally, innovation had a prominent position amongst all the interviewees' responses. However, ABN AMRO and Rockwool supported that innovation in terms of advice and consulting turns them into solution providers inside a circular economy.

[ABN AMRO] When the question about the organizational part of innovation was asked ABN AMRO argued that they finance, manage and advice their clients. They added, that what needs to be changed, is the content of their advice not the structures (pers. comm. with Ms. C. Pessers 2014). Although the question was not directly related with the proposition, it is nevertheless supports it.

[Rockwool] Same case with the Rockwool. In the same question the response was that the business development is now making a checklist about indicators that are good for the materials. But also the solutions. It is mentioned that in the past

they were just an insulation supplier but now they act as a solution provider by talking to the markets, see new developments, making new business models. "Innovation for a large deal comes from the suppliers. Therefore suppliers should be consulted in front, so they can bring solutions. We are not a product supplier anymore. We deliver solutions that bring value and sustainability" (pers. comm. with Ms. H Stappers 2014).

Therefore we formulate proposition 8: **"Innovation turns companies into solution providers."**

[Philips] Collaboration is needed between the departments because the transition towards a circular economy needs constant feedback. It starts changing now they are entering circular economy but it takes a lot of time before you fully run circular economy (pers. comm. with Mr. A. Pheifer 2014). However, innovation that occurs in R&D also provides feedback by staying in touch with the users after the lease contract is signed, by getting all the feedback form the users and staying in touch with what the market needs and by getting the healthcare machines back in the Best Refurbishment facilities (Mr. A. Pheifer 2014, pers. Comm.).

[Rockwool] They have they own recycle plant since 1981 in Roermond. This serves in closing the loop, decreasing their environmental footprint but also the supply chain because next to it they have a recycling service to offer to their customers (pers. comm. with Ms. H. Stappers 2014).

[LDM Brass] When the question about the organizational part was asked the answer from LDM Brass was that they have been doing some innovative business with a sanitary company that provided equipment to hotels. They tried to get them into redecorate every 6-7 years by buying back or renting out their brass. Then LDM used to melt it and make new bars out of it (pers. comm. with Mr. H. van Dugteren 2014). By doing so LDM innovative model is closing the loop and so provide constant hard feedback.

Consequently proposition 9 implies that: **"Innovation provides constant feedback (information/material)."**

Besides the case of ABN AMRO who operates in the banking sector, so in that case feedback can be only soft all the case of LDM Brass who did not make a comment about managing the feedback Philips and Rockwool argued that although currently are organized in silos they are putting effort to change that because they believe that in a successful circular economy feedback should not managed in silos.

[Philips] Communication (soft feedback) between the R&D, marketing and sales is managed like silos currently. Collaboration is needed between the

departments because the transition towards a circular economy needs constant feedback. It starts changing now they are entering circular economy but it takes a lot of time before you fully run circular economy (per. Comm. with Mr. A. Pheifer 2014). Philips has large supply chains but internal communications is also complex. In a circular economy model constant feedback is needed instead of just giving a semi-finished product to the next department and "running away. Presentations within business units and departments help Philips employees to understand the necessity of communication and collaboration (Mr. A. Pheifer 2014, pers. Comm.).

[Rockwool] Business development was all about serving the business outside. If they needed a product they would invent it. Never before they were tasting what kind of other (not Rockwool) materials they were using. How about the LCA of "other" materials. They are organized in silos. Now they do see that CSR issues are becoming integrated so the now organize themselves horizontally. For that purpose they developed a team consisting of colleagues coming from various disciplines and they meet occasionally (pers. comm. with Ms. H. Stappers 2014).

As a result proposition 10 underlines that: **"Feedback should not be managed in silos in a circular business model."**

As it became clear from the literature review, the collection and reverse logistics are becoming very successful. In order to achieve increased material productivity, by ensuring that end of life products can be reintroduced into the business system, collection and reverse logistics are very important. Classical companies that operate in the field of waste management are increasingly diversifying their capacities and divert from landfilling towards more recycling and even refurbishment operations. (Francavilla 2014). Reverse logistics stands an attractive business for logistics service providers which they see not only an opportunity to fill backhaul loads (Macarthur 2013a). However our respondents as well claimed to be interested in these operations.

[Philips] Philips ensures its customers of high performance, every step of the way. "You need a partner you can trust to perform every step of the way – one who provides the highly reliable equipment, upgrades and customer services that are critical to your success. We call this promise of performance Diamond Select" (Philips 2014c). "To maintain the high standards set by Philips, all Diamond Select systems undergo a thorough five-step refurbishment process.

Step 1 - Stringent Selection. Philips identifies and selects prime performers with a reliable track record.

Step 2 - Skilled De-Installation & Transport. Proper de-installation and specialized transport by experienced Philips personnel ensures that the system arrives at the Philips facility in good condition.

Step 3 - Expert Refurbishing. The system is fully inspected, components are inventoried and registered, and the refurbishment process begins: all components are tested, obsolete or defective parts are replaced, latest software releases/all field updates are installed, system is customer-configured, system is cleaned and painted to look like new, full performance and image quality checks are performed according to original manufacturer's specifications, expert refurbishing.

Step 4 - Effective Installation. The system is installed, calibrated, and tested by system engineers to the same exacting standards as any new piece of equipment.

Step 5 - Full Warranty & Support. As with all new systems, Diamond Select refurbished systems come with Philips warranty, applications training, attractive financing options and the support of Philips' award winning worldwide customer service" (Philips 2014c).

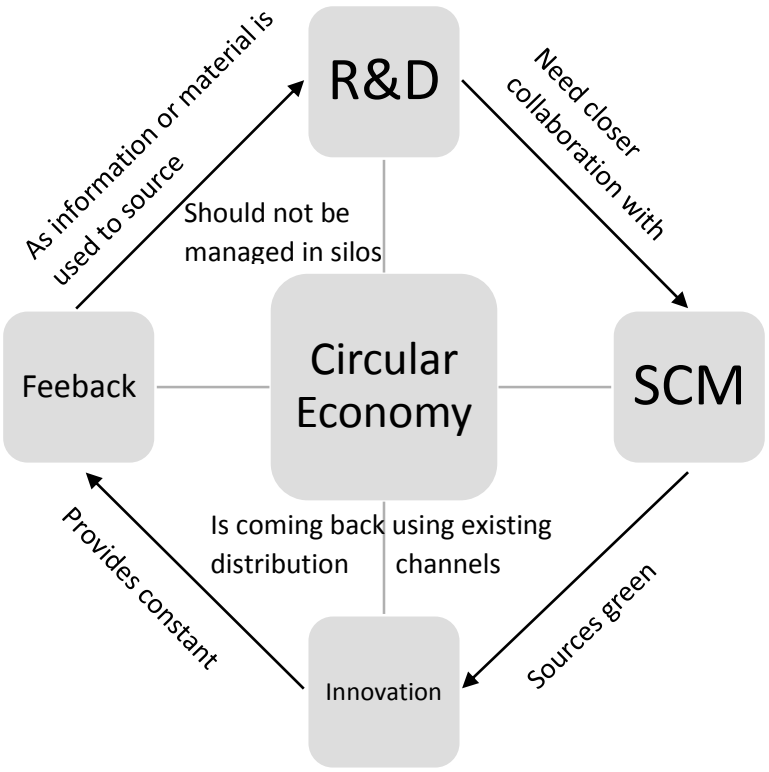
[Rockwool] **"**Rockwool continuously invests in environmental provisions and thus the production changed dramatically. Production residues by recycling back into the production process.

Pallet Return Service - ROCK CYCLE

There is a return system with which both mineral wool waste as packaging film can be traced back to ROCKWOOL for recycling. Thus Rockwool quality recycled in its own cycle: from wool to wool" (Rockwool Group 2014c).

Finally we conclude in proposition 11: **"Feedback returns to the company by using existing distribution channels of the supply chain."**

Figure 4.5 Propositions 8-11 can be graphically demonstrated in the scheme below



Source: own elaboration

As it is elaborated in the schematic approach above, the functions of R&D and SCM need closer collaboration in a circular economy. SCM sources sustainable innovation which in turn provides constant feedback in the loop (in terms of hardware i.e. materials or soft innovative ideas). The loop closes with the feedback coming back to the company by using existing distribution channels. However, feedback should not managed in silos in a circular economy.

Summarizing, all the above mentioned analysis is presented in the table 4.1 below, where the propositions/new theories are collected, their sources are presented along with the companies' alignment. The propositions that stem out from the literature review can be recognized by the source given in the second column of the table. Those who can be supported by the multiple case study research only have a blank space in the second column. Nevertheless, the third and final column indicates whether the proposition, no matter where it stems from, is supported by the participating companies (+) or not (-).

Table 4.1 Collective table presenting all propositions and their sources of origin

Propositions	Theoretical	ABN AMRO	LDM Brass	Philips	Rockwool
1. CSR is more political and proactive in a circular business model than in a traditional linear one	(Scherer & Palazzo 2007; Scherer & Palazzo 2011)	+	-	+	+
2. Corporate social responsibility needs more transparency in a circular economy society	(Porter & Kramer 2006; Auld et al. 2008; Dahlsrud 2008; Keating et al. 2008; Andersen & Skjoett-Larsen 2009; Pedersen 2009). (Blyth 2005). (Porter & Kramer 2006). (Seuring & Müller 2008). (Matten & Moon 2008). (Benn et al. 2006). Auld et al. (2008) (De Brito et al. 2008). (Moore & Manring 2009). (Eltantawy et al. 2009; Lee & Kim 2009). (Carter & Rogers 2008). (Seuring & Müller 2008).	+	-	+	+
3. Closer collaboration is needed between the functions of supply chain management, R&D/Business Development and the corporate social responsibility		+	-	+	+
4. Partners has various driving forces for engaging with circular economy such as development of new business models and true sustainability	(Macarthur 2013b; Francavilla 2014; Clausen et al. 2010; Park et al. 2010; Turntoo 2014; Cisco 2014; Statham	+	+	+	+

	2006; Sherman 2014)				
5. Partners should share the same sustainability commitment in a circular economy	(Scherer & Palazzo 2011)	+	+	+	+
6. CSR needs to make a visible value creation in a circular economic business model	(Turner & Houston 2009)	+	+	+	+
7. A visible value creation brings new partners in the circular economy		-	-	+	+
8. Innovation turns companies into solution providers	(Macarthur 2013b)	+	-	-	+
9. Innovation provides constant feedback (information/material)		+	-	+	+
10. Feedback should not be managed in silos in a circular business model		-	-	+	+
11. Feedback returns to the company by using existing distribution channels of the supply chain		-	+	+	+

Source: own elaboration

Discussion/Conclusions

In this section the case study results will be compared with the literature study results. In addition recommendations for further research will be made.

Driving forces for engaging in circular economy

In the initial sections of this report literature research has been carried out in order to answer the first specific research question (What are the main driving forces for adopting a cradle to cradle/circular economy strategy?) Literature suggested a wide variety of driving forces;

- Development of new profitable business
- Collection and reverse logistics
- Product remarketers and sales platforms
- Remanufacturing and product refurbishment
- Material recycling systems
- Enabling business models that close reverse cycles
- Financing
- Solving strategic challenges and building competitive advantage
- Reducing material bills and warranty risks
- Improved customer interaction and loyalty
- Less product complexity and more manageable life cycles
- Innovation boost due to system redesign/rethinking

Case study results confirmed that most of the above mentioned driving forces are represented by the participating companies. Some were more popular, such as the development of new business models, and some less or not popular at all such as the innovation boost due to system redesign/rethinking, which was not mentioned as an engaging driver. Although innovation had a prominent role in the interviewees answers, it was not mentioned as a driver, and therefore it cannot be confirmed as a case study result. Other drivers such as financing or reducing material bills were mentioned only once but still they are confirmed results. Table 4.1 above explicitly links the results with the cases from the participating companies.

Implications with corporate social responsibility

The research that has been undertaken tried to answer the second sub question (What are the implications on a firm's corporate social responsibility?) During the last thirty years, corporate social responsibility scholars have addressed the question whether "it pays to be socially responsible" (Scherer & Palazzo 2007). However, these studies did not take into account the intrinsic reason for corporate responsibility (Margolis & Walsh 2003). As already described from some scholars in management studies, the role of the firm until recently was strictly viewed as to gain profit. Social

responsibility was perceived as a state task (Levitt, T. 1970, as cited in Meloan et al.) (Taylor W. Meloan, Samuel Van Dyke Smith 1970). However, globalization has led the firms to take charge of social and political responsibilities lately. Studies have shown that more and more firms are not conceived only as economic actors but also as political. Public health, education, social security, and protection of human rights are some of the aspects on which firms engage nowadays (Kinley & Tadaki 2004). Those activities go beyond the traditional perception of corporate social responsibility (Scherer & Palazzo 2007).

The case study data supported the literature data and consequently the shift that the partcipating companies have experienced in their CSR strategies. CSR practices in ABN AMRO, Philips and Rockwool became proactive, not just philantropic and even political in some cases as it was mentioned by Mr. A. Pheifer and Ms. C. Pessers in our personal communication. The number of activities currently performed in the companies has increased over the last years. Below are some examples; Philips program overview: SimplyHealthy@Schools, Philips Community Light Centers, Fabric of Africa – Collaboration Platform, Philips Cares, Philanthropy by Design (see Annex G); ABN AMRO program overview: Microfinance, Reading and arithmetic help, Calvijn College, Be a Hero with Your Money, Dutch Victim Support Fund, Walking Fair, Christmas angel, Social Marketplace and Community team activities (see Annex H); Rockwool Foundation projects focus on Food Security and Poverty Alleviation, Social Capacity Building, International Peace Building, Health Interventions (Rockwool Group 2014a). As Ms. C. Pessers (2014) argued "corporate social responsibility has shifted over the last few years. We shift from just being philanthropic to internalize our externalities. Being not just reactive but proactive" (pers. comm. with Ms. C. Pessers 2014). Philips added that CSR is an integral part of their sustainability efforts. Apart from being an innovator, Philips believes in fostering relationships and according high priority to the interest of community in which it operates. Corporate Social Responsibility is about reaching out to the underprivileged and connecting with the heart. Building on our rich heritage of involvement in social issues, we have established our own approach of supporting the communities where we live and work. A dedicated team of over hundred employees form the Community Involvement Team (CIT) which cares, involves and touches lives through its activities in healthcare, employability and education. Be it donating blood, painting schools or teaching children in slums, they work with the same passion and commitment" (Philips 2014; pers. comm. with Mr. A. Pheifer 2014). As a result of the above analysis we conclude CSR needs to be more political and proactive in a circular business model than in a traditional linear one.

The empirical evidence also argues that CSR needs to be more transparent in a circular economic model and that needs to make a visible value creation throughout the whole supply chain of the firm (pers. comm. with Mr. A. Pheifer, Ms. C. Pessers and Ms. H. Stappers). The participants confirmed that transparency is needed throughout the company's structure and processes in order to achieve a successful transition into a circular business model. ABN AMRO claimed their efforts to maximize transparency in all their communication. As part of their drive to pursue sustainable business operations, they rebuilt their sustainability reporting systems in 2013 so that they can provide greater transparency about their progress on several fronts (ABN AMRO 2013). Philips has

a long tradition of sustainability reporting, beginning in 1999 when they published their first environmental annual report. In 2003, they expanded their reporting with the launch of their first sustainability annual report, which provided details of their social and economic performance in addition to their environmental results. Based on ongoing trend analysis and stakeholder input, they identify the key material issues for their company from a sustainability perspective. They have mapped the issues, taking into account the: level of concern to society at large and stakeholders, versus impact on Philips, and the level of control or influence they can have on an issue through their operations and products/solutions. This is a dynamic process, as they continuously monitor the world around them. They develop their policies and programs based on their findings (Philips 2012a). In order to facilitate transparency, in 2013 for the first time the ROCKWOOL Group's Sustainability Report was published according to the international standard for sustainability reporting, Global Reporting Initiative (GRI). Three are the main pillars of Rockwool's CSR namely; Transparency – net positive impact of the products. Awareness – create a better life for people internal by being a responsible employer and external by contributing with products that have a positive impact on life. In the Rockwool case that means next to be energy efficient at the same time the material used also protects against noise (noise absorbent) / protects life and property (fire safe) and life time performance of the product, furthermore it is a fully natural product made out of rock and is recyclable (Rockwool Group 2013; pers. comm. with Ms. H. Stappers 2014). Therefore we can conclude that corporate social responsibility needs more transparency in a circular economy society.

An additional implication that occurs to the CSR from the implementation of a cradle to cradle/circular economy strategy is the urgency for better and faster communication inside and outside the boundaries of the firm and closer collaboration with the functions of R&D/business development and SCM (pers. comm. with Mr. A. Pheifer, Ms. C. Pessers and Ms. H. Stappers). As it was also stated by Philips "collaboration between the R&D, marketing, sales, SCM is needed because the transition towards a circular economy needs constant feedback" (pers. comm. with Mr. A. Pheifer 2014). Rockwool also stated that "we now do see that CSR issues are becoming integrated, so we organize ourselves horizontally. We have a team consisted of members from several departments that meets occasionally" (pers. comm. with Ms. H. Stappers 2014).

Implications with supply chain management

"Circular economy is regenerative by design" (Ellen Macarthur Foundation 2014a). Consequently if a firm wants to transit into a circular economy the first thing that should work with is the management of its supply chain. Almost all the interviewees argued their responsibility in the field of sustainability extends beyond their own internal business operations. They also scrutinize their partners and suppliers within their purchasing policy, assessing them on the transparency and sustainability of their own operations. Several rating system, such as FIRA, were used for that reason, so they can make a properly founded assessment.

Besides transparency, the issues of commitment, collaboration and trust also came out from the empirical evidence. More and more, products are being created and manufactured in close cooperation with a wide range of business partners, therefore it is needed suppliers to share the same commitment to sustainability, and not just in the development and manufacturing of products but also in the way they conduct their business. Supplier compliance with the sustainability requirements are monitored through a system of regular audits, so here lies the matter of trust.

However circular economy does not only challenge commitment and trust. It also creates new challenges such as the urgency of developing reverse logistics distribution channels that will be used to get the materials back to the companies for refurbishment. In addition it creates new partnerships as it was mentioned in the interviews, mostly with recycling companies.

Another mater that came out is the matter of educating the supply chain, and letting them see the new business models. Informing them about their future compliance – being ready for the future which starts today.

Implications with innovation

The concepts of cradle to cradle and circular economy can be both characterized as innovation thinking for the firms. In the endeavor to answer the third sub question (What are the implications on a firm's innovation management?) it came clear from the literature research that innovation in circular economy experiences a boost due to system redesign. "Any increase in material productivity is likely to have an important positive influence on economic development beyond the effects of circularity on specific sectors. Circularity as a "rethinking device" has proved to be a powerful new frame, capable of sparking creative solutions and boosting innovation rates" (Macarthur 2013a). The case study supports the literature data since all the interviewees started experiencing changes through innovative thinking. As the empirical evidence supported innovation needs time and can be distinguished in the following categories namely; innovative thinking, process innovation, and product innovation. Literature distinguish innovation in technological, social and institutional. Further innovation can be focused on either the product, the process the market, the creation of new businesses or the new suppliers. Finally, it can be categorized as either radical or incremental and either as architectural or component (see table 1.3)

It all started with the innovative thinking of circular models which subsequently led to implications in the way innovation is managed in the firms. The interviews led to a common conclusion, more collaboration is needed with the functions of business development/R&D, supply chain management and the CSR strategists as already have been analyzed in the previous section. An additional implication that occurs from the implementation of a circular economic model regards the way feedback is managed within the firm. By feedback we mean both the soft feedback (i.e. information) but also the hard one (i.e. hardware) that occurs from the innovative process of closing the loop. All the respondents argued that innovation provides constant feedback which is currently

managed in silos. The implication however stands in the endeavor of the firms to organize themselves horizontally because of the circular economy. Finally another surprising results that came out from the case study is that innovation turns companies to solution providers (pers. comm. with Ms. H. Stappers). This is a new result since it was not referred by literature.

Limitations and future research

This research has led to knowledge on the implications of a cradle to cradle/circular economy strategies with the strategic management of a firm, and more precisely with its CSR, innovation management and SCM. This research is contributing to scientific knowledge on covering the gaps between the relationships of the above mentioned concepts. Based on the case study research and the experiences each firm testified, the results can be used as guidelines for other companies that wish to transit into a circular economy. The results imply that the adoption of a circular economy strategy will affect the company's structure and its strategic management, regarding decisions that affect CSR, innovation and SCM. This assumption could be statistically tested in future research in order to specify the effects.

The conclusions of this research are drawn based on the experiences of a limited number of participants. Therefore, the findings cannot be generalized to all firms that engage into a circular economy. Future research is needed, in which the case study is repeated, to collect more data to substantiate the conclusions. Another note that should be made is that during this research project the focus was given in three perspectives that are touched by the transition to a circular economy. However, a future research project might give a new insight in other perspectives, for example focusing more in the consumer behavior, the lease contracts etc.

Moreover, the case study results are obtained from an interview with the company representatives (approximately 60 minutes), company documents (if accessible), the company website and other published information. Due to the limited time span of this research project, the researcher has been limited in obtaining full knowledge of each case in order to prevent (small) deviations from reality.

Finally, a note should be made regarding the level of knowledge of the researcher about one of the case companies (LDM Brass). Due to the fact that the company has abandoned the concept of a C2C it was more difficult to answer the questions of the interviewer. On the one hand, it has increased insight in the concepts of cradle to cradle and circular economy underlining different perspectives.

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Annexes

Annex A Case study protocol

The case study protocol is used to guide the data collection during the execution of each case study and is developed in order to increase the reliability of the research (Yin 2009). In this appendix, the procedures and general rules that were followed during the execution of the case studies are described. A case study protocol is especially of high importance when multiple case studies are executed (Yin 2009). An overview of the case study project is given in the sections below. The participating companies, the field procedures and the case study questions are presented.

Annex B Selecting potential cases

Below is the list of companies that engaged with either cradle to cradle or circular economy. This list has been composed by visiting websites and using social media.

Name	Contacted	Responded	Email
Desso NV	6/11/2013, 13/11/2013		info@desso.com
Rockwool Benelux BV	6/11/2013, 17/01/14,27/01/2014	7/11/2013	hannie.stappers@rockwool.com
Knoops Eco Printing BV	6/11/2013, 13/11/2013		info@eco-printing.nl
DSM Innovation Center	6/11/2013, 13/11/2013		theo.jongeling@dsm.com
James	6/11/2013, 13/11/2013		martijn@james.eu
EuroCeramic BV	6/11/2013	11/11/2013	info@euroceramic.nl
Jalema BV	6/11/2013, 13/11/2013		info@jalema.com
Koninklijke Mosa BV / Royal Mosa	6/11/2013, 13/11/2013		servicedesk@mosa.nl
Usit Design	6/11/2013, 13/11/2013		info@usitdesign.nl
Van Houtum	6/11/2013, 13/11/2013		info@vanhoutum.nl
Van Gansewinkel	6/11/2013, 27/01/2014	6/11/2013	florens.slob@vangansewinkel.com
OoPéBé Concept	6/11/2013, 13/11/2013		info@oopebeconcept.nl
Turntoo BV	6/11/2013, 13/11/2013	13/11/2013	info@turntoo.com
Philips	6/11/2013, 8/11/2013, 20/11/2013, 17/01/14	8/11/2013, 11/11/2013, 20/11/2013	hans.annink@philips.com, allard.pheifer@philips.com
LDM Brass	16/10/2013, 17/01/14, 28/01/2014, 18/10/2014	16/10/2013	hans.van.dugteren@ldmbrass.com
Unilever	24/1/2014	28/1/2014	
Royal Bam Group	24/1/2014		info@bam.nl
De Lage Landen	24/1/2014		
Cisco	24/1/2014		
ABN Amro	13/1/2014, 10/2/2014, 18/10/2014, 25/2/2014	28/1/2014	celine.pessers@nl.abnamro.com, richard.kooloos@nl.abnamro.com, emilie.ottervanger@nl.abnamro.com, dick.ligthart@nl.abnamro.com, duurzaamheid@nl.abnamro.com

Annex C Introducing the participating companies

"Koninklijke Philips N.V. (Royal Philips, commonly known as Philips) is a Dutch diversified technology company headquartered in Amsterdam with primary divisions focused in the areas of Healthcare, Consumer Lifestyle and Lighting. It was founded in Eindhoven in 1891 by Gerard Philips and his father Frederik. It is one of the largest electronics companies in the world and employs around 122,000 people across more than 60 countries" (Philips 2011). "Philips is organized into three main divisions: Philips Consumer Lifestyle (formerly Philips Consumer Electronics and Philips Domestic Appliances and Personal Care), Philips Healthcare (formerly Philips Medical Systems) and Philips Lighting" (Philips 2011).

"ABN AMRO serves retail, private and commercial banking customers in the Netherlands and across the globe. Along with a comprehensive range of products and services, they offer in-depth financial expertise, extensive knowledge of numerous sectors and an international network supporting their customers' domestic and international operations. As a leading retail and commercial bank, they have a strong base in the Netherlands and follow their customers abroad. They are active internationally in areas in which they have substantial expertise, such as Energy, Commodities & Transportation (ECT) and ABN AMRO Clearing, and focus on their existing Private Banking activities in the Netherlands, Europe and Asia" (ABN AMRO 2014a).

"The ROCKWOOL Group is amongst the global leaders within the insulation industry with products and solutions for all major application areas for both residential and non-residential buildings. Together with other construction-related products such as acoustic ceilings and cladding boards, the Group contributes to energy efficient and fire-safe buildings with good acoustics and a comfortable indoor climate. They also create green solutions for the horticultural industry, special fibers for industrial use, effective insulation for the process industry and marine and offshore as well as noise and vibration systems for modern infrastructure. The ROCKWOOL Group was founded in 1937. They have more than 10,500 employees in more than 30 countries cater for customers in a big part of the world. The Group's head office is located close to Copenhagen. In 2013 the Group generated sales of DKK 14,903 million. The company is listed on the NASDAQ OMX Nordic Exchange Copenhagen" (Rockwool Group 2014b).

"LDM manufactures and supplies copper alloy rod and billets for special high-grade applications. Their customers are primarily in the automotive and aviation industries, the defense sector, construction, the premium bathroom fittings and fixture branch, and the maritime sector. LDM supplies over 30 countries around the world. Drawing on their extensive knowledge of products and processes, they are able to make a valuable contribution to finding the ideal solutions and answers to their customers' requirements and challenges. As a manufacturer of copper alloy rod and billets, LDM aims to be one of the very best producers in the world within its chosen niche markets. The company is very flexible towards its customers and produces in a safe, clean and sustainable way" (LDM Brass 2014a).

Annex D Email Protocol

To whom it may concern,

My name is George Serefias and I am following a postgraduate degree in Urban Environmental Management at Wageningen University and Research Centre.

At the moment, I am working on my M.Sc. Thesis with the Management Studies Group, regarding the implications that occur in a company at a strategic level from the implementation of a cradle to cradle/circular economy strategy. To be more specific, the focus is given at the impacts of the strategy on supply chain management, corporate social responsibility and innovation. In order to fulfil the objectives of my research, I would be interested in asking you to participate in a semi-structured interview. I am looking forward to hearing from you at your earliest convenience.

Yours faithfully,

George Serefias

MSc Urban Environmental Management

Management Studies Group

Wageningen University

Skype: georgios.serefias

Cell: +31 645779285

Annex E Semi-structured interview table

How adopting a cradle to cradle/circular economy strategy affects a firm's strategic management? What are the main driving forces for adopting a cradle to cradle strategy?

Research Questions (concepts)	**Interview Questions (implementation)**	**Answers (empirical data)**
What are the main driving forces for adopting a cradle to cradle/circular economy strategy?	1. What are the main drivers for implementing a cradle to cradle/circular economy strategy?	
What are the implications of a cradle to cradle/circular economy strategy on the firm's corporate social responsibility?	1. How do you perceive corporate social responsibility (particularly in terms of the interrelationship of financial, social and environmental dimensions) and what features characterize the corporate social responsibility practices of your firm? 2. In your organization what is the primary motivation for sustainability or corporate social responsibility initiatives?	
What are the implications of a cradle to cradle/circular economy strategy on the firm's innovation management?	1. Focusing on the organizational part, is innovation organized the same way now that you are transitioning towards a circular economy? 2. Is more collaboration between the departments needed or you would deem necessary the creation of new departments even?	
What are the implications of a cradle to cradle/circular economy strategy on the supply chain management of the firm?	1. How does your company measure the success of its sustainability initiatives in the supply chain? 2. What indicators if any does your company currently use to measure supplier performance in sustainability? 3. Does your organization have any standards for sustainable supply chain management? (I.e. Codes of conduct, product process related – Energy star, FSC, management systems and initiatives)? Do you require that your suppliers implement any standards for sustainable supply chain management? 4. How can your suppliers be encouraged to be more sustainable? Examples? 5. Did you ever need to change one of your suppliers in your endeavor to transition into circular economy? 6. What are the barriers to incorporating sustainability in sustainable supply chain management issues? 7. What areas do you see for future work in sustainable supply chain management corporations?	

Annex F Field procedures

Each single case study has been executed by conducting an interview with a representative who has knowledge and responsibility for the areas under study. Besides, relevant company documents were gathered as data as well. A note should be made that not all participating companies shared the same amount of documents due to limited resources or other reasons. As a third source of data on the single cases, articles, videos and interviews that are published on the internet have been collected and analyzed as well when possible. Below, an overview of the collected data per company is given.

Company Name	**Collected data**
ABN AMRO	Interview with Innovation manager (recorded) Discussion with Management Studies' intern Phone call with Advisor ESE Risk & Policies Sustainability reports 2011-2013 https://www.abnamro.nl/en/personal/index.html
LDM Brass	Interview with Health & Safety, Environment, Quality Assurance manager (recorded) http://www.ldmbrass.com/en/home
Philips	Interview with Circular Economy implementation manager (recorded) Sustainability reports 2011-2013 Philips Healthcare portfolio inspired by circular economy (available online at The Guardian) The Circular Revolution (available online at Project Syndicate) http://www.philips.com/global/index.page
Rockwool	Interview with Director of Public Affairs (recorded) Sustainability report 2012 CSR Progress Report 2013-2014 Samen bouwen aan een duurzame toekomst Daadwerkelijk duurzaam

SimplyHealthy@Schools

SimplyHealthy@Schools is Philips global community program, helping underprivileged school children live healthier lives. Employees engage children around the Healthy Heroes toolkit, illustrating simple ways that they can improve their health and well-being. We also provide a free upgrade of the lighting in the schools we visit. The program is aimed at 8 to 12 year olds and pays special attention to air, light, water, oral hygiene, exercise and the environment. When these factors are improved, children perform better and their overall mental and physical well-being also increases. In 2013, Philips employees travelled to over 100 schools in 24 countries, touching the lives of over 13,000 students.

Philips Community Light Centers

In 2012, Philips and the KNVB established a three year partnership, built around the creation of 90 solar 'community light centers' across the African & South American continents. Light centers are areas of approximately 1000m2, or the size of a small soccer pitch, which are lit using a new generation of highly efficient solar powered LED lighting.

The aim of the community lights centers is to create areas of light for rural communities which live without electricity, effectively 'extend the day' and creating numerous opportunities for social, sporting and economic activities in the evening. These new light centers will also enable and support the KNVB's WorldCoaches program in Africa and South America. The WorldCoaches program trains football coaches in using football for social development, focusing on communities in developing countries.

Fabric of Africa – Collaboration Platform

Many of the brightest, most successful ideas are born of synergy. Over the past decades, we've worked closely with support organizations to implement healthcare projects across the Maghreb and Sub-Sahara Africa. We're always interested in exploring collaborative opportunities with stakeholders in the development, business, academic, non-profit and medical communities. If you are similarly committed to better healthcare in Africa, please visit our Fabric of Africa site for further information.

Philips Cares

One way that Philips North America helps to improve peoples' lives is by supporting projects that create healthy, sustainable communities that contribute to the success and well-being of future generations. Through the Philips Cares community outreach program in the United States, each year thousands of employees participate in meaningful volunteer opportunities that suite their needs, schedules, and passions. With a charitable focus on education, energy efficiency, and health, Philips

sponsors nonprofit organizations such as the American Heart Association, American Red Cross, and March of Dimes. Through Philips Cares and our charitable partnerships, Philips and its employees are able to improve the quality of life in their communities today and for tomorrow.

Philanthropy by Design

Since 2005, Philips Design has been working on developing humanitarian propositions that address social and environmental issues affecting developing regions.

Through the Philanthropy by Design program, we leverage Philips Design's creative expertise and socio-cultural knowledge and work with non-profit organizations and public institutions to come up with creative solutions for some of the world's most challenging problems.

In 2012, the Philanthropy by Design Fight Malnutrition - Trunky & Monkey concept was awarded the red dot 2012, GIO Special Award for Excellence 2012 (Good Industrial Design – Dutch award), GOOD DESIGN 2012, and the Spark design awards 2012.

The Philanthropy by Design Chulha Stove was selected by the World Health Organization (WHO) as one of the most innovative health technologies in 2012 for low-resource settings.

Source: (Philips 2014d)

Microfinance

ABN AMRO has partnered with Qredits, an organization that extends small loans of up to 50,000 euros to Dutch business start-ups. In addition to providing funding, volunteers from the bank and other businesses act as personal coaches for these entrepreneurs, helping them achieve their ambitions. The coaching programs last at most one year. For more information, visit www.qredits.nl

Reading and arithmetic help

Children whose arithmetic, reading or language skills have fallen behind by the time they leave primary school are often unable to catch up during their secondary education. As a result, they often end up taking a secondary school program at a lower level than they could have managed if they had kept up when they were younger. The Reading Help and Arithmetic Help projects enable them to bridge the gap: after six weeks, they've made up the ground they have lost in their arithmetic.

Calvijn College

ABN AMRO volunteers have been coaching lower secondary school pupils from the Calvijn Met Junior College in Amsterdam since 2003. The project helps these students pick the right course for the next school year. It comprises one training session followed by six afternoons of actual coaching. The coaching project gives the children an opportunity to discover the world of banking. For their part, the volunteers learn about the day-to-day world of lower secondary school pupils.

Be a Hero with Your Money

'Be a Hero with Your Money' is an educational program about money, designed especially for primary school pupils. It has been developed in cooperation with the National Institute for Family Finance Information, Nibud, and offers volunteers from the bank the opportunity to give guest lessons to primary school pupils on how to handle money responsibly. By offering this program, ABN AMRO Foundation aims to help prevent children getting into debt at an early age.

Dutch Victim Support Fund

ABN AMRO Foundation has joined forced with the Dutch Victim Support Fund to help victims of traumatic events, such as sexual abuse, domestic and other violence and burglary. Aside from the emotional problems they may encounter, victims of crime and their families can suffer financially too. The bank's employees act as coaches to help these people get their financial affairs back on track. Our employee volunteers are trained to prepare them for this task. It generally takes at most five meetings to reach our goal of financial self-sufficiency.

Walking Fair

ABN AMRO Foundation has been organizing an annual sponsored walk since 2012: the Walking Fair. Under the motto 'Walking for charity' the bank's employees walked one or several rounds of a set route in various locations across the country. ABN AMRO Foundation donates 10 euros per round to the causes selected by the participants.

Christmas angel

More than 200,000 elderly people in the Netherlands are extremely lonely and very rarely have visitors. They tend to feel particularly isolated in the month of December, when most people celebrate the festive season with their friends and family. In an effort to bring some light into the lives of socially isolated old people, the National Fund for the Elderly, a charity for people with a physical disability, the Zonnebloem, and ABN AMRO Foundation have been organizing the Christmas Angel campaign since 2004: elderly people living alone are visited by a volunteer from ABN AMRO and given a Christmas tree. They decorate the tree and spend the afternoon together. During the 2013 festive season, 1,483 elderly people received an ABN AMRO Christmas tree.

Social Marketplace

ABN AMRO Foundation has partnered with KPMG and MOVISIE to set up the Social Marketplace, a market where supply and demand meet. Suppliers are local companies and institutions that offer help; the demand side consists of social organizations that need help – and the idea is to match the two. Matches are made in human resources, knowledge, and access to networks, material, facilities and expertise. With a few million euros worth of matches made in over fifty locations, the Social Marketplace is a highly successful event. The marketplace is supported nationwide by a steering group consisting of the founders, MVO Nederland (CSR Netherlands), the Association of Netherlands Municipalities (VNG) and the Chamber of Commerce. More information is available at: http://www.beursvloer.com/english

Community team activities

A social team activity is any activity undertaken by a team of employees for a social target group: from visiting a museum with elderly people to working in the garden of a care institution. A social team activity is not only an opportunity for the team to give back to the community; it also strengthens ties within the team.

Source: (ABN AMRO 2014b)