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CIRCULAR ECONOMY AND CORPORATE FINANCIAL PERFORMANCE

An Empirical Investigation

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Abstract

The present thesis studies the concept of Circular Economy (CE) and its association with Corporate Financial Performance (CFP). Interestingly, the challenging nature of environmental reporting, in general, significantly constrains the existence of a widely acceptable way of measuring Circular Economy Performance (CEP). In addition, the concept of CE is rather new, especially outside China, where governmental regulations for CE have been implemented. As a result, the academic literature seems to lack insights on the relationship between CEP and CFP. In the present study, a novel database is used, in order to measure the CEP of the sample studied. This database is retrieved from the publicly available report of the Dutch Association of Investors for Sustainable Development (VBDO) and it contains the evaluation of 52 Dutch listed companies, in terms of their CEP (Ioannou et al., 2016). In this way, the present thesis aims at filling in the existent research gap and providing interesting insights to both the academic and the corporate world.

Previous literature on CE mainly describes the characteristics of the concept and attempts to define the term. Several authors mention that CE originated from Industrial Ecology (Geng & Doberstein, 2008; Yuan et al., 2006; Preston, 2012), which aims at a material symbiosis (Andersen, 2007). Other authors highlight the "3R" principle, which refers to "Reduce, Reuse, and Recycle" of materials and energy (Geng et al., 2009; Liu & Bai, 2014; Su et al., 2013; Wu et al, 2014; Yuan et al., 2006). Despite the contribution of different authors, a widely accepted definition for CE does not exist. Furthermore, a clear division between the concept of CE and similar concepts, such as Corporate Social Responsibility (CSR) and Creating Shared Value (CSV), is also non-existent. Therefore, the present study attempts to also discuss these literature gaps.

The major findings of the present study in terms of theory are two. First, after reviewing the existent definitions of CE, the analysis seems to clearly indicate the pivotal role of three main points concerning CE: a) the regenerative and restorative capacity of resources, b) the resource efficiency, and c) the economic growth. Second, the analysis suggest that the concepts of CE and CSR, as well as CE and CSV, differ substantially from each other. As far as the empirical contribution of the present study is concerned, no statistically significant linear relationships seem to hold between CEP and CFP. On the other hand, a significant non-linear relationship seem to hold between CEP and CFP. Specifically, an inverted U-shape relationship seems to hold between CEP and CFP, a fact that may imply the existence of a CE optimal. Moreover, no significant relationship has been discovered concerning the different industry effects. As for the disaggregate analysis, a positive relationship between Strategy & Governance CEP score and CFP may seem to hold, while a negative relationship between Innovation CEP score and CFP may seem to exist. Additionally, the relationship between the indirect component of Strategy & Governance and CFP seems to be stronger, compared to the direct component of Innovation, something that contradicts the authors' expectations and may require additional research to be clarified. Finally, it is concluded that firm size may work as a moderator on the relationship between CEP and CFP, when CFP is measured by EPS.

Contents

1 Introduction

This chapter introduces the reader to the topic of the present research. First, for the sake of clarity, a division between the linear economic model and the circular economic model is demonstrated, and the transition from the first to the second is described. Second, the topic of the present document is introduced, namely the relationship between CEP and CFP. Third, the problem concerning the aforementioned topic is defined. Fourth, the academic literature gap is clearly stated. Fifth, the purpose of the present research is described. Sixth, the contribution to the existent literature is analyzed. Seventh, the principal findings of the present analysis are reported. Eighth, the structure of the present document is presented.

1.1 The transition from the linear economic model to the circular economic model

The corporate world has been accused of lurking behind the existence of social, environmental and economic problems and consequently, is considered to be prospering to the detriment of the broader community (Porter & Kramer, 2011). Ecosystem degradation and resource depletion are two representative examples of such problems. According to Porter and Kramer (2011), one of the main reasons why the business world and society have been pitted against each other is the fact that economists have been strong advocates of the idea that there is a trade-off between social progress and economic efficiency. To this end, business has chosen to mainly use the linear economic model. As linear is defined the economic model which uses natural resources as input, then proceeds through production processes to the creation of waste, and finally disposes waste into the nature as output (Mathews & Tan, 2011, p.437). The fact that "natural resources are mined and extracted, turned into products and finally discarded" (Preston, 2012, p.3) is the reason why scholars refer to this model as the "take-make-dispose" system. Other scholars refer to it as the mainstream linear (Mathews & Tan, 2011), the flow economy (Winkler, 2011), the open-ended economy (Pearce & Turner, 1990), or the "cowboy economy" (Boulding, 1966). This "throughput flow of matter and energy" (Hu et al., 2011, p.222), still dominates the corporate world, ignoring the natural limits of the planet (Mathews & Tan, 2011). According to Wu et al. (2014), the linear economic model is characterized by 3H's, namely high-volume-of resource inputs, high-volume-of GDP outputs, and high-volume-of pollutant emission. Furthermore, the linear economic model has its basis on "piece thinking", in a sense that raw materials are transformed into products (pieces) which are then exposed as waste when no longer needed, rather than "systems thinking" (Ioannou et al., 2016). However, economic activities are joint activities, not single production activities, as being assumed by the linear model (Kurz, 2006). According to MacArthur and McKinsey (2015), stakeholders should step out of their silos and start cooperating with each other. In other words, operating in isolation may deprive stakeholders from important opportunities which exist within their surroundings.

Admittedly, the biosphere in which the business world is operating is reaching its limits, a fact which has led the mankind to move towards a view of economic-ecological interdependence (Schwartz & Steininger, 1997). According to Mathews and Tan (2011), it is both economically

and ecologically inefficient for business to operate in the traditional linear manner. Boulding (1966) conceptualizes planet Earth as a spaceship, where there is no possibility to acquire resources, nor to sink unwanted residuals. Consequently, if mankind's aim is survival, a regenerative ecological cycle should be introduced. As a result, the concept of industrial ecology or eco-industrial development is capable of providing a solution to this issue. Industrial ecology has its basis on the notion that a healthy environment and a healthy economy can coexist (Geng & Doberstein, 2008). Porter and Kramer (2011) provide support to this claim by standing by the belief that there is a positive relationship between the health of the communities in which a company operates and its competitiveness. Inspired by the values of industrial ecology and the contribution of Boulding (1966), Pearce and Turner (1990) came up with the term of CE in their attempt to highlight the necessity to stop treating the environment as a waste sink. To date, there is not a widely acceptable definition of the CE (MacArthur & McKinsey, 2015); however, several authors and organizations have attempted to define this term (see Table 1). For the purpose of the present economic analysis, a CE is defined as "an industrial system that is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times" ("The Concept," n.d.). The main goal of such a system is to reconcile industrial development with environmental protection, by adopting integrated management approaches (Zhu et al., 2010). In that sense, the definition of CE is based on three principles: preserve and enhance natural capital, optimize resource yields, and foster system effectiveness (MacArthur & McKinsey, 2015). In fact, Preston (2012) strongly supports that CE has the potential to transform the way that resources function within the economy.

Moreover, the term of CE has become widely accepted by popular business press, as well. In the beginning of 2014, the business magazine Entrepreneur published a list with the 100 potential trends of 2014, among which there was also CE (Clifford, 2014). In January 2015, the first CE Awards, namely "The Circulars", took place in Davos, Switzerland. Fortune was and still is the media partner of this event (Dumaine, 2014). Another important thing to mention is the existence of different organizations which have as a main purpose the expansion of the idea of CE. The most famous of all, is the Ellen MacArthur Foundation which was launched in 2010 and since then, has partnered with the most circular companies around the world, such as Google, Apple, H&M, Cisco, etc. Apparently, both the business press and the corporate world are aware of CE and its advantages. However, the academic literature on CE is still limited.

1.2 Circular Economy and Corporate Financial Performance

Several authors have concluded, both theoretically and empirically, that CSR pays off (see, for example, Margolis et al., 2009). Porter and Kramer (2011) support that the corporate world has underestimated the economic value, which can be achieved by creating societal value. In fact, Ambec and Lanoie (2008) claim that better environmental performance may enhance financial performance by either increasing revenues, or reducing the costs of a company. On the one hand, increased revenues could be the outcome of better access to certain markets, differentiation of the

available products, or the sale of pollution control technology. On the other hand, the decreased costs could be achieved in terms of risk management and relations with external stakeholders, cost of material, energy and services, cost of capital, or cost of labor (Ambec & Lanoie, 2008). Likewise, someone would expect that CE may result in better financial performance.

According to Andersen (2007), industrial ecology implies that a CE will be beneficial to both the society and the economy. As a matter of fact, over the past few years, the concept of CE has been proved to serve economic purposes, rather than exclusively dealing with environmental challenges (Yuan et al., 2006). However, in some cases, profitability could require the development of new business models, and/or significant investments (Wijkman & Skanberg, 2015). In their attempt to measure the financial returns of Environment-oriented Cost Management, Hicks and Dietmar (2007) conclude that some of their measures require a substantial investment and payback period. Nevertheless, in less than one year of implementation, more than half of their measures experienced a total return on their investment. Moreover, a representative example of CE is Dongming Bright Cattle Co. Ltd, a Chinese leather production company, which managed to save 3.5 million RMB of economic costs annually, while simultaneously experiencing an impressive environmental performance (Hu et al., 2011).

Finally, several organizations, such as the Netherlands Organization for Applied Scientific Research (TNO), the Ellen MacArthur Foundation, and McKinsey & Company, have conducted significant empirical research with the purpose of estimating the financial effects related to the implementation of CE. The report created by the Ellen MacArthur Foundation and the McKinsey Center for Business and Environment concludes that, if CE was implemented within Europe, a 3% increase in resource productivity could be achieved annually by 2030 (MacArthur & McKinsey, 2015). This is translated into an increase of GDP by 7 percentage points after implementing CE, relative to not implementing CE. Additionally, TNO conducted a study, according to which the current level of recycling, repairing, and reusing of a wide variety of products within the Netherlands provides a solid background, in order for the country to become a good example of CE (Bastein et al., 2013). Nevertheless, as far as the academic literature is concerned, empirical research on the relationship between CE and CFP is extremely scarce.

1.3 Problem Statement

As can be easily understood from the academic contribution of Zhu et al. (2010), measuring CE could be described as a challenging task. In China, the intervention of governmental institutions concerning CE, has clearly facilitated both the implementation of circular business practices and the measurement of their effectiveness. However, this is not the case with several other countries around the world. In some cases, the extent of employing circular business practices on behalf of the corporate world is not so easy to observe, let alone the effectiveness of such practices when existent. In Europe, for example, the term of CE became more well-known pretty recently (MacArthur & McKinsey, 2015), a fact that may significantly restrict the ease of the observation

of circular business practices. Since CE became more popular after 2010 within Europe, several companies, such as Unilever, Chevron, DSM, etc., already claim to implement the concept of CE. However, verifying these claims and evaluating the level of CE implementation may turn out to be a great challenge, given the nature of environmental reporting (Montabon et al, 2007).

To the best of our knowledge, a valid and widely acceptable way of measuring CE does not exist. As a result, this fact, along with the limited real examples of circular business practices and the scarce academic literature, may urge the corporate world to be more skeptical concerning the effectiveness and the efficiency that CE could provide to business. As a result, an interesting research question could involve the effect of CE on CFP, provided that the way of measuring the effectiveness of circular business practices is reliable.

1.4 Research gap

As already mentioned, the business press has touched upon the concept of CE and the business world is aware of the term. However, the academic literature still lacks empirical insights. Some attempts of measuring CE and its effect on firm performance have taken place mainly in the case of China, thanks to the existence of governmental policies. However, the relationship between CE and CFP has not been adequately addressed outside China. Actually, empirical evidence for the relationship between CE and firm performance is scarce, even in the case of China. To this end, an interesting research topic could involve the empirical investigation of the relationship between CE and CFP.

1.5 Purpose of the research

VBDO attempted to objectively evaluate the CEP of 52 Dutch listed companies, based on an innovative questionnaire. VBDO's report provides the CEP scores of these companies (Ioannou et al., 2016). By using and enriching this database with additional, appropriate variables, the purpose of the present document could be specified as follows:

An empirical investigation of the relationship between the Circular Economy Performance and Corporate Financial Performance.

1.6 Contribution to the literature

The contribution of the present research is twofold. First, the present master thesis adds a lot to the understanding of the concept of CE, thanks to its extended theoretical section. The concept is defined and differentiated from the similar concepts of CSR and CSV; to the best of our knowledge, no previous research has contributed to the academic literature in a similar way. Second, the present study sheds light on the effect of CEP on CFP, by empirically examining this relationship. To the best of our knowledge, such a study has not been conducted in the past, and as a result, a very fresh perspective is examined.

Interesting to mention is the fact that the findings of the present research may be of great interest to both the academic and the corporate world. The value of our findings to the academic literature mainly concern the innovative nature of the topic itself. As for the corporate world, the findings of the present study may facilitate the decision of employing CE initiatives on behalf of the business.

1.7 Principal Findings

The main conclusions of the present research concerning theory are the following two. First, after reviewing the existent literature on CE, the analysis seems to point out the importance of the inclusion of three main points for the definition of CE: a) the regenerative and restorative capacity of resources, b) the resource efficiency, and c) the economic growth. Second, the analysis reports that the concepts of CE and CSR, as well as CE and CSV, differ substantially from each other. Concerning the empirical contribution of the present study, no statistically significant linear relationships seem to exist between CEP and CFP. As a matter of fact, an inverted U-shape relationship seems to hold between CEP and CFP, a fact that may imply the existence of a CE optimal. Moreover, the industry effects does not seem to have any significant association with CFP, when taking into account CEP. Furthermore, the disaggregate analysis suggests that a positive relationship between Strategy & Governance CEP score and CFP may seem to hold, while a negative relationship between Innovation CEP score and CFP may seem to exist. In addition, the relationship between the indirect component of Strategy & Governance and CFP seems to be stronger, compared to the direct component of Innovation, opposing the authors' expectations. Finally, firm size may work as a moderator on the relationship between CEP and CFP, when CFP is measured by EPS.

1.8 Structure of the paper

The next chapter provides an overview of the related literature on CE and CFP and the hypotheses are formulated. Chapter 3 described the data used in the analysis and explains the methods employed, in order for the purposes of the present study to be achieved. Chapter 4 presents and analyzes the output of the analysis conducted. Chapter 5 concludes by highlighting the most important findings of the present study, describing the potential limitations, and suggesting several examples for further research.

2 Related Literature

This chapter describes the concept of CE and its relationship with CFP. First, CE is described and analyzed. Second, several ways of measuring CFP are presented. Third, the relationship between CE and CFP is demonstrated. Fourth, the hypotheses, which are examined in the next chapters, are formulated.

2.1 Circular Economy

In this first section of the related literature, the focus is CE. First, the concept of CE is analyzed in details and a review of its definitions is presented. Second, CE is compared with CSR. Third, CE is analyzed relative to CSV. Fourth, several potential ways of measuring CE are described.

2.1.1 The concept of Circular Economy

CE has its origins in Industrial Ecology (Andersen, 2007; Geng & Doberstein, 2008; Yuan et al., 2006; Preston, 2012). Industrial Ecology aims at the cooperation between different companies and production processes, in order to achieve a material symbiosis and as a consequence, benefit both the society and the economy (Andersen, 2007). To this end, the concept of CE exists for more than 30 years (Vaughn, 2014). Nevertheless, CE started attracting some attention only after 1990, when the term of CE was introduced by Pearce and Turner (1990). In 1996, the so called "Closed Substance Cycle and Waste Management Act" was introduced in Germany and in 2000, the "Basic Law for Establishing a Sound Material-cycle Society" was enacted in Japan (Mathews & Tan, 2011). The main focus of the German act was on the recycling in closed loops and the reduction of solid waste, so as to minimize the use of land for the purpose of waste disposal (Geng et al, 2013). Japan could be considered to be one step further, mainly because of the lack of landfill spaces. The regulation of 2000 involved measures concerning resource depletion, solid waste management, and land scarcity (Hashimoto et al, 2010), while the country has already created the so called eco-towns, which target at specific levels of recycling and reduced landfill requirements (Van Berkel et al., 2009). In addition, more attention was paid to CE by China in 2002, when the governmental authorities accepted the concept of CE as a strategy, which would result in economic growth by preventing resource depletion (Yuan et al., 2006). In this way, the Chinese corporate world became aware of the term CE and was obliged to comply with the corresponding legislation. In 2009, the Chinese government enacted the "Law for the Promotion of Circular Economy", which, according to Mathews and Tan (2011), is the first clear national movement towards, not only the environmental, but also the social and economic development of a country, owing to CE. The Western cultures started getting more familiar with the term and employing CE initiatives only after 2010 (MacArthur & McKinsey, 2015).

Figure 1: Material metabolism mode of byproducts.

Source: Based on Geng and Doberstein (2008); Li et al. (2010).

Table 1: Definitions of Circular Economy.

Source	Definition
Bastein et al., 2013 (p.4)	A circular economy is an economic and industrial system based on the reuse of products and raw materials, and the restorative capacity of natural resources. It attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system.
Geng and Doberstein, 2008 (p.232)	…in China it (the term 'circular economy') is understood to mean the realization of a closed loop of materials flow in the whole economic system.
"The Concept," n.d.	A circular economy is an industrial system that is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times.
Liu and Bai, 2014 (p.146)	A circular economy focuses on "reducing", "reusing" and "recycling" (3Rs) materials and energy; this has a close relationship with environmental awareness and behavior.
Ma et al., 2014 (p.506)	A circular economy is a mode of economic development that aims to protect the environment and prevent pollution, thereby facilitating sustainable economic development.
MacArthur and McKinsey, 2015 (p.23)	...the circular economy is defined as an economy that provides multiple value-creation mechanisms which are decoupled from the consumption of finite resources.
Preston, 2012 (p.1)	Circular economy is an approach that would transform the function of resources in the economy. Waste from factories would become a valuable input to another process – and products could be repaired, reused or upgraded instead of thrown away.
Su et al., 2013 (p. 215)	Circular economy is a sustainable development strategy proposed by the central government of China, aiming to improve the efficiency of materials and energy use.
Wu et al., 2014 (p.164)	CE aims to achieve optimum production by minimizing natural resource utilization and pollution emission simultaneously, and minimum wastage by reusing the wastes from production and minimum pollution by recycling and restoring the technically useless wastes.
Yang and Feng, 2008 (p.814)	Circular economy is an abbreviation of "Closed Materials Cycle Economy or Resources Circulated Economy", aiming at the efficient use of resources, taking reducing, reusing and recycling as principles and "closed materials cycles and recycled use of energy" as features.
Yuan et al., 2006 (p.5)	…the core of CE is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases.
Zhou and Liu, 2005, in Hu et al., 2011 (p.222)	Circular economy is an economic growth and development system to integrate the economy resource and the environment factors based on the material metabolism mode, which has the mechanism of efficient use and waste stream feedback.

Several authors have attempted to define CE. Table 1 reviews the existing definitions of CE. Even though there is not a widely accepted definition, it can be easily observed that three main points are highlighted by different authors: a) the regenerative and restorative capacity of resources, b) the resource efficiency, and c) the economic growth. When referring to the regenerative and restorative capacity of resources, the reutilization of the resources, after the end of the life cycle of a product, is implied. In other words, several authors support that byproducts may be generated (Geng & Doberstein, 2008; Li et al., 2010; Zhu et al., 2010), as depicted in Figure 1. In fact, according to this concept, the waste streams of a company may be utilized as input materials for

another company, extending the life of aforementioned resources. Another point to consider is the fact that, when referring to CE, several authors pinpoint the role of the "3R" principle, which stands for "Reduce, Reuse, and Recycle" of materials and energy (Geng et al., 2009; Liu & Bai, 2014; Su et al., 2013; Wu et al, 2014; Yuan et al., 2006). Hu et al. (2011) point out the importance of the inclusion of an additional "R", namely "Recover", according to which either waste is used as products, or raw materials are processed technically and their initial properties are transformed. By employing the "4R" principle, resource efficiency may be achieved, as highlighted by several authors. Finally, concerning the last highlighted point of the economic returns, CE is no more considered to be exclusively an environmental strategy, but an economic strategy, from which economic returns may be achieved (Yuan et al., 2006).

The concept of CE can be implemented in three levels, the micro, the meso and the macro-level, for which Geng and Doberstein (2008) used the concept of the "three circles". The micro-level concerns the smallest of the three circles and involves the internal corporate initiatives, which are implemented by individual companies. At this level, the double target of the enterprise is better economic and environmental performance (Zhu et al., 2011). Some examples of such initiatives include waste minimization, cleaner production, eco-design of manufacturing plants, and environmental management systems (Geng & Doberstein, 2008; Zhu et al., 2011). The meso-level engages those activities happening at the inter-firm level, aiming at facilitating the creation and promotion of byproducts (Yuan et al., 2006). This is the case of industrial zones (Zhu et al., 2011), also known as industrial symbiosis (Mathews & Tan, 2011), where companies are cooperating at a cluster or supply chain level (e.g. eco-industrial parks). The outcome of such a cooperation may be the joint resource or energy efficiency (Mathews & Tan, 2011). Finally, the biggest circle represents the macro-level, whose initiatives are being implemented at a social level (Geng & Doberstein, 2008) and the corresponding cooperative relationships may be more complex and chaotic (Su et al., 2013). This level may involve a whole city, a municipal area, or a state (Su et al., 2013), and the only representative example is the case of China (Mathews & Tan, 2011). Su et al. (2013) categorized the CE practices at each of those levels in four areas, namely the production, consumption, waste management and other support areas, in the case of China. The main results of their analysis can be found in Table 2. The focus of the present study is the micro-level, since the internal initiatives of the companies of the sample are mainly examined.

Table 2: Structure of the CE practices in China, from Su et al. (2013).

	Micro-level	**Meso-level**	**Macro-level**
Production area	Cleaner production Eco-design	Eco-industrial park Eco-agricultural system	Regional eco-industrial network
Consumption area	Green purchase and consumption	Environmentally friendly park	Renting service
Waste management area	Product recycle system	Waste trade market Venous industrial park	Urban symbiosis
Other support	Policies and laws; Information platform; Capacity-building; NGOs		

The Circular Economy, according to the Ellen MacArthur Foundation

The Ellen MacArthur Foundation operates with the purpose of "accelerating the transition to a regenerative, circular economy"[1]. The organization's perception of CE is illustrated in Figure 2. According to the organization, CE attempts to "rebuild capital, whether this is financial, manufactured, human, social or natural", something that facilitates the flow of materials and services. [2] The organization supports that the CE rests on the following three principles:

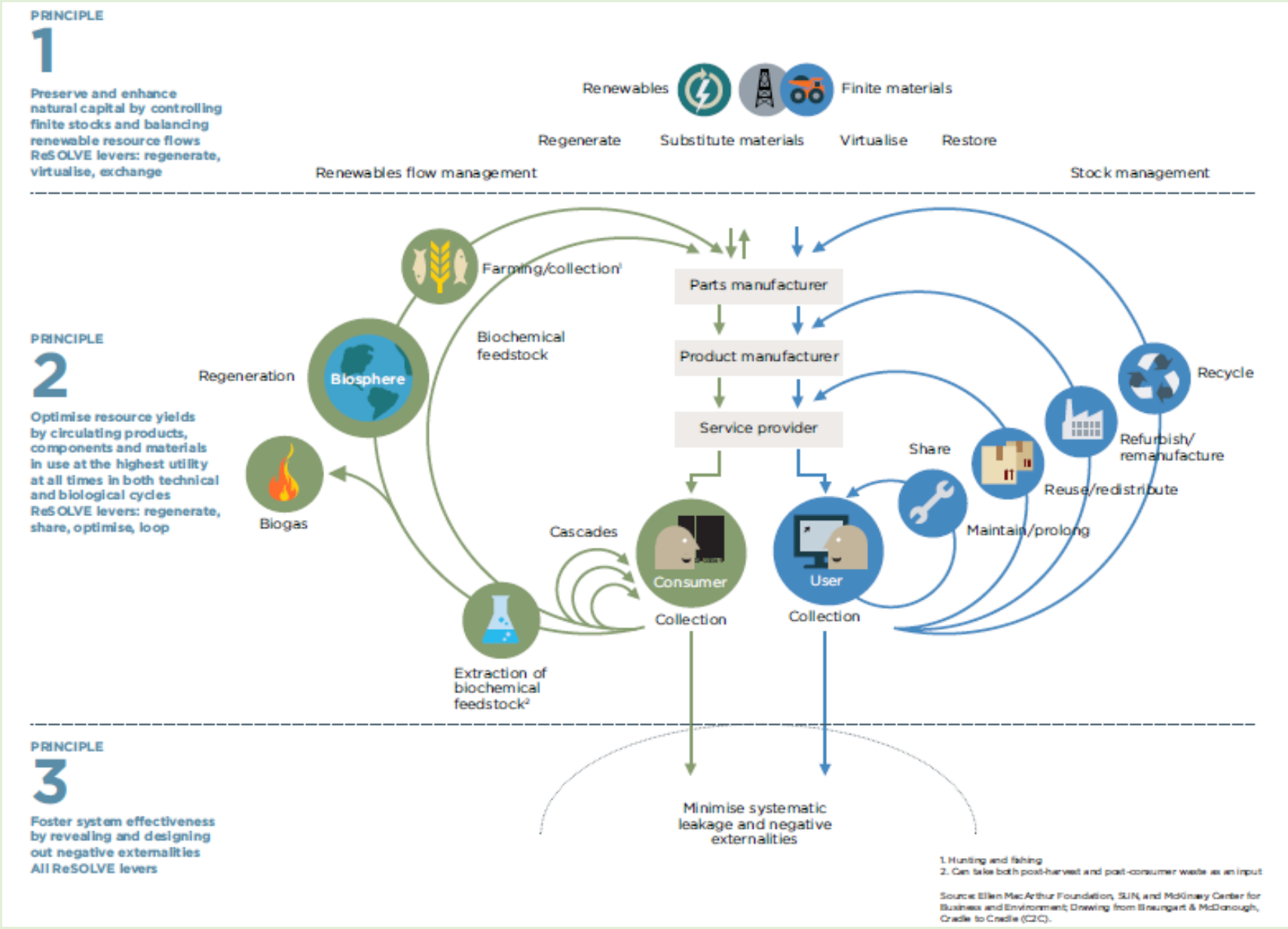
1. Preserve and enhance the natural capital by controlling finite stocks and balancing renewable resource flows: Resources are selected wisely whenever needed; renewable or better performing resources are always prioritized.
2. Optimize resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles: Products, components and materials are circulated as many times as possible, in order to maximize their yield.
3. Foster system effectiveness by revealing and designing out negative externalities: Main targets are the reduction of the negative effects on the various human needs, as well as the management of the negative externalities.

Some of the main characteristics of CE, according to the Ellen MacArthur Foundation, which are demonstrated in Figure 2 are the following:

- Design out waste: Biological materials can be easily composted, while technical materials may be designed in such a way that their reuse with minimal energy and high quality retention are promoted. In this way, waste is substantially minimized.
- Build resilience through diversity: Modularity, versatility, and adaptivity are the three indispensable features of resilience.
- Energy from renewable sources: Systems should target at running on renewable energy.
- Think in systems: The way that different parts may affect one another as part of a whole, as well as how the whole may affect the different parts, should be considered.
- Think in cascades: In the case of biological materials, value creation can be optimized by cascading materials through other applications.

[1] Ellen MacArthur Foundation webpage: https://www.ellenmacarthurfoundation.org/about
[2] Ellen MacArthur Foundation webpage: https://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram

Figure 2: Outline of a Circular Economy.



Source: MacArthur and McKinsey (2015).

2.1.2 Circular Economy and Corporate Social Responsibility

As already mentioned, there is not a widely accepted scientific definition. Ma et al. (2014, p.506) state that "circular economy is a mode of economic development that aims to protect the environment and prevent pollution, thereby facilitating sustainable economic development". In that sense, the term of CE could be confused with that of CSR. According to Dahlsrud (2008), the most commonly used definition for CSR is the following: "a concept whereby companies integrate social and environmental concerns in their business operations and in their interactions with their stakeholders in a voluntary basis" (European Commission, 2001, p.6). At first glance, when elaborating on these definitions, some similarities could be identified, such as the environmental concern of the business. However, a closer look of the concepts of CE and CSR could highlight that their differences far outweigh their similarities. In the following section, differences are identified in terms of five areas: value, context, motivation to employ a strategy, budget and profits.

First, CSR strategies target at "doing good" to the society (Porter & Kramer, 2011), while CE targets at both economic and environmental benefits (Yuan et al., 2006). Dahlsrud (2008) reviewed 37 definitions of CSR. By analyzing these definitions, the author was able to identify five dimensions that may be used to define CSR, namely environmental, social, economic, stakeholder, and voluntariness dimensions. According to the author, a definition refers to the social dimension if it refers to the relationship between business and society. In fact, the social dimension is present in 31 of the 37 definitions of CSR. On the other hand, Dahlsrud's findings emphasize that when defining CSR, the use of the environmental dimension is significantly lower, compared to the four other dimensions. In contrast, when looking at the definitions of CE in Table 1, both the economic and environmental dimensions can be identified in most cases. Consequently, the value of CE is significantly differentiated from that of CSR.

Second, CE and CSR differ in terms of their relationship with the business model of a company. As Porter and Kramer (2011) support, CSR is closely related with citizenship, philanthropy, and sustainability issues, while the context of their CSR activities is rarely connected to the corporate value creation. In contrast, employing CE requires the shift of the core business strategy towards a closed-loop thinking (Preston, 2012). In that sense, CE is part of the business model and as a result contributes to the firm's value creation.

Third, there are different reasons that motivate a company to employ a CSR, compared to a CE strategy. The reasons why a company engages in CSR are either discretionary, or the outcome of external pressure (Porter & Kramer, 2011). In other words, if the CSR initiatives employed by a company did not happen thanks to a manager's will, then they were probably employed in an attempt to improve the company's image and reputation. Unlike CSR initiatives, CE initiatives aim at a viable and competitive business plan, taking into consideration resource depletion (Su et al., 2013). As a result, CSR initiatives may be employed in response to external shareholder pressure, while CE initiatives are mainly employed in response to the scarcity of natural resources,

or as a strategy for resource efficiency which may bring economic returns. The scarcity of natural resources may be considered to be a form of external pressure, however it is not external shareholder pressure, like in the case of CSR.

Fourth, some differences could also be observed in terms of budget determination and its restrictions. Concerning CSR, the budget is limited in most cases, and the implementation period is short. For example, the company's employees volunteer in a social activity. Additionally, the budget used does not exceed the determined one, because otherwise, the company could be accused of irresponsible use of shareholders' capital (Porter & Kramer, 2011). However, this is not the case with CE. The implementation period of CE initiatives is longer, while the budget does not seem to be so restricted. This could be the outcome of the promising investments made, which require some time before the payback period. Resource efficiency and capital saving may be achieved (Ma et al., 2014; Yuan et al. 2006).

Table 3: Comparison of CSR and CE, based on Porter and Kramer (2011).

CSR	CE
Value	
Doing good (social benefits, not always environmental dimension included).	Being viable and competitive, while protecting the environment (economic and environmental benefits).
Context	
Citizenship, philanthropy, sustainability. Rarely is there any connection to the business.	Joint company and environmental value creation. CE is part of the business model.
Motivation to employ a strategy	
Discretionary or in response to external pressure. Usually, CSR is seen as a necessary expense to improve reputation.	In response to resource depletion, in order to be viable and competitive.
Budget	
Limited and mainly short term. Use of higher than the expected budget would be considered as irresponsible use of the shareholders' money.	Mainly long term plans which do not always raise the corporate costs, but could enhance resource efficiency and consequently save money.
Profits	
Separate from profit maximization.	Integral to profit maximization.

Fifth, profit maximization in the case of CE is significantly contrasted with that of CSR. As already mentioned, CSR aims at doing social good and improving or enhancing the company's reputation. In addition, there is no connection to the business model of the company and the initiatives are rather short term. As a consequence, the implementation of CSR initiatives are usually seen as an expense that has to be made (Porter & Kramer, 2011). To put it differently, CSR initiatives may be implemented, in order to make the company appear attractive to its customers and as a result,

maintain or improve the company's profits. On the other hand, CE seeks to use the company's resources efficiently (Yang & Feng, 2008) and optimize its production processes (Wu et al., 2014). As a result, economic returns are directly targeted and profit maximization is at the heart of CE.

All in all, CSR and CE may seem to have some similarities at first glance; however, a deeper analysis has the potential to emphasize their significant differences. They mainly concern the value, the concept, the motivation, the budget and the profits of the implementation of each model. Table 3 displays an overview of those differences.

2.1.3 Circular Economy and Creating Shared Value

The term of CSV was initially introduced by Porter and Kramer, in their attempt to prove that there is no trade-off between economic efficiency and social progress. Instead, they support that profitable opportunities may arise when business contribute to the addressing of social issues (Porter & Kramer, 2011). In fact, they define shared value as "policies and operating practices that enhance the competitiveness of a company, while simultaneously advancing the economic and social conditions in the communities in which it operates" (Porter & Kramer, 2011, p. 6). Consequently, the first obvious similarity with CE that can be easily observed is that both models engage not only the social, but also the economic dimension. In other words, when a company employs a CE or a CSV strategy, it aims at obtaining both economic and social benefits. Accordingly, both concepts seem to employ long term strategies, since profit maximization is at the heart of the CE and CSV strategies. However, even though more similarities may be identified between CE and CSV, compared to the case of CE and CSR, there are two important elements identified which distinct CE from CSV.

First, the main difference between CE and CSV concerns the content of the strategies themselves. A CSV strategy attempts to face a social issue while being profitable and taking into account the corresponding costs (Porter & Kramer, 2011). On the other hand, CE aims at resolving "the conflict between industrial development and environmental protection" (Zhu et al., 2010). To put it differently, a CE strategy focuses on resolving specifically the environmental risks; it is not concerned with other social issues, such as employees' safety. As a result, the scope of CSV is broader than that of CE.

Second, CSV opportunities can be achieved in three ways: "by reconceiving products and markets, by redefining productivity in the value chain, and by enabling local cluster development" (Porter & Kramer, 2011, p.5). According to the authors, resource use has the potential to affect the value chain transformation. In that sense, CE could be considered to be part of the solution of those societal problems that are created due to inefficient resource use. Consequently, CE could be seen as part of the broader category of CSV.

2.1.4 Measuring Circular Economy Performance

In order for the research objective of the present document to be achieved, a sound way of measuring CEP is of paramount importance. This is not an easy task though, given the fact that the complexity and the special characteristics of the relationship between natural environment and socioeconomic systems may be neglected (Huang et al., 2006). As Montabon et al. (2007) support, there are no standards for environmental reporting, as in the case of financial reporting, something that substantially limits the research of similar topics. In industrial ecology, several authors have used methods, such as lifecycle assessment and material flow analysis; however, generating a model for such systems may turn out to be extremely hard (Yuan et al., 2006). As a result, no widely accepted concept has been identified for measuring CEP. Nevertheless, this is not the case for contextually broader and more popular concepts, such as Corporate Social Performance (CSP), which is often used as another way of referring to CSR (Barnett, 2007; Carroll, 1979; Wood, 1991). When referring to CSP, Peloza (2009) takes into account both social and environmental initiatives, because business value may be driven by both. Consequently, when assessing environmental initiatives, like in the case of CE, the CSP measures may be applied.

CSP has attracted substantial attention and consequently, a few widely accepted measurement strategies exist. The meta-analysis of Margolis et al. (2009) identified two ways of defining CSP; either as a multi-dimensional construct concerning the company's responsibilities and principles, or as a stakeholder-centered approach. Their analysis takes into account both definitions and in this way, they manage to divide CSP measures in 9 categories: a) corporate policies, b) disclosure, c) environmental performance (objective or self-reported), d) philanthropic donations, e) revealed misdeeds, f) self-reported social performance, g) observers' perceptions, h) third-party audits, and i) screened mutual funds (Margolis et al., 2009). In addition, Post (1991) attempted to divide CSP measures into four broad categories: a) disclosures, b) reputation ratings, c) audits, processes and observable outcomes, and d) managerial values and principles. Impressively, we can observe that after 18 years of academic research, the identified CSP measures do not differ substantially. Furthermore, Peloza (2009) examined 159 studies, which focus on the relationship between CSP and financial performance. The author states that, in order to capture CSP the majority of the studies use one of the following ways: pollution control or output; environmental, health, and safety investments; third party audits or awards; the KLD index; and Fortune magazine rankings. Finally, an interesting case is the study of Montabon et al. (2007) who conducted a content analysis, meaning that the authors used the companies' corporate reports to gather the data they needed, in order to evaluate the relationship between environmental management practices and firm performance. Their sample consists of 45 companies, a number of observation which is rather small, but as they state, it is common in content analyses. This method is quite similar with the method used in the present study for which CEP is measured by VBDO and verified by Accenture. This is because VBDO conducted a content analysis, in order to measure CEP of the 52 Dutch listed companies of the present analysis, based on the available information on their corporate websites. However, in the case of the VBDO evaluation, a questionnaire was created and utilized,

in order for objective results to be achieved, as opposed to Montabon et al. (2007), who report the lack of a standardized way of measuring environmental performance as one of their limitations. Since the CEP measurement of VBDO is used without any changes, the category of the third party audit, which is existent in all tree aforementioned meta-analyses, may be the representative way of measurement of CEP in the present study.

2.2 Measuring Corporate Financial Performance

This section presents and describes the potential ways of measuring CFP. Depending on the purpose of the corresponding research, several ways of measuring CFP exist. According to Peloza (2009), there are several reasons why measuring the returns of a CSP strategy in financial terms is important. The author's main point is that, in order for a CSP strategy to be accepted and funded, the responsible manager should illustrate the financial returns that can be captured by the company due to this strategy.

After reviewing 159 studies on the business case of CSP, Peloza (2009) made a clear division among end state outcome metrics, intermediate metrics, and mediate metrics. The author states that most of the examined studies use the end state outcome metrics, which are further divided into three broad categories and are commonly used by other authors as well (Allouche & Laroche, 2005; Margolis et al., 2009; Orlitzky et al., 2003). First, there are the so called market-based measures, such as price per share, which focus on the shareholders' returns and satisfaction (Cochran & Wood, 1984). Second, the accounting-based measures which focus on the firm level efficiency (Cochran & Wood, 1984). Some of the most commonly used measures of this category include the company's returns on investments (ROI), return on assets (ROA), return on equity (ROE), and earnings per share (EPS). Third, the perceptual measures are based on surveys, which usually require the respondents to subjectively answer some questions concerning the company's success and efficiency. Moreover, the intermediate metrics are further subdivided by Peloza (2009) into three additional categories. First, the cost-based approaches evaluate to what extent the initiatives employed affect the company's cost structure. Second, the revenue-based measures are trying to capture the potential increase in the company's revenues. Third, the integrative approaches entail either one metric which combines cost and revenue estimates, or a long-term evaluation of the returns of the initiative. Finally, Peloza (2009) distinguishes the category of mediate metrics, which involves a mediation process that denotes a causal effect between CSP and financial performance. Again, the author distinguishes four categories of the mediating metrics. First, there are those mediate metrics which focus on the calculation of the cost savings, as a result of the implementation of an initiative. Second, there are the mediating metrics concerning employees. In this case, the employer of a company may seem attractive to potential employees, resulting in lower hiring costs, or the high employee satisfaction may lead to advantages for the company (Turban & Greening, 1997). Third, the relationship among employees may positively affect the performance of the company. Fourth, the perceptions of customers and regulators about the company have the potential to affect the company's performance.

The present study employs ROA, ROE, and EPS, in order to measure CFP. Consequently, according to the division of Peloza (2009), the measures used in the present study belong to the category of the accounting-based measures of the broader category of the end state outcome metrics.

2.3 Circular Economy and Corporate Financial Performance

This section explores the potential relationship between CE and CFP. The economic potential of CE for the corporate world is extremely promising (Liu & Bai, 2014). To date, research has mainly focused on the societal benefits of CE, ignoring its promising economic returns (MacArthur & McKinsey, 2015). Ambec and Lanoie (2008) claim that better environmental performance may contribute to better economic performance through either reduced costs or increased revenues. They suggest that reduced costs may be experienced also through materials, energy and services savings. A report published recently by the Ellen MacArthur Foundation and the McKinsey Center for Business and Environment (MacArthur & McKinsey, 2015), concludes that CE could reduce the annual primary resource costs of Europe's economies by 32% by 2030, relative to the current total spent. This fact can be translated into €0.6 trillion of resource benefits per year, by 2030, or annual gains of resource productivity by 3%. Several authors have managed to evaluate the effects of CE implementation at the macro-level, in the case of China (Hao et al., 2009; Li & Zhang, 2005; Peng et al., 2005; Qian et al., 2008). However, this is not the case with firm level analyses.

As far as the academic literature is concerned, provided that the concept of CSR is quite famous, there are several meta-analyses which examine the relationship between CSR and CFP at a firm level basis (Orlitzky et al., 2003; Allouche & Laroche, 2005; Margolis et al., 2009). All three studies agree that there is a positive and significant relationship between CSP and CFP; however, the effect is not substantially big. Nevertheless, the empirical evidence on the relationship between CE and CFP is scarce, but several authors are examining the relationship between environmental and financial performance, which is more relevant with the relationship between CE and CFP, compared to the relationship between CSR and CFP. Florida (1996) examines the relationship between firm performance and environmental management practices, through the analysis of questionnaires. Environmental management practices are part of the micro-level of the CE implementation practices (Geng & Doberstein, 2008; Zhu et al., 2011). The author concludes that environmental performance may be improved through better manufacturing processes and higher productivity efforts, emphasizing the positive relationship between better economic and better environmental performance. In addition, Ambec and Lanoie (2008) suggest that there is a positive environmental-financial relationship, thanks to market gains or cost reductions. Klassen and Whybark (1999), also by using questionnaires, investigate the correlation between manufacturing technologies and operational performance measures with the financial performance of the unit. The authors discovered that proactive environmental management practices resulted in higher manufacturing performance, while the opposite effect held when reactive environmental management practices were taking place. Furthermore, Montabon et al. (2007) also examine the

relationship between environmental management practices and firm performance. They identified a positive and significant correlation between environmental management practices and measures of performance, as well. Finally, Hu et al. (2011) mainly focus on the case of leather industry in China to prove that significant cost savings can be experienced through the application of CE. By using the example of Dongming Bright Cattle Co. Ltd, a Chinese company which saves by implementing the CE model, they concluded that reduced costs and lower pollution levels may be combined.

At the meso-level of implementation of CE practices, Park et al. (2010) focus on three case studies in the industries of information technology and electronics in China. They indicate that sustainable supply chain management has the potential to offer competitive advantages to the companies engaged in such a supply chain. Winkler (2011) refers to this approach as sustainable supply chain networks (SSCN), in an attempt to establish a closed-loop production system in a supply chain. The author concludes that through SSCN, the combined goal of economic and environmental performance is encouraged. Zhu et al. (2011) refer to such a supply chain as environmental supply chain cooperation (ESCC) and investigate their contribution to the better performance of CE practices. Overall, they conclude that when targeting at the dual goal of environmental and economic performance, ESCC initiatives associated with customer and supplier cooperation are significant, or even essential in some cases. In fact, the authors highlight the importance of ESCC practices in order for the combined environmental and economic goals to be achieved. Additionally, at this meso-level, Yang and Feng (2008) study the case of Nanning Sugar Co., Ltd., a Chinese company that produces sugar, and its transition to a circular corporation. Their purpose is to provide the analysis of this transition, in case it may be handy for similar companies.

2.4 Formulating the hypotheses

After having studied the related literature, this section aims at formulating the hypotheses which will be examined and analyzed in the next chapters. The main purpose of the present study is to investigate the relationship between CEP and CFP. As mentioned in the literature section, authors generally find a positive but small effect of CSP on CFP (Orlitzky et al., 2003; Allouche & Laroche, 2005; Margolis et al., 2009). However, concerning environmental performance, which is usually considered to be one of the factors affecting social performance, the returns may be more significant, thanks to direct cost savings and higher revenues strategies (Ambec & Lanoie, 2008; Peloza, 2009). For instance, Reed (2001) was able to calculate the economic returns of Baxter International, as a result of its environmental initiatives. In the same logic, since CE aims at an improved environmental and economic performance of the corporate world, we expect that CEP is positively associated with CFP.

Hypothesis 1: There is a positive association between Circular Economy Performance and Corporate Financial Performance.

Nollet et al. (2016) investigate the relationship between CSP and CFP. They conclude that there is a non-linear relationship between those two variables. More specifically, they discover that for the case of ROA and Return on Capital (ROC), there is a U-shaped relationship between CSP and CFP. The authors support this relationship holds, because CSP requires a substantial amount of investments, before the increase of the company's product demand and consequently, the positive relationship between CSP and CFP. Barnet and Salomon (2012) also reach the same conclusion, after examining the relationship between CSP and CFP, using the KLD database. They also argue that the CSP costs must be exceeded, in order for the investments to pay off and allow for the positive relationship between CSP and CFP to hold. To this end, we expect that a non-linear relationship between CEP and CFP holds. More specifically, since significant investments are required when investing in CE, as indicated in the literature section, a U-shaped relationship, or a convex function, is also expected here, as well. The second hypothesis is formulated accordingly.

Hypothesis 2: The relationship between Circular Economy Performance and Corporate Financial Performance is a convex function.

The scores provided by VBDO (Ioannou et al., 2016), which are used in the present research, distinguish among four dimensions: Strategy & Governance, Implementation, Innovation, and Communication & Engagement. McWilliams and Siegel (2010) support that different aggregate CSR activities of a company may result in one final score, implying that a disaggregate analysis may provide more reliable and robust results. Consequently, it may be interesting to take advantage of the disaggregate information of the present sample and investigate whether there is a stronger relationship between some of those dimensions and CFP. The Strategy & Governance section of the questionnaire mainly examines the company's awareness of the concept of CE and whether it has any targets concerning CE; this dimension does not seem to be directly associated with the company's CFP. Nevertheless, a positive association between the Strategy & Governance score and CFP is expected, thanks to the company's awareness and planning. The implementation section evaluates the level of Implementation of CE practices within a company; this dimension does seem to be directly associated with the company's CFP. As a result, a strongly positive association between the Implementation score and CFP is expected. The Innovation section examines whether the company has already implemented any circular business practices and the existent strategic partnerships of the company concerning CE; this dimension does seem to be directly associated with the company's CFP. Consequently, a strongly positive association between the Innovation score and CFP is expected. Finally, the Communication & Engagement section examines whether the company is raising awareness and engages its customers and its stakeholders in CE; this dimension does not seem to be directly associated with the company's CFP, but probably it could be associated with it indirectly through the company's enhanced reputation, for instance. Thanks to such indirect relationships, a positive association between the Communication & Engagement score and CFP is expected. Overall, those dimensions that may be directly associated with CFP are expected to have a stronger relationship with CFP, compared to

the dimensions that may affect CFP indirectly, ceteris paribus. For the sake of clarity, the dimensions that may be directly associated with CFP, namely the Implementation CEP score and the Innovation CEP score, are defined as the direct components, while the dimensions that may be indirectly associated with CFP, namely the Strategy & Governance CEP score and the Communication & Engagement CEP score, are defined as the indirect components.

Hypothesis 3a: There is a positive association between the different dimensions and Corporate Financial Performance.

Hypothesis 3b: The positive association between the direct components and Corporate Financial Performance is stronger, compared to the indirect components.

According to Reed (2001), the special circumstance of different companies should be respected and treated accordingly. The author supports that the economic returns may be substantially distinct across different industries. In fact, the growth of the different industries may moderate the effect of environmental performance on economic performance (Russo & Fouts, 1997). The analysis of Zhu et al. (2011), concerning the effects of SSCN on CE, takes into account the industry effects as well. The authors decided to distribute the questionnaires to four Chinese industrial sectors, namely manufacturing enterprises in the chemical and petrochemical, electronic, automobile, and mechanical industries. Since CE aims at achieving an optimal level of production (Wu et al., 2014) and maximize value creation (Bastein et al., 2013), we expect that tangible product sectors will experience higher returns, compared to the service sectors.

Hypothesis 4: The returns on Corporate Financial Performance are higher in tangible product sectors, compared to tangible and/or intangible service sectors, when taking into account Circular Economy Performance.

Finally, an additional factor that may affect the relationship between CEP and CFP is the size of the corporation. Zhu et al. (2011) support that intensified external pressure and more abundant resources of larger companies enhance their possibilities to engage in CE practices. Additionally, while reviewing 588 journal articles and 102 books and book chapters on CSR, Aguinis and Glavas (2012) declared firm size to be a moderator on the relationship between CSR and firm performance. As they claim, “as firm size increases, additional resources and visibility of the firm strengthen the relationship between CSR and outcomes” (Aguinis & Glavas, 2012, p. 942). In the same logic, we expect that a positive association between firm size and the relationship between CEP and CFP may hold, implying the moderate effect of firm size on the relationship between CE and CFP.

Hypothesis 5: There is a positive association between firm size and the relationship between Circular Economy Performance and Corporate Financial Performance.

3 Data and Methodology

This section provides detailed information concerning the data used in the analysis and explains the methods employed, in order to achieve the research objectives of the present analysis. First, the data sources of the present analysis, as well as the way of the data collection are described. Second, the variables' selection and operationalization is discussed. Finally, this section concludes by explaining the ways in which the data are analyzed and the methods employed.

3.1 Data sources

This section presents the sources and the ways in which the data of the analysis were retrieved. The basic database is provided by VBDO, while the Orbis database was utilized for the collection of corporate financial information. Whenever possible, additional financial information was retrieved through corporate annual reports, in order to supplement missing data.

3.1.1 VBDO Benchmark Circular Business Practices

According to its mission, VBDO aims at creating a market in which companies and investors are aware of the environmental issues at stake. Being consistent with this mission, VBDO is promoting circular thinking across the Netherlands, since 2014 (Ioannou et al., 2016). To this end, in January 2016, the organization published a report which contained the CEP evaluation of 52 Dutch listed companies. Each one of the 52 companies of the sample has been evaluated, based on a questionnaire, and has received a final total score. The scores of the 52 Dutch listed companies formulate the basic database of the present study. To the best of our knowledge, this database is the first published attempt to evaluate CEP at a firm level basis. As a result, it may be interesting to explain the procedure of the evaluation procedure. As a first step, the association formulated some criteria concerning circular business practices and discussed about them in a multi-stakeholder meeting of November 2014. The feedback provided by 14 organizations assisted the association to develop the finalized set of criteria, based on which 52 Dutch listed companies were assessed. The desk research was conducted by VBDO during the period between October and December 2015, while only publicly available information was considered for the assessment. As a result, the assessment took into account information concerning circular business practices which had taken place until the financial year of 2014. As a next step, the assessment sheets were reviewed by Accenture and its comments were incorporated. Subsequently, the companies assessed were given the possibility to provide some feedback on their scores and 30 of them took advantage of this opportunity. The final step of the process included the consideration of the feedback provided by the 30 companies and the development of the finalized scores (Ioannou et al., 2016).

Concerning the questionnaire, in total, there are 31 criteria which may sum up to 35 points, while the final score takes the form of a percentage. In most cases, when a criterion was satisfied, based on the desk research, one point was added to the final score of the company (see the Appendix, for full questionnaire and points). The full list of the companies and their scores can be found in the

Appendix. The criteria concern four main dimensions, namely Strategy & Governance, Implementation, Innovation, and Communication & Engagement, which contribute to the final score according to their weighted factors. The first two dimensions contribute to the final score by 30% each, while the remaining two contribute by 20% each. The first dimension includes the criteria which assess the extent of the company's awareness on CE and whether CE is included its main targets. The thematic groups of criteria of this dimension are the following: strategy, long-term strategy, targets, and accountability. The second dimension assesses the level of implementation of CE practices at the business level; its thematic groups of criteria are the revenues of circular products and services, the product design, and the procurement. The third dimension incorporates the company's existent circular business practices and its strategic partnerships concerning CE. The thematic groups of criteria of this dimension are the existence of circular business models, the innovation budget, and the potential strategic partnerships on behalf of the company. Finally, the fourth dimension of communication & engagement section examines whether the company is raising awareness and engages its customers and its stakeholders in CE. For this last dimension, the thematic groups of criteria are the customers, the stakeholders, and raising awareness.

3.1.2 Financial Data

As already mentioned, CEP is evaluated based on the companies' CE initiatives until the year of 2014. Thus, in order to examine the relationship between CEP and CFP, financial data of the year 2014 had to be retrieved. The Orbis database was chosen to serve this purpose; the aforementioned database contains annual report data for more than 79 million companies worldwide. As a result, information for all 52 Dutch listed companies of the study was available for the financial year of 2014. In detail, the information collected includes: a) the number of employees of the companies as a proxy for firm size, b) the long-term debt of the companies in thousand euro, c) the total assets of the companies in thousand euro, d) the EPS of the companies in thousand euro, e) the percentage of ROA using profit/loss statement before tax of the companies, and f) the percentage of ROE using profit/loss statement before tax of the companies.

However, after the inclusion of the variables of interest, the provided data were not complete; some of them were not available. Whenever possible, the missing data were added, after looking into the companies' annual reports, available on their websites. These additional data concerned the variables of the number of employees, the total assets, and the earnings per share of seven companies.

3.2 Measures

This section provides information concerning the variables which were employed in order for the authors to examine the hypotheses. Initially, the dependent variables of the analysis are presented and described, followed by the independent variables and finally, the control variables.

3.2.1 Dependent Variables

The dependent variables are continuous variables which represent the different financial performance measures of the companies. As mentioned in the literature section, there are several ways to measure firm performance, but the present study will focus on the second category of Peloza (2009), which represents the accounting-based measures. Following the example of several previous studies (Allouche & Laroche, 2005; Margolis et al., 2009; Orlitzky et al., 2003; Peloza, 2009), which examined the relationship between CFP and CSP, the present study employs the variables ROA, ROE and EPS, selected from the Orbis database, with some additions on the missing data from the corporate website of the corresponding companies. More specifically, ROA is calculated by Orbis as the fraction of profits before taxes to the total assets, multiplied by 100; ROE is calculated by Orbis as the fraction of profits before taxes to the shareholders' funds, multiplied by 100; and EPS is used as it is without any further calculations. Important to mention here is the fact that ROA, ROE and EPS are normally distributed, and as a result, they are used in the analysis without any transformation.

3.2.2 Independent Variables

Depending on the hypothesis tested, the independent variables vary. In other words, the model used in the analysis may change according to the hypothesis tested; the corresponding model will be clearly stated. This is mainly because the sample is rather small and in order to make the results as valid as possible, the fewest variables possible were included in the corresponding models.

Concerning the first hypothesis, which is the basic one, the CEP score, provided by VBDO (Ioannou et al., 2016), are used as the independent variable. The highest possible score is 100, while the lowest is 0. After examining whether the aforementioned variable is normally distributed, the conclusion is that the CEP score is not normally distributed and the best possible transformation of the variable is the square root transformation. Before transforming the variable, one value was added to every observation, in order for the lowest value to be 1. This is because the square root of the numbers between 0 and 0.99 react differently than the numbers above 1. As a result, when referring to the CEP score variable, the square root transformation will be implied. In order to examine whether there is a non-linear relationship between CEP and CFP, as hypothesized, the initial CEP score (before the square root transformation) are included as the squared CEP scores variable; no further transformations are required. Concerning this last variable, the authors will refer to it as the squared CEP score variable.

As far as the third hypothesis is concerned, the disaggregate scores provided by VBDO are utilized. These scores concern four different dimensions, namely strategy & governance, implementation, innovation, and communication & engagement. For each of those dimensions a categorical variable is created, in order to capture the different scores. Strategy & Governance is divided into 3 categories and it takes value 1 when the company's score is between 0 and 3, value 2 when the company's score is between 4 and 7, and value 3 when the company's score is between 8 and 10.

Implementation variable is divided into 3 categories and it takes value 1 when the company's score is between 0 and 3, value 2 when the company's score is between 4 and 7, and value 3 when the company's score is between 8 and 10. Innovation variable is divided into 3 categories and it takes value 1 when the company's score is between 0 and 2, value 2 when the company's score is between 3 and 5, and value 3 when the company's score is between 6 and 8. Communication & Engagement variable is divided into 3 categories and it takes value 1 when the company's score is between 0 and 2, value 2 when the company's score is 3 or 4, and value 3 when the company's score is 5 or 6.

Table 4: Information about the variables of the analysis.

Variable	**Type of the variable**	**Source**	**Description/ Definition**
ROA	Continuous	Orbis Database	Return on Assets; measured as the ratio profits before taxes/total assets, multiplied by 100.
ROE	Continuous	Orbis Database	Return on Equity; measured as the ratio profits before taxes/shareholders' funds, multiplied by 100.
EPS	Continuous	Orbis Database	Earnings per Share.
CEP score	Continuous	VBDO report	Circular Economy Performance score; square root transformation.
CEP score squared	Continuous	VBDO report	Circular Economy Performance score squared.
Firm size	Continuous	Orbis Database	Number of Employees; logarithmic transformation.
Debt	Continuous	Orbis Database	Debt Burden; measured as the ration long-term debt/total assets; square root transformation.
Industry	Categorical	Created by the authors, based on literature	Company Sectors; value 1: tangible product sectors, value 2: tangible service sectors, value 3: intangible service sectors.
Strategy & Governance	Categorical	VBDO report	Strategy & Governance score; value 1: 0-3 points, value 2: 4-7 points, value 3: 8-10 points.
Implementation	Categorical	VBDO report	Implementation score; value 1: 0-3 points, value 2: 4-7 points, value 3: 8-10 points.
Innovation	Categorical	VBDO report	Innovation score; value 1: 0-2 points, value 2: 3-5 points, value 3: 6-8 points.
Communication & engagement	Categorical	VBDO report	Strategy & Governance score; value 1: 0-2 points, value 2: 3-4 points, value 3: 5-6 points.

In order to test the fourth hypothesis, a categorization of the different sectors is required. Following the sector division employed by Brand and Dam (2009), Uhlaner et al. (2012), and Hoogendoorn et al. (2015), the 52 companies of the present research are classified into the tangible product sectors, the tangible service sectors and the intangible service sectors. In this way, a categorical variable is created and assigned value 1, when the company belongs to the category of tangible product sectors, value 2 when the company belongs to the tangible service sectors, and value 3 when the company belongs to the intangible service sectors.

Finally, as mentioned in the literature section, firm size may affect the relationship between CEP and CFP. With the purpose of examining this last hypothesis, the natural logarithmic transformation of the number of employees for each of the companies is used as a measure of firm size; a tactic that has been chosen by other authors in the past (Dean & Snell, 1991; Zhu et al., 2011). Another reason why the logarithmic transformation of the variable was preferred concerns the normal distribution of the number of employees. After running the corresponding tests, it was concluded that the logarithmic transformation is the most normally distributed alternative.

3.2.3 Control Variables

Including the appropriate control variables is of extreme importance, when examining the relationship between CSP and CFP (Allouche & Laroche, 2005). This is attributable to the fact that the various conditions of the different companies may affect their performance in many different ways (Reed, 2001). To this end, several authors include a leverage, such as the company's debt to assets, or debt to equity ratio, in order to control for influences on the financial performance of the company (Hart & Ahuja, 1996; Lee et al., 2014). As mentioned by Lee et al. (2014), a high level of debt within a company results in limited awareness of new business ventures and limited profits. Consequently, debt burden is considered to be a factor that shall be included in the present analysis and is defined as the ratio of the long-term debt of a company to its total assets. However, due to the fact that the variable is not normally distributed, its square root transformation was utilized in order to maintain the unbiasedness of the model.

Table 4 summarizes some basic information concerning the variables of the analysis. The type of the variables, the sources from which they were gathered and a short description of their context are presented. Table 5 provides some descriptive statistics of the variables, namely the number of observations, the mean value, the standard deviation, and the minimum and maximum value they take. In almost every case, the number of observations is 51, except for the case of ROE. The initial sample consisted of 52 companies. However, we chose to drop an observation, because it contained a missing value, something that did not allow the models to be completely comparable. In addition, the mean value of ROA is approximately 3.54, the mean value of ROE is approximately 8.38, and the mean value of EPS is approximately 0.79. It may be observed that in some cases, like in ROE, the minimum/maximum values seem to be out of line relative to the rest of the data. However, this could be attributable to the limitation of the small sample of the analysis. Since dropping

observations in small samples may be tricky, the authors decided not to drop any additional observations.

Table 5: Descriptive statistics.

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
ROA	51	3.538	8.500	-24.615	19.418
ROE	47	8.377	21.910	-86.371	53.607
EPS	51	0.795	2.172	-7.145	5.020
CEP score	51	4.877	2.344	1.000	9.220
Firm size	51	8.480	2.370	3.045	12.310
Debt	51	0.3889	0.183	0.000	0.724

Moreover, Table 6 presents the descriptive statistics of the categorical variable Industry. The majority of the companies belong to the tangible product sectors, while 7 companies belong to the tangible service sectors, and 14 companies belong to the intangible service sectors.

Table 6: Descriptive statistics of categorical variable Industry.

Industry	Frequency	Percent	Cumulative percentage
Tangible product sectors	30	58.82	58.82
Tangible service sectors	7	13.73	72.55
Intangible service sectors	14	27.45	100.00
Total	51	100.00	

Table 7 depicts the correlation matrix of the different variables of the analysis. It can be easily observed that no serious correlations between the variables exist. ROA, ROE, and EPS seem to be highly correlated with each other, but this is something that might have been expected, due to the fact that all variables are used for the same purpose. Besides, these variables are used interchangeably, not simultaneously. As a result, it may be concluded that the assumption of no perfect collinearity is not violated.

Table 7: Correlation matrix.

Variables	1	2	3	4	5	6	7
1 ROA	1.00						
2 ROE	0.91	1.00					
3 EPS	0.81	0.78	1.00				
4 CEP score	0.14	0.20	0.12	1.00			
5 Firm Size	0.03	0.01	0.11	0.46	1.00		
6 Debt	0.01	0.09	0.03	0.04	0.07	1.00	
7 Industry	-0.05	-0.17	-0.10	-0.19	-0.06	0.24	1.00

3.3 Methodology

This section explains the ways in which the data are analyzed and which methods are employed. Due to the limited number of observations, the number of variables which may be included in the analysis is limited. As a result, four different formulas are constructed, in order to examine the different hypotheses. Formula 1 aims at examining hypotheses 1; there is a positive effect of CEP on CFP. When an additional variable is included, formula 2 is constructed and examines hypotheses 2, and 4; the effect of CEP on CFP is not linear, and the returns on CFP are higher in tangible product sectors, compared to tangible and/or intangible service sectors, respectively. Formula 3 is similar with formula 1, with the only difference being that the main independent variable utilizes the disaggregated scores, in order to examine whether hypothesis 3 holds; a higher score in the each of the evaluated categories of Strategy & Governance, Implementation, Innovation, and Communication & Engagement positively affects Corporate Financial Performance. Finally, formula 4 examines whether hypothesis 5 holds, stating that there is a positive association between firm size and the relationship between CEP and CFP.

Formula 1 has been constructed as follows:

$$FP = \beta_0 + \beta_1 * CEP + \beta_2 * S + \beta_3 * I_2 + \beta_4 * I_3 + \beta_5 * D + u \ (\mathbf{1})$$

Where FP denotes the financial performance measure of the company, which may take the values of ROA, ROE, or EPS; CEP denotes the evaluated CEP score of the company by VBDO, as defined in the independent variables section; S denotes the firm size of the company; I_2 denotes the tangible service sectors and I_3 the intangible service sectors, while the tangible product sectors is the base category; D denotes the debt burden; and finally, u denotes the standard error.

Formula 2 has been constructed as follows:

$$FP = \beta_0 + \beta_1 * CEP + \beta_2 * CEP^2 + \beta_3 * S + \beta_4 * I_2 + \beta_5 * I_3 + \beta_6 * D + u \ (\mathbf{2})$$

Where CEP^2 denotes the evaluated CEP score of the company by VBDO squared.

Formula 3 has been constructed as follows:

$$FP = \beta_0 + \beta_1 * Score + \beta_2 * S + \beta_3 * I_2 + \beta_4 * I_3 + \beta_5 * D + u \ (\mathbf{3})$$

Where Score can be replaced by the four categorical variables, namely Strategy & Governance, Implementation, Innovation, and Communication & Engagement, one at a time. As a result, four different versions of this formula may occur, consisting four different models.

Formula 4 has been constructed as follows:

$$FP = \beta_0 + \beta_1 * CEP + \beta_2 * CEP^2 + \beta_3 * S + \beta_4 * IS + \beta_5 * I_2 + \beta_6 * I_3 + \beta_7 * D + u \ (\mathbf{4})$$

Where IS denotes the interaction between the size and the corresponding score of a company.

Our sample consists of cross-sectional data, and as a result, appropriate Ordinary Least Squared (OLS) regression models are applied. As already mentioned, the initial sample consists of 52 observations, but we chose to drop one observation, in order to make the models more easily comparable. The results of the analysis are presented in chapter 4.

4 Results & Discussion

This chapter presents the results of the analysis and attempts to interpret them. First, the results section describes the outcome of the analysis. Second, in the discussion section the results are analyzed and interpreted. Third, several important limitations of the present study are mentioned.

4.1 Results

In this section, the results of the analysis are described, according to the order of the tables. To begin with, in order to test hypothesis 1 concerning the positive relationship between CEP and CFP, formula 1 is utilized. As for hypothesis 2 concerning the non-linear relationship between CEP and CFP, as well as hypothesis 4 concerning the relationship between industry effects and CFP, taking into account CEP, formula 2 is utilized. ROA is used as the dependent variable in Table 8, ROE in Table 9, and EPS in Table 10. In Table 11 and Table 12, hypothesis 3 concerning the disaggregate CEP scores is examined, while formula 3 is utilized. Finally, in Table 13, the analysis is focused on the association between firm size and the relationship between CEP and CFP; here, formula 4 is utilized.

In Table 8**,** the final model is constructed step by step. Initially, model 1a includes only the main independent variable, namely the CEP score. When adding more variables, models 1b, 1c and 1d are created. It can be easily observed that, when including the variables of firm size and industry, in models 1b and 1c respectively, the coefficients of the first model change quite substantially. This is not the case for the variable of debt in model 1d, though. As a result, it is concluded that the final model should include the variables of firm size and industry, but not the debt. The importance of the exclusion of debt is also verified by two specification tests, namely the Ramsey RESET test and the linktest. When including debt in the final model, the tests indicate that the model is not correctly specified, while when excluding debt from the final model, the tests indicate that the model is correctly specified. When excluding debt, adjusted R^2 is higher as well. As a result, model 1e is constructed and it shows that the relationship between CEP score and ROA is positive, as hypothesized. However, the results indicate that there is an insignificant relationship between the two variables. In order to test for the second hypothesis empirically, the squared CEP score is included in model 1e. The coefficients change substantially and the results become significant. Consequently, the final model includes the squared CEP score. Model 1g in Table 8: Circular Economy Performance and Corporate Financial Performance (ROA). is the final model in the case that ROA is the dependent variable. The results indicate that an inverted U-shaped relationship between CEP and ROA exists, something that contradicts the claims of the existing literature. Thus, hypothesis 2, stating that there is a convex relationship between CEP score and CFP, cannot be accepted in the case of ROA. Despite the unexpected results, it may be interesting to calculate the highest point, until which the relationship between CEP and ROA is positive and after which this relationship becomes negative. This point is calculated as the outcome of the fraction $-\frac{\beta_1}{2\beta_2}$. Taking into consideration the fact that CEP score exists at the scale from 1 to 10,

the relationship between CEP score and ROA is positive up to 5.3823, while after this point it becomes negative. In addition, hypothesis 4 concerning the relationship between the industry effects and CFP, while taking into account CEP score, cannot be confirmed, since the coefficients of interest are not statistically significant. This is also the case with the control variable of firm size, as well. Model 1g was tested for multicollinearity and heteroskedasticity, but it does not suffer from any of these illnesses.

Table 9 depicts the same models, but ROA is replaced with ROE. After going through the same procedures, the models 2a-2g are created and are similar with the models 1a-1g, respectively. The final model in the case that ROE is the dependent variable, namely model 2g, is depicted in Table 9. The results are similar with Table 8, and like before, hypothesis 1, 2, and 4 cannot be confirmed. In the case of 2g**,** the highest point of the inverted U-shaped relationship is reached when the CEP score is 5.3799. Here, it is important to mention that the results reported correspond to the robust standard errors of the model, because the initial model diagnosed to suffer from heteroskedasticity; multicollinearity is not an issue.

Table 10 depicts similar models as in the previous two cases, but now the dependent variable is EPS. Again, most of the results are similar with the results of Table 8, with the exception of the variable of debt. In the case where EPS is the dependent variable, even though the variable of debt does not seem to provoke a substantial change to the coefficient of CEP score in model 3d, when including debt in the final model, the model seems to be correctly specified. However, the adjusted R^2 is negative, while when excluding debt from the model, the adjusted R^2 is bit above zero. Consequently, three reasons assisted the authors to decide to exclude debt from the final model: a) the coefficients of model 3a in Table 10 did not change substantially when including debt in model 1d, b) the adjusted R^2 is negative when including debt in the final model, and c) excluding debt can make the model more easily comparable to the previous two models with ROA and ROE. As a result, model 3g in Table 10 is the final model. The initial model diagnosed to suffer from heteroskedasticity and consequently, the robust standard errors are utilized in model 3g. Here, the robust standard errors do not indicate any significant relationships between the variables of the model. As a result, hypothesis 1, 2 and 4 cannot be confirmed. However, it may be interesting to mention that the p-value of the squared CEP score is extremely close to being statistically significant (p-value = 0,106). Along these lines, based on the coefficients of the variables of interest, an inverted U-shaped relationship between CEP and CFP in the case that EPS is the dependent variable may seem to exist.

Moreover, Table 11 and Table 12 will be described and analyzed together, in order to allow for the third hypothesis to be examined. This is because, the limited number of observations cannot allow the inclusion of the 4 dimensions, namely Strategy & Governance, Implementation, Innovation, and Communication & Engagement, in the same model; the models with the same dependent variables will be compared with each other. Thus, models 4a-4c concern the CEP score

of Strategy & Governance, while models 5a-5c employ the CEP score of Implementation. Accordingly, models 6a-6c concern the CEP score of Innovation, while models 7a-7c concern the CEP score of Communication & Engagement. Models 4a, 5a, 6a, and 7a present the relationship between Strategy & Governance CEP score, Implementation CEP score, Innovation CEP score, and Communication & Engagement CEP score and ROA, respectively; models 4b, 5b, 6b, and 7b present the relationship between Strategy & Governance CEP score, Implementation CEP score, Innovation CEP score, and Communication & Engagement CEP score and ROE, respectively; models 4c, 5c, 6c, and 7c present the relationship between Strategy & Governance CEP score, Implementation CEP score, Innovation CEP score, and Communication & Engagement CEP score and EPS, respectively. Concerning model 4a, it is observed that all variables have the expected sign. However, the only variable that is statistically significant and can be interpreted is the variable of the second subscore of Strategy & Governance. This result shows that having a score between 4-7, in Strategy & Governance, may increase ROA by 5.52 units, compared to having a score between 0-3, ceteris paribus. This outcome is significant at the 10% level of significance. As a result, the positive relationship between the Strategy & Governance CEP score and ROA seems to hold in this case, indicating that hypothesis 3a may be confirmed. However, this is not the case with models 4b and 4c, or when ROE and EPS are the dependent variables respectively, where most of the variables have the expected sign, but the models do not indicate any statistically significant relationships. In addition, concerning the Innovation CEP score, in model 5a, as well as in 5c, the sign of the Implementation subscore 2 is negative, while a positive one was expected. This is not the case in model 5b, though where the sign of the coefficient is the expected one. Concerning the signs of the rest of the variables, they are mostly as expected. However, none of the coefficients of models 5a, 5b, and 5c is statistically significant. As a result, hypothesis 3a, indicating a positive association between Implementation CEP score and CFP, cannot be confirmed. Concerning the Innovation CEP score, all three models, namely models 6a, 6b, and 6c, seem to agree on the signs of the variables. However, only subscore 2 in model 6a may be interpreted, since it is the only statistically significant result. According to this result, an Innovation score among 3-5 will result in a lower ROA score by 4.992 units, compared to a score among 0-2, ceteris paribus. This outcome is statistically significant at the 10% level. Consequently, the positive relationship between the Innovation CEP score and ROA does not seem to hold, indicating that hypothesis 3a may not be confirmed. As far as the Communication & Engagement score is concerned, referring to models 7a-7c, the signs of the coefficients of interest are mixed. However, the results of those models are not statistically significant and therefore, cannot be interpreted, or compared to the rest of the results. Again here, hypothesis 3a cannot be confirmed. Important to mention is the fact that models 4b, 5b, 5c, 6b, 7a and 7b portray the robust standard errors, because of the problem of heteroskedasticity. No other illnesses were detected in the models of Table 12. Overall, comparison between the Strategy & Governance CEP score and Innovation CEP score may only be valid. It may be observed that the opposite relationship than hypothesized one seems to hold. More specifically, the direct component of Innovation seems to have a weaker relationship

with CFP, compared to the indirect component of Strategy & Governance. This fact does not allow for the hypothesis 3b to be confirmed.

In Table 13, hypothesis 5 is examined, stating that firm size is positively associated with the relationship between CEP and CFP, while formula 4 is utilized. Model 8a-8c examine the case that the dependent variable is ROA, models 9a and 9b examine the case that the dependent variable is ROE, and models 10a-10c examine the case that the dependent variable is EPS. In every case, model a is the base model, while in model b, the variable of firm size is added. The difference of the coefficients between models a and b are compared, and when the difference is substantial, the final model, model c, contains the interaction of the CEP score and firm performance. Here, we need to mention the fact that the coefficients of models 9a and 9b are not substantially different; also, a joint significance test indicated that the variables of CEP score, firm size, and their interaction are not jointly significant in the case of ROE. As a result, the interaction term is not included in the model in the case of ROE. Models 8c and 10c, which are examining the last hypotheses, suffer from heteroskedasticity, and as a result, the robust standard errors are portrayed. It can be observed that the interaction term is statistically significant only in model 10c, when EPS is the dependent variable; the effect is insignificant in model 8c. Consequently, the association between firm size and the relationship between CEP and EPS is the following:

$$EPS = 2{,}616 + 0{,}162 * CEP - 0.570 * Size + 0{,}169 * Inter.$$

This equation indicates that when firm size increases by one unit, in our case by one employee, the relationship between EPS and CEP shall be calculated according to the aforementioned formula.

Table 8: Circular Economy Performance and Corporate Financial Performance (ROA).

VARIABLES	Model 1a ROA	Model 1b ROA	Model 1c ROA	Model 1d ROA	Model 1e ROA	Model 1f ROA	Model 1g ROA
CEP Score	0.524	0.604	0.466	0.523	0.545	4.956**	5.673**
	(0.513)	(0.583)	(0.560)	(0.518)	(0.631)	(2.026)	(2.338)
CEP Score Squared						-0.457**	-0.527**
						(0.203)	(0.232)
Industry = Tangible product sectors	(base category)						
Industry = Tangible service sectors			-1.080		-1.058		2.401
			(3.891)		(3.930)		(4.061)
Industry = Intangible service sectors			-0.485		-0.465		-0.516
			(2.837)		(2.866)		(2.745)
Firm Size		-0.171			-0.167		0.143
		(0.577)			(0.589)		(0.580)
Debt				0.290			
				(6.642)			
Constant	0.982	2.046	1.546	0.874	2.569	-7.290	-10.17
	(2.768)	(4.542)	(3.424)	(3.735)	(4.994)	(4.530)	(7.373)
Observations	51	51	51	51	51	51	51
R-squared	0.021	0.023	0.023	0.021	0.024	0.115	0.125
Adjusted R-squared	0.000915	-0.0180	-0.0397	-0.0199	-0.0604	0.0778	0.0274

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

Table 9: Circular Economy Performance and Corporate Financial Performance (ROE).

VARIABLES	Model 2a ROE	Model 2b ROE	Model 2c ROE	Model 2d ROE	Model 2e ROE	Model 2f ROE	Model 2g ROE
CEP Score	1.905	2.324	1.273	1.937	1.712	16.40***	17.42***
	(1.362)	(1.539)	(1.564)	(1.371)	(1.708)	(5.076)	(5.729)
CEP Score Squared						-1.516***	-1.619***
						(0.514)	(0.509)
Industry = Tangible product sectors	(base category)						
Industry = Tangible service sectors			-8.598		-8.983		2.163
			(11.13)		(11.22)		(14.40)
Industry = Intangible service sectors			-6.152		-6.446		-6.623
			(7.693)		(7.756)		(5.259)
Firm Size		-0.928			-1.036		-0.00986
		(1.542)			(1.563)		(1.362)
Debt				12.28			
				(18.09)			
Constant	-0.683	5.113	4.992	-5.442	11.72	-27.14**	-27.62
	(7.208)	(12.06)	(9.428)	(10.09)	(13.90)	(11.18)	(14.87)
Observations	47	47	47	47	47	47	47
R-squared	0.042	0.049	0.063	0.052	0.072	0.200	0.220
Adjusted R-squared	0.0204	0.00628	-0.00283	0.00849	-0.0161	0.163	0.125

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

Table 10: Circular Economy Performance and Corporate Financial Performance (EPS).

VARIABLES	Model 3a EPS	Model 3b EPS	Model 3c EPS	Model 3d EPS	Model 3e EPS	Model 3f EPS	Model 3g EPS
CEP Score	0.107	0.0748	0.0696	0.106	0.0353	1.056*	1.140
	(0.131)	(0.149)	(0.143)	(0.133)	(0.161)	(0.528)	(0.850)
CEP Score Squared						-0.0979*	-0.113
						(0.0528)	(0.0688)
Industry = Tangible product sectors	(base category)						
Industry = Tangible service sectors			-0.693		-0.703		0.0420
			(0.993)		(1.001)		(1.259)
Industry = Intangible service sectors			-0.344		-0.353		-0.364
			(0.724)		(0.730)		(0.614)
Firm Size		0.0695			0.0725		0.139
		(0.148)			(0.150)		(0.157)
Debt				0.332			
				(1.703)			
Constant	0.272	-0.159	0.645	0.149	0.202	-1.499	-2.542
	(0.710)	(1.163)	(0.874)	(0.958)	(1.272)	(1.181)	(2.376)
Observations	51	51	51	51	51	51	51
R-squared	0.013	0.018	0.025	0.014	0.030	0.079	0.101
Adjusted R-squared	-0.00675	-0.0230	-0.0369	-0.0269	-0.0541	0.0409	0.00159

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

Table 11: Disaggregate Circular Economy Performance Score (Strategy & Governance, Implementation) and Corporate Financial Performance (ROA, ROE, and EPS).[3]

VARIABLES	Model 4a ROA	Model 4b ROE	Model 4c EPS	Model 5a ROA	Model 5b ROE	Model 5c EPS
Strategy & Governance Subscore = 2	5.520*	9.000	0.776			
	(2.985)	(7.766)	(0.766)			
Strategy & Governance Subscore = 3	0.143	-5.283	-0.696			
	(3.620)	(10.29)	(0.930)			
Implementation Subscore = 2				-0.518	0.785	-0.701
				(2.742)	(6.407)	(0.846)
Firm Size	0.0232	-0.229	0.130	0.0923	-0.471	0.134
	(0.572)	(1.402)	(0.147)	(0.562)	(1.336)	(0.153)
Industry= Tangible product sectors	(base category)					
Industry = Tangible service sectors	-1.512	-13.35	-0.675	-2.369	-13.21	-1.047
	(3.655)	(17.54)	(0.938)	(3.892)	(17.91)	(0.994)
Industry = Intangible service sectors	-0.534	-8.010	-0.365	-0.867	-7.629	-0.435
	(2.789)	(4.806)	(0.716)	(2.867)	(5.788)	(0.591)
Constant	2.371	12.54	-0.170	3.582	15.60	0.283
	(4.939)	(9.862)	(1.268)	(4.896)	(9.615)	(1.118)
Observations	51	47	51	51	47	51
R-squared	0.084	0.098	0.075	0.009	0.050	0.051
Adjusted R-squared	-0.0176	-0.0125	-0.0274	-0.0768	-0.0401	-0.0318

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

[3] Note: Models 4a-4c represent the Strategy & Governance scores, while models 5a-5c represent the Implementation scores.

Table 12: Disaggregate Circular Economy Performance Score (Innovation, Communication & Engagement) and Corporate Financial Performance (ROA, ROE, and EPS).[4]

VARIABLES	Model 6a ROA	Model 6b ROE	Model 6c EPS	Model 7a ROA	Model 7b ROE	Model 7c EPS
Innovation Subscore = 2	-4.992*	-6.736	-1.033			
	(2.887)	(7.271)	(0.738)			
Innovation Subscore = 3	-4.714	-14.91	-0.293			
	(5.611)	(10.66)	(1.435)			
Communication & Engagement Subscore = 2				1.490	5.846	-0.0861
				(2.328)	(5.605)	(1.105)
Communication & Engagement Subscore = 3				-0.274	-1.793	-0.0546
				(3.418)	(11.34)	(1.134)
Firm Size	0.460	0.305	0.157	0.0723	-0.195	0.0901
	(0.572)	(1.515)	(0.146)	(0.533)	(1.406)	(0.150)
Industry= Tangible product sectors	(base category)					
Industry = Tangible service sectors	-3.507	-16.39	-0.997	-2.371	-13.35	-0.773
	(3.751)	(18.06)	(0.959)	(5.165)	(18.13)	(0.977)
Industry = Intangible service sectors	-1.769	-9.625*	-0.507	-1.144	-8.710	-0.371
	(2.877)	(5.643)	(0.736)	(2.865)	(6.173)	(0.784)
Constant	2.542	13.33	0.0977	3.450	13.80	0.254
	(4.831)	(10.49)	(1.236)	(5.153)	(10.67)	(1.291)
Observations	51	47	51	51	47	51
R-squared	0.072	0.080	0.071	0.011	0.054	0.029
Adjusted R-squared	-0.0306	-0.0325	-0.0326	-0.0986	-0.0608	-0.0785

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

[4] Note: Models 6a-6c represent the Innovation scores, while models 8a-8c represent the Communication & Engagement scores.

Table 13: Effect of firm size on the relationship between Circular Economy Performance (CEP) and Corporate Financial Performance (ROA, ROE, and EPS).

VARIABLES	Model 8a ROA	Model 8b ROA	Model 8c ROA	Model 9a ROE	Model 9b ROE	Model 10a EPS	Model 10b EPS	Model 10c EPS
CEP Score	5.606**	5.673**	3.052	17.42***	17.42***	1.074*	1.140*	0.162
	(2.298)	(2.338)	(2.738)	(5.738)	(5.861)	(0.600)	(0.605)	(0.708)
CEP Score Squared	-0.513**	-0.527**	-0.692***	-1.619***	-1.619***	-0.100*	-0.113*	-0.175**
	(0.223)	(0.232)	(0.222)	(0.557)	(0.582)	(0.0583)	(0.0601)	(0.0841)
Industry = Tangible product sectors	(base category)							
Industry = Tangible service sectors	2.330	2.401	1.910	2.173	2.163	-0.0268	0.0420	-0.141
	(4.009)	(4.061)	(4.081)	(10.92)	(11.16)	(1.047)	(1.051)	(1.154)
Industry = Intangible service sectors	-0.498	-0.516	-0.305	-6.620	-6.623	-0.347	-0.364	-0.285
	(2.716)	(2.745)	(2.540)	(7.103)	(7.199)	(0.709)	(0.711)	(0.590)
Firm Size		0.143	-1.757		-0.00986		0.139	-0.570
		(0.580)	(1.299)		(1.497)		(0.150)	(0.370)
Interaction of Firm Size and CEP score			0.453					0.169**
			(0.299)					(0.0832)
Constant	-9.012	-10.17	3.657	-27.70*	-27.62	-1.419	-2.542	2.616
	(5.641)	(7.373)	(9.825)	(14.22)	(19.14)	(1.473)	(1.909)	(2.196)
Observations	51	51	51	47	47	51	51	51
R-squared	0.123	0.125	0.180	0.220	0.220	0.084	0.101	0.220
Adjusted R-squared	0.0472	0.0274	0.0683	0.145	0.125	0.00461	0.00159	0.113

Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

4.2 Discussion

This section discusses the results which were obtained in the previous section and attempts to provide some explanations to them. Since, to the best of our knowledge, there are no other empirical studies on the relationship between CEP and CFP, our results cannot be compared to equivalent studies. However, related literature exists, such as studies which are examining the relationship between CSR and CFP. The structure of this section follows the order of the formulated hypotheses.

To begin with, hypothesis 1, which suggests that there is a positive association between CEP and CFP, cannot be supported (Table 8, Table 9, Table 10; models 1e, 2e, 3e). This result is not consistent with the majority of the related academic literature, examining the relationship between CSR and CFP (Allouche & Laroche, 2005; Margolis et al. 2009). However, when observing the significant results of the quadratic models (Table 8, Table 9, Table 10; models 1g, 2g, 3g), the aforementioned non-statistically significant linear relationship between CEP and CFP may be justified. This is attributable to the fact that, when testing for non-linear relationships between CEP and CFP, a concave relationship between the variables of interest is discovered. In other words, the relationship between CEP and CFP is more complex than just a linear relationship. Related literature has also come to similar conclusions. For example, Barnet and Salomon (2012), as well as Nollet et al. (2016), discovered that a non-linear relationship exists between CSP and CFP. In this way, our finding contributes to the existing literature by supporting the interesting perspective that a non-linear relationship between environmental and financial performance may exist and should be carefully examined, something that up to date, has not been adequately addressed (Nollet et al., 2016). Nevertheless, our findings suggest that there is an optimal point, after which the relationship between CEP and CFP is negative. This result is contradicting the findings of Barnet and Salomon (2012) and Nollet et al. (2016), which conclude that a U-shape relationship between CSR and CFP exists. A possible explanation for this outcome may be that, as indicated in the related literature section, the concepts of CSR and CE differ from each other. This fact may allow for differentiated relationships to hold. Another possible explanation may have to do with the nature of the data of the present study. As already mentioned, cross-sectional data are utilized for 52 Dutch listed companies. On the other hand, both Barnet and Salomon (2012) and Nollet et al. (2016) utilize panel data concerning a larger sample size. This fact may pinpoint the importance of observing CEP of business across time, as well as the importance of having an appropriate sample size. Nevertheless, our findings support the theory of Lankoski (2000), who suggests that there is an inverted U-shape between environmental performance and economic performance. The author's theoretical contribution to the literature is based on the traditional neoclassical environmental economics framework, while taking into account the environmental private benefits. Lankoski claims that win-win situations are theoretically plausible, depending on several factors, such as the costs of the environmental performance. In fact, in our sample, none of the companies has CE at the core of its business, something that could be the case with a metals' recycling company, for example. As a result, it may seem rational that if, for instance, a

construction company employs a completely circular business model, it will end up achieving negative growth in its returns, due to costs of the initiatives employed. In other words, several initiatives may definitely benefit the aforementioned construction company, but some others may be more costly to achieve, something that could affect the company's return indicators. As a result, our findings provide a fresh, interesting perspective on environmental performance, which could have substantial benefits in practice. In general, the implications of these findings could affect both the corporate and the academic world. On the one hand, concerning the corporate world, companies may be less doubtful in terms of the effectiveness of CE initiatives. They may attempt to comply with CE initiatives and achieve the optimum level, something that could result in the so called "win-win situation" of Lankoski (2000). On the other hand, concerning the academic world, the non-linear relationship between environmental and economic performance has not been sufficiently addressed (Nollet et al., 2016). As a result, the importance of examining non-linear effects between environmental and economic performance is highlighted.

Furthermore, hypothesis 3a, which states that a positive relationship exists between each of the evaluated dimensions of Strategy & Governance, Implementation, Innovation, and Communication & Engagement and CFP, may seem to be supported in the case that Strategy & Governance CEP score is the independent and ROA is the dependent variable of the model. In other words, if a company is well informed about CE and is planning to implement several CE initiatives, it seems that the company may experience higher ROA. Being proactive and well informed seems to assist the company's ROA outcomes. This claim is also supported by Barnet and Salomon (2012), who argue that being well informed may result in higher research investments, and consequently, higher profits. However, we found no support to claim that this is the case for ROE and EPS, as well. This fact could be justified by the different nature of those variables. ROE and EPS are mainly used by stakeholders, in order to gauge how their investments are generating income. On the other hand, ROA is used as an efficient way of measuring how the management of a company is using its assets for the purpose of generating higher income. As a result, since Strategy & Governance score is based on management decisions of the companies, the fact that the results of ROA are partially significant, while those of ROE and EPS are not, may be justified. Concerning Innovation score, the opposite result than the expected one may seem to hold, in the case of ROA. This finding came as a surprise to the authors. However, it could be argued that, in order for a company to have a high Innovation score, several investments have to be made. In some cases, investments may need some time to pay off. As a result, a high Innovation score may initially have a negative effect on the company's returns, but it may substantially enhance the company's returns after a certain period of time. To put it differently, a non-linear relationship may hold between the Innovation CEP score and CFP. Given the fact that the Innovation score in our sample is a categorical variable, a quadratic term cannot be included. However, it would be of interest to examine whether this non-linear relationship holds. Again here, the outcomes of ROE and EPS are not statistically significant. Additionally, when testing whether hypothesis 3b holds, stating that the relationship between the direct components and CFP is

stronger than in the case of the indirect components, no support could be found. In fact, the opposite relationship seems to hold, when comparing the direct component of Innovation to the indirect component of Strategy & Governance. This unexpected finding may be attributable to the interpretation of the separate effects of those components. In other words, if the non-linear relationship between the Innovation CEP score and CFP holds, while such a relationship does not hold in the case of Strategy & Governance CEP score, the comparison of those components may be more complex than just comparing the coefficients of the variables of interest. Another explanation may entail the inclusion of the different dimensions in the same model, something that is not possible in our case, due to the nature of the data sample. Thanks to these findings, certain interesting insights for both the academic and the corporate world may arise. First, based on the different circumstances, the importance of choosing the appropriate measures is pinpointed. Second, the implications of the lack of academic insights on CE in general, and consequently, at the disaggregate level, seem to be significant, especially to the corporate world. The doubtfulness in terms of CE's returns to the corporate world could be eliminated if several studies could verify that even the most costly disaggregate categories, such as Innovation, do pay off. Third, different companies may wish to focus on those categories of the disaggregate analysis that are more efficient for them, depending on their different circumstances. In this way, higher efficiency could be achieved.

Additionally, no support was found for the fourth hypothesis, arguing that the returns on CFP are higher in tangible product sectors, compared to tangible and/or intangible service sectors, when taking into account CEP. This fact came as a surprise to the authors, since CE is "based on the reuse of products and raw materials, and the restorative capacity of natural resources" (Bastein et al., 2013, p.4). In other words, the nature of the tangible product sectors made it extremely probable that significant differences would hold, compared to the tangible and/or intangible service sectors. However, as shown in Table 6, the vast majority of the companies in our sample belongs to the tangible product sectors. Given the small number of observations of the sample, this fact could affect the outcome of the variable in question. As a result, the importance of having a bigger sample is highlighted also in this case. Another potential explanation of this outcome could be hidden behind the lack of time lags, since our sample contains cross-sectional data. Taking into account the fact that our study contains cross-sectional data, the inclusion of time lags was not possible. Nevertheless, the diversified nature of the different sectors may affect their payback period. Otherwise stated, the investments of the tangible product sectors may be more costly, due to the requirement of raw resources during the production process, compared to the tangible and/or intangible service sectors. Therefore, the authors highly recommend the further examination of industry effects on the relationship between CEP and CFP, while utilizing other samples.

Finally, the present study seems to support hypothesis 5, stating that there is a positive association between firm size and the relationship between CEP and CFP, only in the case that CFP is measured by EPS. This finding supports the similar claim of Aguinis and Glavas (2012) that firm

size works as a moderator of the relationship between CSR and financial performance. This finding contributes to the existing literature by confirming the important claim that a large company with a good performance on CE may experience better economic returns in the case of EPS, compared to a small company. This could be attributable to the effect of the economies of scale. In some cases, investing in CE may initially require quite substantial amounts of money, like for example, in the case of operating a building which uses green energy. In such a case, the economies of scale may assist a large company to see the returns of its investment more rapidly, compared to a smaller company. However, this is not the case with the other performance measures of ROA and ROE, for which the present study does not indicate any significant relationships. Actually, in the case of ROE, the interaction term cannot be included in the final model, due to the lack of joint significance of the factors with the product. A possible explanation for this fact could be again, the nature of ROE as a returns' indicator. As a result, the importance of employing appropriate measures is again highlighted. Another possible explanation for the insignificant results in the cases of ROA and ROE may have to do with the nature of the sample that was utilized. More specifically, only 52 Dutch listed companies were included in the analysis, something that implies that mainly large companies are examined. The lack of smaller companies may have obscured the results. Noteworthy is the fact that this moderate effect of firm size on the relationship between CFP and CEP should not be generalized for all kinds of financial returns, but it should clearly be stated that it holds only in the case of EPS, based on the present study. In fact, further research could provide the present study with a robustness check, or even prove that, while using a more representative sample, this relationship holds also in the case of other financial returns, such as in the case of ROA.

4.3 Limitations

As it may have already been pointed out, the present study is not without its limitations. The first limitation lies in the nature of the data itself; cross sectional data are utilized. This fact does not allow for time lags between the moment of the implementation of a CE initiative and the moment that the initiative will pay off. In fact, VBDO was contacted by the authors and asked whether information on the year of implementation of CE practices of the different companies could be provided. Unfortunately, the answer was negative, since no such information was available.

Another important limitation has to do with the size of the sample. The recommendation of Hair et al. (1998), allowing for 10 observations per variable to be included in a model is not satisfied in the present study. The authors are aware of the fact that this limitation could be the reason why the relationships among different variables may be obscured. In addition, as already mentioned, the limited number of observations may affect the normal distribution of the categorical industry variable. However, in every case, the variables included in the model were the most important ones, based on the existing literature and several tests which were conducted. In this way, the present study substantially contributes to the existing literature by providing fresh and innovative findings that otherwise would still be missing from the existent scarce literature on the topic; no

other samples concerning the concept of CE could be identified by the authors. Besides, the initial attempts of similarly innovative concepts have enriched the academic literature in several cases, even when experiencing sample size limitations, such as in the case of Montabon et al. (2007).

5 Conclusions

This last chapter presents the conclusions of the present study. First, the most important findings are presented. Second, several suggestions for future research are suggested, focusing on the topic of the present study.

5.1 Concluding remarks

The present study investigates the relationship between CEP and CFP, by using a very innovative data source from VBDO. Cross-sectional data are utilized for the year of 2014. The sample consists of 52 Dutch listed companies, for each of which a CEP score has been assigned. Disaggregate data are available via the same database and are utilized in the analysis. Moreover, hypotheses are examined concerning the potential relationships of the tangible product, the tangible service and the intangible service sectors. Firm size is also examined as a moderator of the relationship between CEP and CFP. Additionally, CFP is measured by using ROA, ROE and EPS.

Concerning the theoretical contribution of the present study, several important points are highlighted. First, even though there no existent definition of CE that is widely acceptable, the present analysis seems to clarify the pivotal role of three main points across the various definitions of the term: a) the regenerative and restorative capacity of resources, b) the resource efficiency, and c) the economic growth. Second, the analysis support that the concepts of CE and CSR, as well as the concepts of CE and CSV, differ substantially from each other. The differences are more extensive and intense between the concepts of CE and CSR, since they concern five main dimensions, namely value, context, motivation to employ a strategy, budget and profits. However, substantial differences also exist between the concepts of CE and CSV, focusing on the broader nature of CSV and the fact that CE could be considered to be part of CSV.

Moreover, the findings of the present study indicates that no significant linear relationship exists between CEP and CFP. However, when examining whether a non-linear relationship holds between CEP and CFP, a significant association was discovered. In fact, an inverted U-shape relationship seems to hold between CEP and CFP, according to the sample that was utilized. This fact may imply that there is a CE optimal. This interesting finding could totally change the academic and corporate perspective for CE. Moreover, no significant relationship was discovered concerning the different industry effects; however further research is necessary before coming to any final conclusions. The disaggregate analysis provides some partial insights concerning the Strategy & Governance and Innovation category. More specifically, a positive relationship between Strategy & Governance CEP score and CFP may seem to be present, while a negative relationship between Innovation CEP score and CFP may seem to exist. Additionally, the relationship between the indirect component of Strategy & Governance and CFP seems to be stronger, compared to the direct component of Innovation, something that contradicts the authors' expectations and may require additional research to be clarified. Finally, it is concluded that firm size may work as a moderator on the relationship between CEP and CFP, when CFP is measured

by EPS. The present sample does not facilitate extensive research, so those interesting findings may intrigue further academic research.

The present study adds very fresh and innovative findings that may be of great interest to the corporate and the academic world. To the best of our knowledge, no other existent study examined the relationship between CEP and CFP throughout the academic literature, due to the newness of the CE concept and the lack of databases that measure CEP. Given the lack of academic literature on the specified topic, further academic research could provide further support for the extremely interesting findings of the present study.

5.2 Suggestions for further research

It is quite clear now that the empirical literature on CE is rather scarce. Given the limitations of the present study, it would be of great interest to examine whether similar findings can be concluded after conducting different studies, as well. Ideally, a larger sample size should be utilized, in order to avoid significant limitations. Time lags shall be included, if available, in order to capture the potentially various effects of CE across time. Attention should also be paid at the industry effects, since the limitations of the present study did not allow the authors to draw any conclusions. In fact, Lankoski (2000) supports that the growth of the different industries may affect the relationship between environmental and financial performance. As a result, an interesting study could examine whether this fact hold in the case of CE. In addition, firm size may also entail interesting insights. The present study takes into account mainly larger companies, due to the nature of the available data; the current database contains information on 52 Dutch listed companies. However, the inclusion of companies of different sizes may significantly affect the relationship at stake. Moreover, taking into account the findings of the present study, the power of the disaggregate data could turn out to provide extremely interesting insights on CE returns. A whole study could be conducted with the purpose of examining the different effects of the disaggregate data of CE on CFP.

Another important point to mention here is the fact that the present study focuses on the financial returns that companies implementing CE practices may experience. However, as indicated in the literature section, firm performance can be evaluated in several ways, some of which are not financial, such as in terms of efficiency, or productivity. Especially in the case of CE, such measures would be of added value both to the corporate and the academic world. This is mainly because of the nature of CE, which aims at achieving resource efficiency.

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Appendix

1. VBDO Questionnaire

Category/ Group/ Criterion/ Sub-criterion	Max. points
A. Strategy and governance (30%)	
1. Strategy	
1.1. The corporate or sustainability strategy makes explicit reference to the circular economy or related concepts, such as bio-based economy, cradle-to-cradle, cycling of materials, zero waste and CO2/ energy/ emissions neutrality	1
1.2. The company specifies why the circular economy is important for its business	1
2. Long-term strategy	
2.1. The company has a long-term vision for (at least) 2025	1
2.2. The company has a long-term vision for (at least) 2050	1
3. Targets	
3.1. The company has set SMART targets on its circular ambition	1
3.2. The company has set the following targets relating to the circular economy: (A company satisfying most or all of the sub-criteria 3.2.1 to 3.2.4 can score no more than two points. More specifically, if the company satisfies only one of these sub-criteria, it scores one point. If it satisfies two or more sub-criteria, it scores the maximum number of two points for this criterion.)	2
3.2.1. Percentage or amount of reduced waste in the production process	
3.2.2. Percentage or amount of input materials/ products that are reused, recycled, renewable, bio-based or sustainable	
3.2.3. Percentage or amount of products at the end of life cycle that are reused, recycled, retrieved, remanufactured, repaired or refurbished	
3.2.4. Percentage or amount of renewable energy	
3.3. Some of these circular targets reach beyond the direct sphere of influence of the company (e.g. they also require supplier cooperation)	1
3.4. Progress against these circular targets is clearly reported and includes a statement on whether or not targets were achieved	1
4. Accountability	
4.1. It is clear who is responsible for the implementation of the sustainability strategy	1
B. Implementation (30%)	
5. Revenue from circular products and services	
5.1. It is clear what revenue is generated from circular products and services	1
5.2. Circular products and services constitute more than 5% of the company's total revenue	1

5.3. The percentage above increased over the past year	1
6. Product design	
6.1. The company performed circular/ life cycle assessments of some of its existing products or services	1
6.2. The company developed a clear approach aimed at: (A company satisfying most or all of the sub-criteria 6.2.1 to 6.2.8 can score no more than four points. More specifically, if the company satisfies up to three of these sub-criteria, it scores one point for each one of them. If it satisfies four or more sub-criteria, it scores the maximum number of four points for this criterion.)	4
6.2.1. Substituting unsustainable input materials for reused/ recycled/ renewable/ bio-based/ sustainable materials	
6.2.2. Reducing waste in production	
6.2.3. Reducing waste in consumption (e.g. by leasing products)	
6.2.4. Increasing reusability of materials at products' end of life cycle	
6.2.5. Extending product lifespan (of durables)	
6.2.6. Managing materials loops or securing commodities	
6.2.7. Keeping product components pure by preventing blending with other substances	
6.2.8. Separating the technical cycle (of assembled products) from the biological cycle (of materials)	
6.3. The company actively contributes to up-cycling of materials	1
7. Procurement	
7.1. The company formulated expectations regarding the circular performance of its suppliers	1
7.2. The company set a minimum threshold of reused/ renewable/ bio-based content for some goods in order to be eligible for purchase	1
C. Innovation (20%)	
8. Circular business models (e.g., new ownership structures, closed products/ materials/services loops, zero-waste, up-cycling)	
8.1. The company piloted one or more circular business models or products in the past year and reports on the results	1
8.2. All circular pilots have a rollout plan	1
8.3. The company has rolled out one or more circular business models or products in past years	1
9. Innovation budget	
9.1. The company states the budget available for sustainable innovation	
10. Strategic partnerships	
10.1.The company engages in one or more supply chain partnerships aimed at realizing a circular supply chain or improving the circular performance of its products	1

10.2.The company is a member of organizations aimed at a circular transition, such as Circle Economy, MVO Nederland (Initiative Circular Economy), De Groene Zaak, Dutch Sustainable Growth Coalition, and the Ellen MacArthur Foundation	1
10.3.The company describes its level of participation in its most important circular economy partnerships in the past year	1
10.4.The company is exploring possibilities to use other companies' waste streams as input for its own production processes or to redirect its waste to other companies' production processes	1
D. Communication and engagement (20%)	
11. Customers	
11.1. Customers are actively involved in circular economy topics through interactive media (e.g. apps, online discussion platforms, or events)	1
12. Stakeholders	
12.1. The company engaged with external stakeholders on circular economy in the past year (in a stakeholder dialogue)	1
12.2. The company engaged with internal stakeholders (employees) on circular economy in the past year (e.g. in a stakeholder dialogue or training)	1
13. Raising awareness	
13.1. General information about the importance of the circular economy is available on the corporate website	1
13.2. Company-specific information about the circular performance of some products or services is available on the corporate website	1
13.3. The company shares its experiences/challenges/lessons learned from working on circular economy	1

2. Companies' scores

Company name	**Total score**	**Strategy & Governance**	**Implementation**	**Innovation**	**Communication & Engagement**
BAM Group	84	8-10	4-7	6-8	5-6
DSM	81	8-10	4-7	6-8	5-6
Philips	76	8-10	4-7	3-5	5-6
Unilever	65	8-10	4-7	3-5	5-6
Air France-KLM	64	8-10	4-7	3-5	3-4
RELX Group	63	8-10	4-7	3-5	3-4
AkzoNobel	60	8-10	4-7	3-5	0-2
Heijmans	57	8-10	4-7	3-5	0-2
ArcelorMittal	55	4-7	4-7	3-5	5-6
KPN	54	8-10	4-7	3-5	0-2

Boskalis Westminster	52	4-7	0-3	6-8	5-6
Ahold	51	4-7	4-7	3-5	3-4
Heineken	42	0-3	4-7	3-5	0-2
Wolters Kluwer	40	4-7	4-7	0-2	0-2
TKH Group	38	4-7	4-7	0-2	0-2
Aperam	37	4-7	4-7	0-2	0-2
Arcadis	37	0-3	4-7	3-5	3-4
Telegraaf Media Groep	36	0-3	4-7	3-5	0-2
Wessanen	31	4-7	0-3	0-2	0-2
Shell	31	4-7	0-3	3-5	0-2
Corbion	30	0-3	4-7	3-5	0-2
Beter Bed	27	4-7	0-3	0-2	0-2
Kendrion	26	0-3	0-3	0-2	0-2
ASML	26	4-7	4-7	0-2	0-2
Ballast Nedam	24	0-3	4-7	3-5	0-2
BE Semiconductor Ind.	22	4-7	0-3	0-2	0-2
Gemalto	20	4-7	0-3	0-2	0-2
Nutreco	20	0-3	4-7	0-2	0-2
Ten Cate	20	4-7	0-3	3-5	0-2
Airbus Group	19	0-3	0-3	0-2	0-2
Wereldhave	18	0-3	0-3	0-2	3-4
Crown van Gelder	17	0-3	4-7	0-2	0-2
Aalberts Industries	16	0-3	4-7	0-2	0-2
PostNL	16	0-3	4-7	0-2	0-2
Accell Group	16	0-3	4-7	0-2	0-2
Sligro	13	0-3	4-7	0-2	0-2
SBM Offshore	13	0-3	0-3	3-5	0-2
ASM International	11	0-3	0-3	0-2	0-2
Grontmij	9	0-3	0-3	0-2	0-2
AMG	8	0-3	0-3	0-2	0-2
Acomo	8	0-3	0-3	0-2	0-2
TNT Express	6	0-3	0-3	0-2	0-2
Eurocommercial Properties	5	0-3	0-3	0-2	0-2
Holland Colours	5	0-3	0-3	0-2	0-2
Nedap	5	0-3	0-3	0-2	0-2

NSI	3	0-3	0-3	0-2	0-2
Fugro	0	0-3	0-3	0-2	0-2
Macintosh Retail Group	0	0-3	0-3	0-2	0-2
OCI Nitrogen	0	0-3	0-3	0-2	0-2
Ordina	0	0-3	0-3	0-2	0-2
Vastned	0	0-3	0-3	0-2	0-2
Vopak	0	0-3	0-3	0-2	0-2