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Business Performance In
The Dutch Circular Economy

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1. INTRODUCTION

"The model of a linear economy, in which it is assumed that there is an unlimited supply of natural resources and that the environment has an unlimited capacity to absorb waste and pollution, is dismissed. Instead, a Circular Economy is proposed, in which the throughput of energy and raw materials is reduced" (Cooper, 1999).

1.1. BACKGROUND CIRCULAR ECONOMY

Since the emergence of the capitalistic economic system around 250 years ago there has been an exponential growth of both population and its material usage. World population has been using more materials with a factor of 34, 27 times more minerals, twelve times more fossil energy carriers and four times more biomass (Krausmann et al, 2009). At the same time, waste generation is growing and the amount of waste will be tripled by 2100 (Goto, 2013). According to these numbers, the current economic 'take-make-waste' system will not hold (European Commission, 2015). Within the context of sustainability, several business models have been created limiting environmental damage while keeping business performance at a profitable level (Fiksel, 2001). One of those economic models is the Circular Economy (CE).

The Circular Economy is an economic, industrial and environmental system based on product- and resource re-usage and the restorative capacity of natural resources. The Circular Economy aims to create value at each stage of the supply chain and to minimize environmental destruction (Ellen MacArthur Foundation, 2012). In the Circular Economy waste is reused as a resource, which transforms the economy from a linear to a circular model (Murray & Skene, 2015). An absolute Circular Economy would demonstrate new incorporated systems of value creation, production and consumption. The growth in production and consumption will not be linked to environmental damage anymore (Wu, 2005). The term Circular Economy reflects its contradiction with the linear economy where the concept refers to two cycles of importance: the recycling cycle and the biogeochemical cycle (Murray et al, 2015). The biogeochemical cycle is referred to as the length of time for a biological or chemical aspect to recover, for example it takes nine days for water to complete a cycle while it takes 37000 years for an ocean to complete a cycle (Murray, 1992).

Three levels of the Circular Economy are defined by Murray et al (2015). The (inter)national/municipality level focusses on the industrial level. The concepts of a Circular Economy has been adopted in China's 11th and 12th five year plans as from 2002 with the aim on cleaner production, pollution prevention and waste control (Zhou et al 2014). The inter-firm cluster level refers to the specific links within the supply chain, for example eco-industrial parks. The single enterprise level includes the firm level of clean production such as closed loop (re)manufacturing. The Ellen MacArthur Foundation defined four sources of value creation within the circular business model at the single enterprise level; (1) The power of the inner circle reflects the gains from decreased production costs, (2) the power of circling longer includes various ways of increasing a product's lifetime, (3) the power of cascading use involves recycling and (4) improving efficiency and productivity is the power of the pure circle.

The gains are in threefold: economic, environmental and social. According to McKinsey (2015), moving towards a Circular Economy could profit Europe both environmentally and economically as it will generate an economic net profit of 1.8 trillion euros in 2030. TNO found many opportunities for businesses operating in the Circular Economy in the Netherlands including a total market value of 7,3 billion euros per year, creating 54000 jobs. Environmental gains potentially include CO^2 emission reduction of 17.150 kt, reduction land use of 2.180 km^2, 0.7 billion m^3 avoided fresh water use and 100.400 kt avoided raw material use. The social gains are less clear. Possible social gains could be the development of knowledge for export leading to economic gain, less volatile resource supply, increased incentives for manufacturing and recycling and the development of new economic activity (TNO, 2013).

1.2. RESEARCH PROBLEM

The Dutch government, the European Union, multiple organizations and financial companies desire to change the Dutch linear economic system into a Circular Economy where waste is minimized and efficiency is optimized (Rijskdienst voor ondernemend Nederland, 2016; European Commission, 2015; Ellen MacArthur Foundation, 2015; DSGC, 2015; ING, 2015; TNO, 2013). Even though many initiatives have started, it will take time to change the Dutch economy into a Circular Economy.

Circular businesses focus on the creation of circular supplies, resource recovery, product life extension, sharing platforms and leasing (Ellen MacArthur Foundation, 2013). These type of business models require investments in redesigning

products, product-lines and the overall supply chain leading to high costs. In addition, price sensitivity and unclear customer preferences cause uncertain demand. How can those businesses survive in our current capitalistic system?

Literature has found multiple links –positive and negative- between environmental performance and business performance (Zeng et al, 2011; Russo & Fouts, 1997; Konar & Cohen, 2001; Yang et al, 2011). Most of these studies have been based on interpretations of environmental performance or on measurable environmental performance such as air-pollution. The gap in the literature lies with the actual business performance of circular businesses. The existence of circular businesses is fundamental for such an economy, although the current business environment is making it difficult for circular business to gain profits. Among other factors, high competition from linear companies make is difficult for circular businesses to set food in the market (Renswoude et al, 2015). This research will focus on Dutch circular businesses, compares the business performance of circular business with linear business and identifies the predominant factors contributing to a successful Dutch circular business.

1.3. OBJECTIVE OF THE STUDY

The main objective of this research is to analyze the business performance of companies operating in the Dutch Circular Economy and compare this with the business performance of Dutch linear companies. The analysis of the business performance of circular companies entails the identification of the decisive variables on which a circular business is profitable or not.

The following research questions will help achieve this objective:

1. How does the circular business model work and how does this differ from the linear business model?
2. How does the business performance of circular companies differ from the business performance of linear companies in the Netherlands?
3. Which business characteristics are decisive in explaining circular business performance?

Distinction should be made between full circular businesses and transitional (multinational) companies. Multinational companies such as Philips, DSM, Unilever, ArcelorMittal and others have already set steps in the transition towards a circular business model, but still have highly non-circular practices (excessive resource use, waste creation, and air pollution) in other departments. Circular companies have incorporated a circular business model. This research focuses on the full circular companies.

1.4. OUTLINE

This thesis is structured as follows. Chapter 2 presents a literature review including an overview of how circular business models are categorized, the characteristics of circular business models and the value creation opportunities and additional costs of circular businesses. In addition, previous research linking environmental performance with business performance is analyzed and summarized. Chapter 3 provides the materials and methods used in this research including the conceptual framework, sample selection and collection, data analysis and hypotheses. Chapter 4 presents the results of research question two and three. Chapter 5 presents the discussion conclusion and recommendations for further research.

2. LITERATURE STUDY ON CIRCULAR BUSINESS MODEL PERFORMANCE

2.1. CIRCULAR BUSINESS MODELS

According to Linder and Williander a circular business model is "a business model in which the conceptual logic for value creation is based on utilizing the economic value retained in products after use in the production of new offerings" (Linder & Willander, 2015). As Linder and Williander emphasize re-usage of waste materials, Mentink defines a business model as "the rationale of how an organization creates, delivers and captures value with and within closed material loops" (Mentink, 2014). On the other hand links Scott (2015) the circular business model to sustainability when he states: "a concept used to describe a zero-waste industrial economy that profits from two types of material inputs: (1) biological materials are those that can be reintroduced back into the biosphere in a restorative manner without harm or waste (i.e. they breakdown naturally); and (2) technical materials, which can be continuously re-used without harm or waste".

The Circular Economy is a combination of various schools such as Cradle to Cradle (McDonough & Braungart, 2010), Blue economy (Pauli, 2010), Industrial Ecology (Allenby & Greadel, 1993), The Performance economy (Stahel, 2006), Regenerative Design (Lyle, 1994), Natural Capitalism (Hawken et al, 1999), Industrial Metabolism (Ayres, 1994) and Industrial Symbiosis (Esty & Porter, 2008). As the Circular Economy is a combination of various schools, a circular company can take different forms and could operate in (almost) all types of sectors. A clear definition and categorization of business models is therefore necessary in order to draw a line between circular and linear companies.

Literature used three different ways of categorizing circular business models. The first, and most frequent used is created by the MacKinsey Foundation & Accenture in 2012. The second is the ReSOLVE framework including six business processes: Regenerate, Share, Optimize, Loop, Virtualize and Exchange. The third categorization is a combination of the previous two models combined with other literature of the Ellen MacArthur Foundation and the ISMA report. The three frameworks are discussed below.

Accenture's Business model framework

The simplest and most used circular business model framework is the following consisting of five broad business models based on the function of the business. This model is first created by Accenture (2014), but widely copied by various reports and websites. The main advantage of this framework is the categorization of business models by their function within the Circular Economy and clearly states the product outcome of such a business model.

- Circular suppliers - Providers of renewable energy, recyclable input materials.
- Resource recovery - Extracting resources/energy from disposed products.
- Product life extension - Maintain and extent product life time.
- Sharing platforms - Enabling product sharing.
- Product as a service - Leasing.

ReSOLVE framework

Lewandowski (2015) has captured all literature relating to circular business models and categorized according to the ReSOLVE framework. This work provides an overview of all circular business models and is more extensive than the circular business model framework build by Accenture. The main categories; Regenerate, Share, Optimize, Loop, Virtualize and Exchange have subdivisions which makes categorization more precise. In table 1, the ReSOLVE framework according to Lewendoski is presented with an explanation per subcategory.

TABLE 1: CIRCULAR BUSINESS MODELS ACCORDING TO THE RESOLVE FRAMEWORK OF LEWENDOSKI (2015).

Circular business models	Explanation
Regenerate	
Energy recovery	Conversion of non-recyclable waste into heat, electricity, fuel
Circular supplies	Using renewable energy
Efficient buildings	Using efficient buildings for activities
Sustainable product locations	Using eco-industrial parks for activities
Chemical leasing	Producer sells functions performed by chemical
Share	
Maintenance and repair	Extended life cycle through maintenance/repair
Collaborative consumption, sharing platforms, product renting, sharing, pooling	Enable product sharing
PSS: Product lease	Exclusive use of product
PSS: Performance based	Exclusive use of service
Incentivized return and reuse of next-life-sales	Collection and distribution of used products
Upgrading	Replacing products with better quality
Product attachment and trust	Products with increased life-time due to attachment and trust
Bring your own device	Users bring own devices to get access to services
Hybrid Model	Durable products with consumables
Gap-exploiter model	Use 'Life-time value gaps'
Optimize	
Asset management	Collection and resale products
Produce on demand	Make to order
Waste reduction, housekeeping, lean thinking, fit thinking	Waste reduction in producing
PSS: Activity management/outsourcing	Use outsourcing to produce lean
Loop	
Remanufacture, product transformation	Restoring products, improve quality
Recycling, resource recovery	Recovery of resources from products
Upcycling	Reuse materials and upgrade value
Circular supplier	Using circular supplies as resource
Virtualize	
Dematerialized services	From physical products to virtual service
Exchange	
New technology	Use new technology for production

The six circle Framework

The six circle framework is created by Renswoude et al. (2015). For their framework they used the four circle theory created by the Ellen MacArthur foundation (2012) and added two extra cycles. With the help of these identified cycles, they created the following categorization presented in table 2 (Renswoude et al, 2015) and later also used by The Dutch Association of Investors for Sustainable Development (VBDO) (Loannou et al, 2015). The main advantage of this framework is its combination of the Circular Economy theory and its practical implementation. In addition, sub-categories are created which makes it easier to divide the different types of business models.

TABLE 2: THE SIX CIRCLE FRAMEWORK ACCORDING TO RENSWOUDE ET AL. (2015)

Circular business model	Explanation
Short cycle	Maintenance, repair and adjustment of products and services
Pay per use	One-time payment to use product/service
Repair	Repair for product life extension
Waste Reduction	Reduce waste in production process
Sharing platforms	Share products and services among users
Progressive purchase	Periodically pay amount before purchase
Long cycle	Increasing product lifetime
Performance based contracting	Long term contracting, owner responsibility
Take back management	Ensure product to get back to producer
Next life sales	2nd hand products

Refurbish and resell	Adjustment and resell
Cascades	Reusing waste
Upcycle	Product Value upgraded and reuse product
Recycling	Product materials cascaded and reused ,recycled, disposed
Collaborative production	Cooperation in value chain in order to close loop
Pure circles	Improving efficiency and productivity in order to achieve 100% re-usability of products and materials.
Cradle to Cradle	Product redesign to create closed loop
Circular sourcing	Source only circular products
Dematerialized services	From visual product to virtual services
Physical to virtual	From physical product to virtual service
Subscription based rental	Periodically pay amount to use service/product
Produce on Demand	Make to order services
Produce on order	Make to order
3D printing	3D printing
Customer vote	Engineer to order

2.2. THE COMMON CHARACTERISTICS OF CIRCULAR BUSINESS MODELS

Literature provides multiple types of characteristics of circular business models. Due to the broad concept of the Circular Economy, the characteristics have been narrowed down and categorized according to the six circle business models created by Renswoude et al. (2015).

On the vertical axe the characteristics are presented provided by four literature sources (Ellen MacArthur Foundation, 2012; Renswoude et al, 2015; Marinelli & Laubscher, 2014; DSGC, 2015). The characteristics are then divided according to the business models they refer to. Circular business models do not have to comply with all the categories. Various characteristics noted in the literature overlap and are therefore combined in table 3.

TABLE 3: CHARACTERISTICS OF CIRCULAR BUSINESS MODELS CATEGORIZED ACCORDING SIX CIRCLE BUSINESS MODELS

Characteristics	Short cycle	Long cycle	Cascades	Pure cycles	Dematerialized services	Produce on demand
Build resilience through diversity[1]				X		
Work towards energy from renewable sources [1,4]			X	X		
Think in systems[1]	X	X	X	X	X	X
Think in cascades[1,4]	X	X	X	X		
Ownership of items remains with the producer [2,4]	X	X		X	X	
Functionality is intended[2]	X	X	X	X	X	X
Holistic systems perspective[2]			X	X		
Resource inputs minimized[2,4]		X	X	X	X	X
Waste creation minimized[1,2,4]	X	X	X	X	X	X
Future oriented & out of the box[3]				X		
Customer access over ownership, pay for performance [3]					X	X
Business model innovations, from transactions to relationships via service and solution models[3]				X	X	X
Reverse cycles, including partners outside current value chains [3]			X	X		
Innovations for material-, component-, and product reuse, product designed for disassembly and serviceability[3]			X	X		
Maximizes the use of secondary resources and manages the entire value chain accordingly[4]	X	X	X	X	X	X
Design product for easy recycling (eco-design) and refurbisment[4]			X			

Encourages staff and management to adopt a 'circular approach' in their thinking and actions[4]	X	X	X	X	X	X
Strives for an optimal balance between financial, social and ecological value[2,4]	X	X	X	X	X	X

[1] Ellen MacArthur Foundation, 2015

[2] Renswoude et al, 2015

[3] Marinelli & Laubscher, 2014

[4] DSGC, 2015

2.3. MEASURING CIRCULARITY

A company is never 100% circular (Renswoude et al, 2015). For practical and physical reasons it is not yet possible to produce with zero waste. Where companies transforms waste into energy, there is CO_2 pollution and water pollution as externalities and service oriented companies produce waste resulting from the cafeteria and paper. When looking at the whole picture, all circular business models together could form a closed loop system, where one company produces, the other collects (waste, used products) and the other recycles, reuses or refurbish the product (Mentink, 2014).

Besides categorizing companies into different types of circular business models as is shown in section 2.1, attempts have been made to put a number on circularity. One of those is the Re-Rate: a key performance indicator created by DSGC (2015). The re-rate compares the value of the input materials before manufacturing with the value at the end-of-the life time product, taking the length of the life of the product into account. Value in this case could be defined in economic, environmental or social terms, or a combination. In addition to the measurement is the calculation of the life-time length, where re-used product (components) can have a higher rate than low value recycled materials (DSGC, 2015). Another approach has been made by the Ellen MacArthur foundation (2015) which created a framework to measure the 'Material Circularity Indicator' (MCI). This is value between 0 and 1 and can be calculated with the help of the Bill of Materials. For this calculation also the input value is determined but relating to the recycled materials/components. The utility is measured, destination after use is defined (landfill/energy recovery/recycling/re-usage) and the final rate is then calculation as a value of efficiency in the recycling process. Then, in order to measure the firm's circularity, the MCI of all company's product should be calculated and aggregated. But in order to take the more practical way, companies can use a 'reference product approach' so that the MCI will be computed for a list of reference products (Ellen MacArthur Foundation, 2015). In any case, measuring these values will be time consuming and is therefore difficult to implement on a large scale and leaves out other waste factors such as environmental externalities.

The Dutch Association of Investors for Sustainable Development (VBDO) 'Benchmark circular business practices 2015' compared 52 Dutch listed companies on their circularity. In this study, 52 listed Dutch companies are investigated with regard to 32 criteria which can be subdivided in the following four groups: strategy and governance, implementation, innovation, communication and engagement. Each company was assessed by their annual-, sustainability reports, websites and publications and points were accredited to them manually. This has been a highly subjective study and very sensitive for greenwashing. Greenwashing is the practice of corporations whereby the reputation is managed through some action of sustainable and/or social activities even though these activities contradict with the general behavior of the corporation (Ramus & Montiel, 2005).

2.4. VALUE CREATION FOR CIRCULAR BUSINESSES

Literature has found various ways in which circular business models could create value and therefore keep up with linear businesses. First of all, gaining competitive advantage is an internal driving force for value creation and is seen as an incentive to implement environmental management (Aragon-Correa et al, 2008). For example, implementing clean production technologies (Zeng et al, 2010), change internal supply chain and product design (Ramus & Steger, 2000) and reduce cost of production (Sharma, 2000). Businesses can build great competitive advantage due to three organizational capabilities identified by Aragón-Correa et al. (2008): shared vision, stakeholder mangement and strategic proactivity. Those organizational capabilities create closer interaction, flexibiliy and entrepreneurial orienation. It proved to pay-off to have very pro-active practices as it reflects in a positive financial performance (Aragon-Correa et al, 2008). An interesting finding of Zeng et al. (2011) is that of the three external driving forces (government, market and social), the governmental driving force has lesser impact that the other internal and external forces (Zeng et al. 2011). Tushman and Nadler stated already in 1986: 'Organizations can gain competitive advantage only by managing effectively for today while simultaneously creating innovation for tomorrow'. This quote reflects the need to be 1) effective and profitable in the short run and 2)

innovative in the long run which is the main challenge of circular businesses. A study conducted on SMEs in Lithuania stated that one of the sources of incentives comes from competitive advantage (Vasilenko & Arbaciauskas, 2012).

Secondly, the Circular Economy enables companies to generate additional revenue streams. Revenue creation can be achieved via three ways. Reuse, reclaim and recycle strategies enable circular companies to extract additional revenues from end-of-lifetime products (Park et al, 2010). Waste sales create additional revenues streams in two ways: 1) the waste could be used as a resource for another company and therefore can be sold and 2) the waste-producing company does not have to pay a dumping fee for the waste. 'Value is achieved through the market for waste' (DSGC, 2015). In addition, premium pricing could be used if the consumer is willing to pay the price.

Thirdly, long term contracts could create long-term revenue streams. In a Circular Economy, there is a shift from customer owned products to producer owned products which implies long-term relationships between the manufacturer and the user of a product. This will cut the costs manufacturing due to product life extension and will generate steady and long term revenues streams. This could have two additional positive effects; 1) the creation of customer loyalty and 2) the creation of additional useful information streams (DSGC, 2015; ING, 2015).

Fourth of all, improved internal resource management leading to supply chain resiliency can have a positive impact on the firm's revenue streams and competitiveness and risk management. The capacity to reuse, reclaim and recycle resources could both decrease resource costs once they negative fluctuate and created positive advantages over less-resource efficient companies (Park et al, 2010; DSGC, 2015). Case studies performed on remanufacturing present a series of successful and revenue creation companies through reuse, reclaim and remanufacture strategies by building a reverse supply chain (Walsh, 2012).

The last revenue creation model is through the creation of beneficial partnerships throughout the value chain. Circular businesses will change the logistics in such a way where value chains will reverse and interfere. This will strengthen strategic partnerships and corporations throughout the chain. In addition, new SMEs could fill in the gaps as an intermediary within the chain (DSGC, 2015).

TABLE 4: VALUE CREATION METHODS FOR CIRCULAR BUSINESS AND RELATED SOURCES

Value creation	Source
Competitive advantage	Aragon-Correa et al, 2008; Zeng et al, 2010; Ramus & Steger, 2000; Sharma, 2000; Zeng, 2011; Vasilenko & Arbaciauskas, 2012
Generate additional revenue streams	Park et al, 2010; DSGC, 2015
Steady long-term streams	DSGC, 2015
Improved internal resource management	Park et al, 2010; DSGC, 2015; Walsh, 2012
Beneficial partnerships	DSGC, 2015

2.5. ADDITIONAL COSTS OF CIRCULAR BUSINESS MODELS

Circular business models require investments in redesigning products, product-lines and the overall supply chain leading to high costs. In addition, price sensitivity and unclear customer preferences could cause uncertain demand and supply. The additional costs of circular companies are in sharp contrast with those of linear companies, taking the take-make-waste approach where investment costs and uncertainty are relatively lower. Assessing the (potential) extra costs and extra revenues (section 2.4) could provide an insight on the market chances of circular businesses.

The literature did not put forward in a clear matter what the exact cost structure of a circular business model would look like (Lewandowski, 2015) but some of the literature did bring up the costs of 'green innovations' for small to medium size start-ups (Vasilenko & Arbaciauskas, 2012; Lawrence et al, 2006; Trianni & Cango, 2006). Cost reduction proved to be a major incentive for SMEs to behave in a sustainable matter (Vasilenko & Arbaciauskas, 2012; Lawrence et al, 2006) and it is therefore of major importance to determine the draw backs in costs for circular SMEs. Especially the indirect hidden costs, investment costs and payback periods have a huge impact on the total profit and loss account of circular companies.

Indirect hidden costs of green innovation business models are costs relating to time and human resources needed for the business. Literature states that these indirect costs constitute to be a critical obstacle due to shortage of time and human capital in SMEs. Clear examples of indirect hidden costs are the available management hours, sufficient human resources

(does the staff have adequate know how and skills?) (Iraldo et al, 2010; Hollins, 2011; Seidel, 2008). Iraldo et al (2010) argue that the smaller the enterprise, the more time and knowledge constrains seem to be.

In addition there are increased transaction costs relating to the costs of legal issues surrounding collateral and its value (DSGC, 2015; ING, 2015). In a linear situation, the ownership over a product is bought by the consumer. For specific circular business models, the producer keeps ownership over the entire lifetime of that product. Which means that there are service related transactions costs when (1) the product is 'rented' by the consumer and (2) when the product is returned to the producers. Lawrence et al (2006) argue that stategically focused consumer/producer networks could reduce the transaction costs and increasing information streams.

Costs could also occur due to an inconsistent flow of input/output. For business models categorized in the long cycles, cascades or pure cycles this could be a source of additional costs. These business models are highly dependent of the flow of used materials in order to create output. Among others, companies with an upcycle and recycle business model are dependent on the incoming flow of used materials. If this flow is inconstant, it is different to manage production lines efficiently and therefore could the production costs increase. Investment costs and pay-back periods worry SMEs and not without reason: green companies are more sensitive to additional financials costs compared to large enterprises with an existent customer base (Hollins, 2011; Rademaekers et al, 2011). For example, case studies indicated that the collection and recycling of waste for a small company could be a time-consuming effort, when the economic gains are low (Eunomia Reserach and Consulting, 2011; WRAP, 2007). The investment costs of setting up supply and information network for reversed goods can be extreme high, especially for SMEs (Lopes-Cardozo, 2016). When such a system is set up, the reverse material and information flow have to be handled accordingly which translates in cost relating to wages, transport, systems and time. In addition, the ING (2016) stated that the accounting measures for circular firms a different than those for linear firms which imposed transformation costs of accounting systems (ING, 2015).

Skanberg & Berglund (2015) stated that new policy measures can be considered by governments and financial corporations in order to reduce costs for green SMEs; ''proactive use of public procurement, earmarking investment in favor of resource efficiency within EUs funding schemes, adoption of resource efficiency targets and the promotion of new business models geared at functional sales.'' In addition, they note that structural change in taxation is needed whereby fewer taxes are levied on labor. In fact, they oppose a tax scheme whereby fewer taxes are levied on workhours and more on consumption of non-renewable resources. Additionally, there is a need to re-analyze the current VAT system where no additional taxes are levied on secondary materials in order to promote re-usage, remanufacturing and refurbishment. (Skanberg & Berglund, 2015) Table 5 present the sources and identified costs in a clear overview.

TABLE 5: ADDITIONAL COSTS FOR GREEN COMPANIES AND RELATED SOURCES

Costs	Sources
Indirect hidden costs	Iraldo et al, 2010; Hollins, 2011; Seidel, 2008
Transaction costs	DSGC, 2015; ING, 2015; Skanberg & Berglund, 2015
Cost of Inconsistent input/output flow	ING, 2015
Investment costs	Lopes-Cardozo, 2016
Accounting costs	ING, 2015

2.6. FINANCING CIRCULAR BUSINESS MODELS

Skanberg and Berglund (2015) stated that the additional level of investment for a national economy to move toward a Circular Economy has been calculated in the range of 3% of its GDP per annum, this means around 20 billion euros in the Netherlands. (Skanberg & Berglund, 2015) Even though several institutions are aware of the necessity of financing, literature indicates that there is a significant financial barrier for small to medium circular business start-ups. SMEs face difficulties in obtaining bank financing, as banks consider 'green' companies as risky (Muller & Tuncer, 2011; Hyz, 2011; ING, 2015; Vasilenko & Arbaciauskas, 2012).

The ING (2016) concluded that foundations and impact investors are most likely to finance circular SMEs as most starting SME are not profitable in the beginning phase. This type of finance can fill the gap from pilot- to growth phase. In addition, Venture capitalists, private equity and family resources also proved to be a source for circular start-ups, but preferably those with a secured growth rate and a fast payback period. For example, Circularity Capital and Circular Economy Investment Fund are investment funds with the goal of providing funds and knowledge in the growth stage of circular SMEs (such as Circularity Capital and Zero Waste Schotland). Interesting to note is that ING also puts 'near banks' forward which

include companies such as Google, Apple, Amazon as financing parties. Crowd funding such as Peer2Peer lending and equity investment is only applicable for those ideas likable to the major public and do not necessarily have the most promising business model (ING, 2015). Working Group Finance created a report weighting the risks of investing in circular business models to the financial benefits. They state: ''It is essential that shareholders, customers, suppliers and third-party finance providers, including banks and asset lenders, understand the longer-term objectives and the benefits that will arise from investment in circular businesses''.

Subsidies could prove to be a large incentive for SMEs to develop sustainable innovations according to a study in Lithuania (Vasilenko & Arbaciauskas, 2012). The Dutch government provides government funding for 'green' entrepreneurs. MIA (environmental investment deduction) and VAMIL (Arbitrary depreciation of environmental investments) are arrangement created by the Dutch government to promote green investment. The Circular Economy receives special attention especially with regard to the bio-based economy, recycling and prevention of excessive resource use (Rijskdienst voor ondernemend Nederland, 2016). Additional subsidies are provided by smaller government organs for example the province Friesland in the north of the Netherlands provides an €83000 subsidy to companies developing in the Circular Economy (Frysk). On a larger scale announced the European commission a €24 billion funding in order to facilitate the transition from a linear economy into a Circular Economy (Furlong, 2016).

2.7. LINKING CIRCULAR BUSINESS PERFORMANCE WITH FINANCIAL PERFORMANCE

Many data sources relating to profitability in the Circular Economy are written by firms and organizations and the basis of these reports is therefore not scientific supported. Examples of those companies are; Ellen MacArthur Foundation, Accenture, DSGC (Dutch Sustainable Growth Coalition), the Circle economy, MVO Nederland and several reports provided by national banks such as ING.

Scientific literature relating to the Circular Economy frequently takes a very general approach based on the holistic view of the economic system (Skanberg & Berglund, 2015) or a qualitative approach of research. In order to link circularity positive or negative to business performance, it is necessary to put circular business performance within the framework of environmental performance. In table 6, previous research relating to the measurement of effect on environmental performance to financial performance is listed. The column on the left shows the research performed by whom, then in short information on the methodology and dataset shown. The third column presents the positive or negative effect of environmental performance on business performance. The last column shows the company size on which the research is performed. Some interesting conclusions can be drawn from this table. First of all, most research is based on multinational cooperatives, or at least stock listen firms from which data is more accessible. Another interesting observation is that most research is focused on manufacturing firms, even though the impact of environmental changes is assumed to be larger for manufacturing firms, this difference between impacts can be different when looking at circular business models.

TABLE 6: RESEARCH LINKING ENVIRONMENTAL PERFORMANCE WITH FINANCIAL PERFORMANCE

Source	Methodology and dataset where relevant	Effect*	Company size**
Zeng et al, 2011	Case study, questionnaires, survey, regression analysis	+	SMEs
Russo & Fouts, 1997	Regression analysis, data from FRDC and compustat, quantitative	+	MNC
Konar & Cohen, 2001	Regression analysis	+	MNC
González-Bendito & González-Bendito, 2005	Survey, Regression analysis	NA	Medium-Large
Yang et al., 2011	Structural equation modelling (SEM)	-	MNC
Montabon et al, 2007	Content analysis, canonical correlation, from data and surveys	+	MNC
Schaltegger & Synnestvedt, 2002	Theoretical framework explaining coexistence conflicting views	NA	NA
Klassen & McLaughlin, 1996	Theoretical model, financial event methodology, archival data	+	MNC
Florida, 1996	Survey methodologies of manufacturing practices	+	MNC
Vance, 1975; McWilliams & Siegel, 2000	Regression analysis	+, N/A	MNC
Waddock & Graves, 1997	Regression and lagged variables	+	MNC
Preston & O'bannon, 1997; Stanwick &	Survey, Regression of multiple cross-section for 1982-1992 & 1987-1992	+	MNC

Stanwich, 1998			
Griffin & Mahon, 1997; Orlitzky et al, 2003; Frooman, 1997	Meta-analysis	-,+,+	MNC
Fogler & Nutt, 1975	Cross-section valuation models	N/A	MNC

*+positive effect environmental performance on business performance, -negative effect environmental performance on business performance, NA (no data available). **SME (Small Medium Enterprise), MNC (Multinational Corporation), NA (No data Available)

In table 7 the measurement indicators are presented which are used for previous research. The literature is categorized per economic- and environmental measurement indicator used. Especially the economic measurement indicators are interesting for this research providing information on how other researchers quantified their data or deliberately used qualitative subjective data sets. The most used business performance indicator presented in table 7 is the ROA (Return on Assets). Some studies used multiple indicators of business performance and are therefore presented at different measures.

TABLE 7: REVIEW ON ECONOMIC AND ENVIRONMENTAL MEASUREMENT INDICATORS USED FOR RESEARCH

Economic measures:	**Source**
ROA	Zeng et al, 2011; Russo & Fouts, 1997; Waddock and Graves ,1997; Preston and O'Bannon, 1997
Sales	Zeng et al, 2011; Yang et al, 2011
Sales turnover	Waddock and Graves 1997; Stanwick and Stanwick, 1998; Yang et al, 2011
Inventory turnover	Zeng et al, 2011
ROE	Zeng et al, 2011; Waddock and Graves, 1997; Preston and O'Bannon, 1997
Market shares	Zeng et al, 2011; Yang et al, 2011
Sales growth	Montabon et al, 2007
ROI	Montabon et al, 2007; Preston and O'Bannon, 1997
# customers	Zeng et al, 2011
Stock market performance	Konar & Cohen, 2006; Klassen & McLaughlin, 1996; Frooman, 1997; Fogler & Nutt, 1975
Expenditures R&D	McWilliams and Siegel, 2000
Operational performance measures	González-Benito & González-Benito, 2005
Environmental measures:	**Source**
Pollution levels	Zeng et al, 2011; Belkaoui, 1976; Alexander and Bucholz, 1978; Vance, 1975; Fogler & Nutt, 1975; Bragdan & Marlin, 1972
Environmental awards	Klassen & McLaughlin, 1996
Corporate environmental reports	Montabon et al, 2007; Stanwick and Stanwick, 1998; Wiseman, 1982
Ratings from external source	Russo & Fouts, 1997; McWilliams and Siegel, 2000; Yang et al, 2011
Environmental management practices	González-Benito & González-Benito, 2005

3. MATERIALS AND METHODS

3.1. CONCEPTUAL FRAMEWORK

The conceptual framework helps develop a model in which the causing variables are clearly presented and categorized. The following conceptual framework presented in figure 1 answers the question: What are the factors affecting the profitability of circular business? The framework below presents the chosen factors which could affect the profitability of circular SMEs. The presented factors are selected due to the ability of measuring in a quantifiable, objective manner. There has to be said that numerous other factors are available which could attribute to the business performance of the circular SMEs. Examples of these types of characteristics are customer perceptions, media exposure, competitors' behavior, knowledge and experience founder and market development. The framework can be divided into five categories; each one will be discussed in the section below the figure.

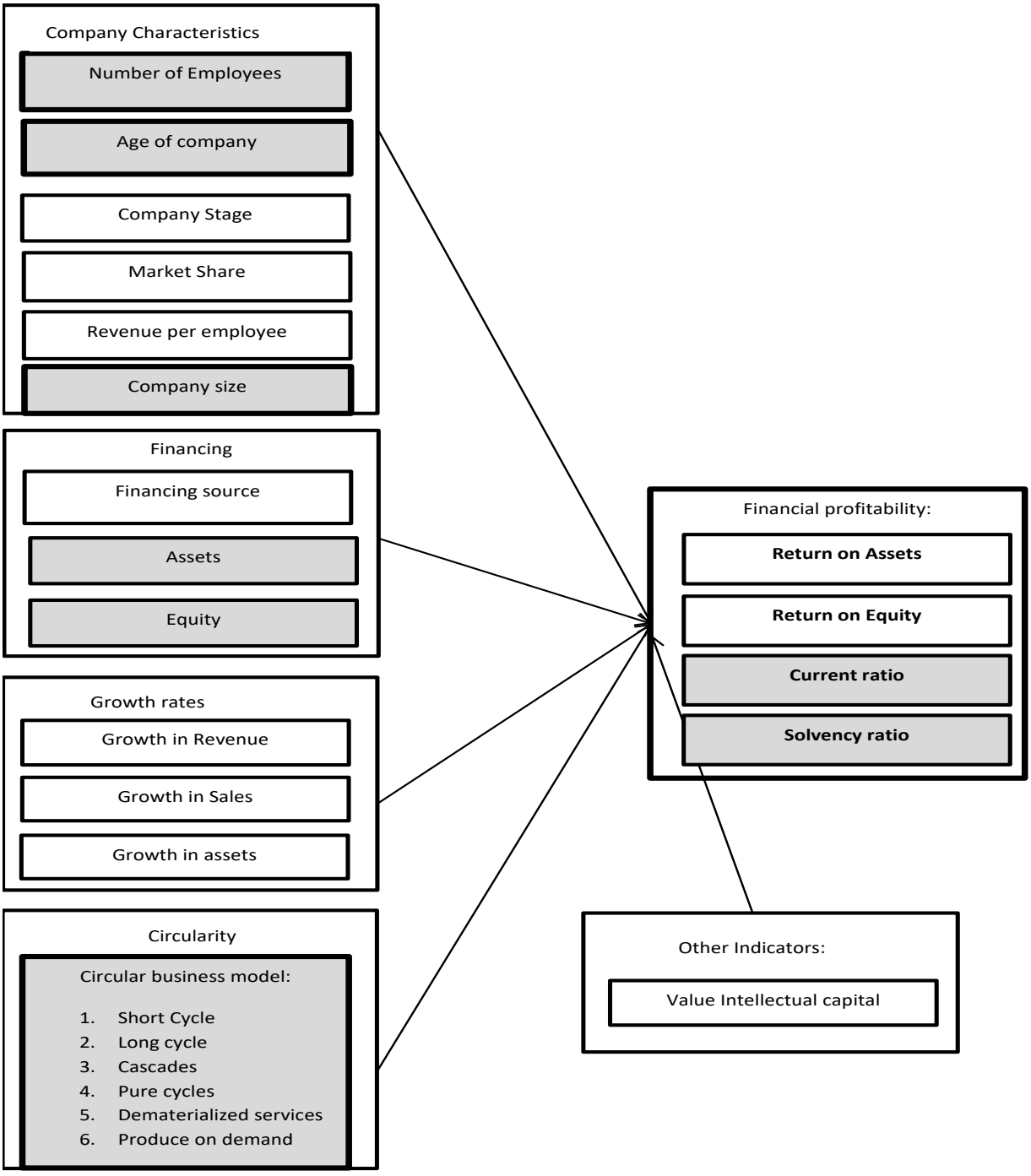

FIGURE 1: CONCEPTUAL FRAMEWORK

The following section discusses the selection of indicators. The financial profitability is the dependent variable and will be discussed first. Then the other indicators as shown in the conceptual framework (figure 1) will be discussed.

Financial profitability (Dependent variable)

Referring to table 6, section 2.7, we see that the Return on Assets (ROA), Sales turnover, Return on Equity (ROE) and stock market performance is mostly used in order to express business performance linked to environmental performance. Important note is that stock market performance cannot be used for this research due to the absence of stock data. Furthermore, sales turnover cannot be used as financial indicator because this data cannot be compared among different sized companies. Most of this research has been focused on large scale organizations. Therefore it is interesting to look into literature regarding measuring business performance relating to SMEs. From the literature the ROA and ROE are most common used. The ROA is net profits divided by total average assets and the ROE measures how the company deals with owners' capital, also known as shareholders' equity. The main advantage of financial performance measurements is that they are objective, easy to quantify and to compare. As wide-used these measures are, they have some implications for example the lack of historical information and are not accessible to all people (Chong, 2008).

Two dependent indicators of business performance used for this research are the current ratio and the solvency ratio. The current ratio measures the ability of the SME to pay their short- and long term obligations. This is calculated by dividing the current assets by the current liabilities. If the ratio is higher than 1, preferably in between 1,5 and 2, then the firms is considered healthy. The solvency ratio (Asset based) measures whether the cash flow of the firm is sufficient to meet its obligations. This is calculated by dividing shareholders' funds by total assets. A company is considered healthy with at least a percentage of 20%. Both ratios are directly extracted from ORBIS. The current- and solvency ratio are used as dependent variables for research questions two and three. The following independent variables are used for answering research question three.

Company Characteristics (independent variable)

Cong (2008) states that a combination of financial data and non-financial data could create another dimension in measuring business profitability. Most common non-financial data used are; number of employees, growth in revenue and sales (Miller et al, 1988), market share, and revenue per employee (Johannisson, 1993). Wiklund and Shepherd (2005) defined five indicators defining business performance: sales growth rate, employee growth, gross margin, profitability and cash flow (Wiklund & Shepherd, 2005). In this research, non-financial data is used as indicator of financial performance. The following factors contribute to the financial performance; number of employees, age of company, company stage, revenue per employee and market share. All of the following factors could contribute to the business performance of the circular company: number of employees, age of company, company stage, market share, revenue per employee and company size are used as company characteristics. Unfortunately, not all data could be extracted from ORBIS. The number of employees, age of company (calculate amount of years from company starting date) and company size (as a result of number of employees) have been calculated. The company stage and market share data was not provided by ORBIS and trying to find the data would be time consuming and probably expansive. The revenue per employee ratio has also not been calculated by ORBIS due to the lack of profit and loss account data.

Financing

Referring to section 2.6, SMEs face difficulties in obtaining bank financing as banks consider 'green' companies risky. In addition, several other financing sources are reluctant financing new initiates as they are scared for the most common non-profitable beginning phase of such business models. However, with initiatives such as INGs: 'Rethinking finance in a Circular Economy', attention has been drawn to this issue which could result in an increase in investments. The source of these investments and the agreements made can have a great impact on the company's profitability. Bank loans, capital investment funds, own/family funding and subsidies and other forms of government funding can have great impact on the profit and loss statements and the overall profitability of circular SMEs. For example, the payback period, discount rate and inflation have significant impact on the revenues. For the companies used in this research, investment sources are not made public and therefore this information cannot be used.

Two other indicators have been used: assets and equity. This data has been rescaled to assets per employee and equity per employee. These are calculated by taking total assets and divide this by the number of employees. The same accounts for the calculation for equity per employee. Even though total assets is not much referred to as business performance indicator or as causing factor it is used in this research. The reason for this is that is provides an insight on how much the firms is

worth and what is owns. Does the company hold high inventories and owns expensive buildings than it has high assets, but if it is a starting small internet company is does not hold many assets. Which one is more profitable? In addition, the total equity of a company is another interesting indicator on the companies' health. As total equity indicated the total assets min the total liabilities then the equity is the leftover value for the company which they could reinvest in the company or write down as revenue. Therefore, the general rule is the higher the wealthier.

Growth rates

There is a major revival of SMEs performance since 2014 and the market is expected to grow with a 1% growth rate. Recovery of domestic spending and increasing demand from abroad are the main contributors of this growth (Nu.nl, 2015). These factors are interesting to include in the research in order to link the growth rates to the SMEs profitability. Are the fastest growing circular companies also the most profitable? Or do lower growth rates implicit higher current ratio and solvency. Growth rates relating to sales, profits and assets are not used. This is in threefold; (1) information relating to profits and sales is not made public, (2) due to the aftermath of the financial crisis, company growth is likely to be attributed to the improvement of market conditions (3) information relating to assets growth could give a distorted picture on the companies. When the company is existent for two years, the growth in assets is could be due to investments and not increased business performance.

Circularity

The type of circular business model could have a potential impact on the financial profitability. The circular companies will be divided into the following six categories created by Renswoude et al. (2015) (table 2, page 6) based on the framework of the Ellen MacArthur foundation (2012); short cycle, long cycle, cascades, pure cycles, dematerialized services and produce on demand. The circular business models are used as a dummy.

Other Indicators

Intellectual property could have major contribution to the SMEs profitability. Intellectual property could cause competitive advantage and exclusive revenue streams as explained in section 2.4. Intellectual property could be expressed as the amount of patents, trademarks and copyrights. This data is also not of frequent occurrence for the smaller and medium enterprises and also not for large waste disposal companies and is therefore not included in this research

3.2. SAMPLE SELECTION

Dutch circular firms have been identified with the use of the following three sources. The first source identified circular firms via Circular entrepreneurship (circulair ondernemen in Dutch) which is a Dutch online community program in order to stimulate circular entrepreneurship. This initiative is supported by the Dutch ministry of infrastructure and environment and is implemented by MVO Nederland. Circular entrepreneurship has identified the 50 'best practices' of circular entrepreneurship in the Netherlands. These 50 circular companies will be used as a representation of all Dutch circular SMEs. Secondly, a list containing the 50 members of Dutch Waste Management Association (DWMA) (partner in the Circular Economy as subtitle) is used. This list mainly consists of broad types of disposal companies ranging from turning household waste into biogas, to collecting and disposal matrasses. The third category of companies includes those firms that have been stumbled upon during the literature study and general orientation.

TABLE 8: IDENTIFYING AND ELIMINATING DUTCH CIRCULAR BUSINESSES

Total 50 best practices in the Circular Economy	50	
- Unsubscribed organizations	2	
- Foundations	8	
- Part of MNE	5	
- Missing data (key financials, organization information)	12	
- Non Dutch	1	
Total:		21
Total 50 members of the DWMA	50	
- Not complete circular business model	8	
- part of province/Other company	7	
- Missing Data	16	
Total:		21

Total identified companies	24	
- Part of MNE	2	
- Foundations	4	
- Missing data	9	
Total:		9
Total:		51

Not all circular business have been identified and used in this research for the following reasons; 1) It is very difficult to identify circular SMEs because they do not always present their business models or advertise with their circularity and 2) even if all circular SMEs could be identified, it would be very time consuming and expensive to collect, process and analyze all data.

3.3. DATA COLLECTION

The company characteristics such as number of assets, equity, employees, company age, sector and company size are provided by ORBIS database. All data is for accounting year 2014. Important note has to be made as ORBIS is not very precise in the categorization of companies to sectors which clarifies why so many firms are categorized as 'other'. Section 3.4.1. handles this issue. Company size is determined as follows; <10 is small, 25-100 is medium, >100 are large.

Many variables could not be included in this research due to lack of access to information and time and money restrictions. Company stage and market share information is not provided by ORBIS and it would require company and market knowledge and is therefore left out. Due to the lack of profit and loss statements provided on ORBIS, and no prospect of gaining access to such data other ways, the following data have been left out: ROA, ROE, revenue per employees, financing source, growth rates and intellectual capital value. Company stage and market share information is not provided by ORBIS and it would require company and market knowledge and is therefore left out.

3.4. DATA ANALYSIS

3.4.1. COMPARING CIRCULAR BUSINESS PERFORMANCE WITH NON-CIRCULAR BUSINESS PERFORMANCE

In order to research whether circular business performance is better than linear business performance, three independent t-tests are performed. The first t-test, tests the business performance (current ratio and solvency ratio) of circular companies versus linear companies. The circular sample group of 48 companies (outliers deleted) will be compared with 1000 randomly selected Dutch linear companies extracted from ORBIS. The following categorizations are made in ORBIS. The Netherlands is picked as country of incorporation. Employees range from 1 till 4979 for the year 2014. The number of 4979 is picked because this is the largest amount of employees to be found in the circular companies' sample. Year of incorporation is on and after 1947 up to and including 2014 and only unlisted companies were selected by the database. ORBIS found 790139 companies randomly displayed and the first 1000 were selected for this t-test.

Secondly, the circular companies are divided according to their company size and are compared with linear companies of the same size. The following three groups are made: small (28), medium (14) and large (6) categorized by the number of employees: small is 1 to 20, medium 20 to 100 and large is +100. These groups are then compared to 1000 randomly selected companies with the same company size in the Netherlands. The same categorization is used as described in the first paragraph of this section, but the range of employees is adjusted to the criteria. ORBIS found 759783 small companies, 23346 medium companies and 7123 large companies.

The third test compares two groups: circular companies and linear companies adjusted for company size and the sector they are operating in. Per sector, groups are made according to size (small, medium, large) and the group average is taken. Then, the sector group average is taken extracted from ORBIS and set against the average of the circular companies. ORBIS data is select as follows; companies were selected with the Netherlands as country of incorporation and then the sector and company size are selected. From this list, ORBIS calculated the mean current- and solvency ratio. These two averages 'compete each other' and makes the sample more reliable and representable. As presented in the table below, 29 companies have been identified by ORBIS as 'other', but if you look closer into the company one can clearly see that this company does fit in some type of category. Therefore these 29 'other companies' will be manually divided into categories which seem suitable. Therefore various sectors have been added and the data is divided as presented in figure 10.

TABLE 9: INITIAL CATEGORIZATION OF SECTORS BY ORBIS

Sector	Amount of companies
Food, beverages and tobacco	1
Gas, water and electricity	1
Machinery, equipment, furniture, recycling	6
Metals & metal products	2
Wholesale and retail trade	9
Chemicals, rubber, plastics, non-metallic products	3
Other	29
Total:	51

TABLE 10: CATEGORIZATION OF SECTORS MANUALLY

Sector	Companies	Small	Medium	Large
Food, beverages and tobacco	1	0	1	0
Gas, water and electricity	1	1	0	0
machinery, equipment, furniture, recycling	6	3	3	0
metals & metal products	2	0	2	0
Wholesale and retail trade	9	6	2	1
Chemicals, rubber, plastics, non-metallic products	3	3	0	0
Operational leasing of cars and light commercial vehicles	2	2	0	0
Other Information Services	3	2	1	0
Other professional, scientific and technical activities	4	3	1	0
Waste collection, treatment and disposal activities; materials recovery	20	11	5	4
Total:	51	31	15	5

The independent variable is measures on a ratio level and consist of two categorical groups (circular companies and linear companies). There is independence of observations because there is no relation between the circular- and the linear companies. Outliers were detected using de Z-score. All variables with a Z- score higher than 3.29 and lower than -3.29 will not be used in further research. And due to the fact that SPSS does not delete these factors automatically via the case wise diagnostic function, these outliers will be deleted manually. Three companies have been deleted according to the prescribed procedure. Levene's test is used in order to test homogeneity of variance where equal variances were not assumed.

3.4.2. IDENTIFICATION OF THE EXPLAINING FACTORS OF CIRCULAR BUSINESS PERFORMANCE

Two separate regressions will be used for this research with the current ratio and the solvency ratio as dependent variables and assets per employee, equity per employee, firm age, firms' size (dummy) and circular business model (dummy). In many cases where two dependent variables are used, multivariate regression is preferred over two separate regressions. Even though this regression includes two dependent variables, the decision is made to use two separate regressions because there are seven dummies involved which result in many empty cells. The two regressions will be separately presented.

$$Financial\ performance = \beta_0 + \beta_{age} + \beta_{ape} + \beta_{epe} + \beta_{cs} + \beta_{bm} + \varepsilon \quad (1)$$

TABLE 11: VARIABLES REGRESSION ANALYSIS

Variables:		Source	Variable name	Measure	Type of variable
Current ratio	Current assets/current liabilities	ORBIS	Financial performance	Nominal	Dependent
Solvency ratio	Shareholders' funds/total assets	ORBIS	Financial performance	Nominal	Dependent
Company age	2014	ORBIS	β_{age}	Nominal	Control
Assets Per Employee	Total assets / # Employees	ORBIS	β_{ape}	Nominal	Control

Equity Per Employee	Total equity / # Employees	ORBIS	β_{epe}	Nominal	Control
Company size	<10 is small, 25-100 is medium, > is large	ORBIS	β_{cs}	Dummy	Control
Circular Business model	Six circle Framework	Six circle framework, company description, common knowledge	β_{bm}	Dummy	Independent

3.5. HYPOTHESES

3.5.1. HYPOTHESIS 1

According to the literature, presented in section 2.7., many studies have found a positive link between environmental performance and business performance (such as Zeng et al, 2011; Russo & Fouts, 1997 and Konar & Cohen, 2001). Literature provides an unclear scenario in the short-run for circular businesses balancing additional costs with additional revenue opportunities. Long term opportunities for circular businesses are portrayed more positive by literature and institutions. With an eye on the growing popularity of more sustainable products, the additional revenue streams could outweigh the extra costs and diminished uncertain demand. Therefore the research hypothesis is al follows: **Circular business models are more profitable than non-circular business models**.

3.5.2. HYPOTHESIS 2

Research question two investigates what variables are decisive to the success of circular businesses, where success is measured as a ratio. The number of employees determines the size of the firm –firm size- which could have a weak positive impact on firms' performance. Pervan and Visié (2012) argue that larger firms can charge higher prices and therefore build higher profits, but due to bureaucratic decision-making flexibility profitability could decrease. Company size (Small, Medium or Large) is therefore used in order to measure the impact of employee's on the organization due to its broader categorization. Company age has significant impact on profitability on the firm according to literature, but is substantiated with the economy of scale theories (Ilaboya & Ohiokha, 2016). There has not yet been any research performed on which circular business model is more profitable. In addition, no comparable research could provide any insight on the matter and therefore no hypothesis could be formed regarding the effect of the type of circular business model on the profitability of the firm. The type of circular business model is an exploratory variable. Table 12, provides an overview of the positive- or negative effects of the independent variables (including control variables) on the dependent variables.

TABLE 12: HYPOTHETICAL POSITIVE OR NEGATIVE EFFECTS OF INDEPENDENT- AND CONTROL VARIABLES ON BUSINESS PERFORMANCE

Variable	Positive (+) or negative (-) effect on business performance
Company size	~+
Company age	+
Total assets	+
Total equity	+
Business model	?

4. RESULTS

4.1. ARE CIRCULAR BUSINESS MODELS PERFORMING BETTER THAN LINEAR COMPANIES?

Table 13 presents the descriptives of the first independent t-test where business performance of Dutch circular businesses is compared with the business performance of Dutch linear businesses. The selection procedures of both groups have been described in chapter 3 of this thesis. This data does not include outliers. The table shows that for the current ratio, the average mean is lower (1.62) than the mean of the circular companies (3.81), but the standard deviation is higher for circular companies. This in contrast to the mean solvency ratio, where the mean of linear companies is higher with 10.02 points. When performing an independent t-test, the output shows that there is no significant difference between the means of these two samples with regard to the current ratio has measurement of profitability. In regard to the solvency ratio as measurement as profitability performing the independent t-test, there is also no significant difference between the means of these two samples.

TABLE 13: DESCRIPTIVES BUSINESS PERFORMANCE OF CIRCULAR- AND LINEAR COMPANIES

		Current ratio				**Solvency Ratio**			
	#	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum
Linear companies	1000	1.62	1.62	0	35.23	32.82	25.20	-91.04	99.99
Circular companies	48	3.81	8.26	0.08	42.47	22.80	39.22	-68.92	97.13

*significance of 0.05 (not present in this sample)

Table 14 shows the outcomes of the independent t-test comparing circular and linear business performance according to company size. In the 'large' category it can be seen that less than 1000 linear companies have been used. 119 companies have been deleted because ORBIS did not show information regarding the current- and the solvency ratio. Looking at small companies, the independent t-test shows no difference when testing for the current ratio, but when testing for the solvency ratio it shows a negative influence for circular business models. For medium and large companies, no significant difference, positive or negative, has been detected by the independent t-tests.

TABLE 14: DESCRIPTIVES BUSINESS PERFORMANCE CIRCULAR- AND LINEAR COMPANIES ACCORDING TO COMPANY SIZE

			Current ratio				**Solvency ratio**			
		#	Mean	St. Dev.	minimum	maximum	Mean	St. Dev.	minimum	Maximum
Small	Linear	1001	3.53	7.74	0	99.94	34.68*	36.89	-100	100
	Circular	28	5.13	10.27	0.08	42.47	18.24*	44.24	-68.92	97.13
Medium	Linear	1001	2.02	2.21	0	29.25	37.27	27.73	-92.33	99.31
	Circular	14	2.41	4.14	0.62	16.7	33.07	26.88	-22.34	93.24
Large	Linear	879	1.95	4.39	0	89.95	34.31	26.85	-90.35	99.84
	Circular	6	0.91	1.08	0.29	3.1	20.09	39.90	-55.83	45.41

*significance of 0.05

Table 15 presents the third type of independent t-test where circular- and linear companies are grouped according to company size and sector and compared with each other. The table presents small differences in the means of current ratio and the solvency ratio. For both ratios, the linear companies have higher ratios, indicating (most of the time) better business performance. But, the independent t-test does not show any significance and therefore it has to be concluded that there is no significant difference between the means of these two samples.

TABLE 15: DESCRIPTIVES INDEPENDENT T-TEST COMPARING CIRCULAR AND LINEAR ACCORDING TO SECTOR AND COMPANY SIZE

			Current ratio		Solvency ratio	
Sector	**size**	**#**	**Circular**	**Linear**	**Circular**	**Linear**
Chemicals, rubber, plastics, non-metallic products	Small	3	1.50	2.97	34.35	32.05
food, beverages, tobacco	Medium	1	1	2.01	31.75	35.58
gas, water electricity	Small	1	0.74	5.45	-34.33	34.30
machinery, equipment, furniture, recycling	Small	3	0.38	3.16	8.26	31.77
machinery, equipment, furniture, recycling	Medium	3	1.15	2.09	21.86	35.20
metals & metal products	Medium	2	1.85	1.90	17.62	34.30
Operational leasing of cars and light commercial	Small	2	1.44	4.69	-19.57	35.86
Other Information Services	Small	1	1.41	5.71	-0.26	37.59
Other Information Services	Medium	2	0.86	1.89	0.31	31.30
Professional, scientific and technical activities	Small	4	11.56	7.82	25.69	45.19
Professional, scientific and technical activities	Medium	1	1.65	9.69	41.26	34.48
Waste collection, treatment and disposal activities	Small	10	2.99	4.70	21.37	35.95
Waste collection, treatment and disposal activities	Medium	5	1.26	1.98	34.07	34.26
Waste collection, treatment and disposal activities	Large	4	1.51	1.68	36.824	35.40
Wholesale & retail trade	Small	6	8.42	3.56	-2.72	30.10
Wholesale & retail trade	Medium	2	15.08	1.94	95.18	32.35
Wholesale & retail trade	Large	1	3.1	1.75	45.41	36.17
Mean			**3.28**	**3.71**	**21.00**	**34.81**
N			**17**	**17**	**17**	**17**
Minimum			**0.38**	**1.68**	**-34.33**	**30.10**
Maximum			**15.09**	**9.69**	**95.19**	**45.19**
Std. Deviation			**4.23**	**2.35**	**4.234**	**3.34**

*significance of 0.05 (not present in this sample)

4.2. IDENTIFICATION OF THE CONTRIBUTING FACTORS OF CIRCULAR BUSINESSES

The descriptive statistics of the data is presented in table 16 below. Please note that the mean of the current and solvency ratio are different from the mean in table 15 because there the mean is calculated per group categorized per sector. The descriptives presented below shows the mean of the total 48 companies (outliers are deleted as described in section 4.1.).

Assets and equity are rescaled per employee and presented with the US dollar currency. The hierarchical regression method is used in order to identify the contributing factors of the business performance of the circular businesses. As control variables the assets per employee, equity per employee and company's age are entered in the first block. The second block includes company size as a dummy variable: small and medium (large is omitted due to the dummy variable trap explained hereafter). The third block includes the test variables which are specified circular business models: short cycle, cascades and pure business models and the long cycle dummy variable is omitted due to the dummy variable trap. The dummy variable trap is 'a scenario in which the independent variables are multicollinear (Algosome)'. In order to deal with this scenario one dummy variable has to be omitted. In this case, the large category of the firm size is omitted because this is the least occurring firms' size. The same accounts for the long circular business model, which only occurs once for all companies.

TABLE 16: DESCRIPTIVES (IN)DEPENDENT VARIABLES REGRESSION ANALYSIS

	N	Minimum	Maximum	Mean	Std. Deviation
Current Ratio	48	.08	42.47	3.81	8.26
Solvency Ratio	48	-68.92	97.13	22.80	39.22
Asset / Employee (USD)	48	35.36	14403816	715316	2204418
Equity / Employee (USD)	48	-605314	6070675	233760	961545
Age	48	1	69	15.56	16,35
Small Dummy	48	.00	1.00	.5625	.50
Medium Dummy	48	.00	1.00	.2917	.45
Large Dummy	48	.00	1.00	.1458	.35
Short Dummy	48	.00	1.00	.1667	.38
Long Dummy	48	.00	1.00	.0208	.14
Cascades Dummy	48	.00	1.00	.6875	.47
Pure Dummy	48	.00	1.00	.1250	.33
Valid N (listwise)	48				

The coefficient table (table 17) presents us with the model parameters. The numbers one, two and three on the left show the block wise entrance of the variables in the model. According to Field (2014), when using predictors based on part work it is a general rule to enter the known predictors first. In this case are the assets, equity, age and company size control variables and are therefore entered first (Field, 2014). When looking at the t-statistics of the variables, we can conclude that none of these predictors make a significant contribution to the dependent variable current ratio. When looking at the collinearity one can see that cascades has a VIF of more than 10 which is cause for concern and tells us that this is probably multicollinear. In addition, equity per employee and assets per employees have VIF values of eight which is no cause for extra concern but off course we have to know that these values correlate. The coefficients of the solvency ratio show more significant results, but not relating to the test-variables. Assets- and equity per employee (USD) have a significant effect on company's solvency. Assets have a negative effect and equity a positive effect. This makes sense, because the higher the equity, the higher the solvency ratio. This results in high multicollinearity which is shown by the VIF factor. Assets per employee and equity per employee have a score above eight which is normally cause for concern. In this case, the concerned variables are control variables and therefore this notion can be ignored (Allison, 2012). Table 17 shows no impact of any type of circular business model on business performance (current- and solvency ratio).

TABLE 17: COEFFICIENT OUTPUT REGRESSION ANALYSIS CURRENT- AND SOLVENCY RATIO

	Hierarchical method	Current Ratio	Solvency Ratio
	Variables	Coefficients	Coefficients
1	(Constant)	4.88	14.65
	Asset Per Employee	-2.027E-006	-1.620E-005*
	Equity Per Employee	4.300E-006	4.561E-005*
	Age	-0.04	0.58**
2	(Constant)	0.99	12.79
	Asset Per Employee	-2.103E-006	-1.610E-005*
	Equity Per Employee	4.934E-006	4.558E-005*
	Age	0.00	0.53
	Small Dummy	4.82	1.33
	Medium Dummy	1.55	6.71
3	(Constant)	-1.97	0.69
	Asset Per Employee	-1.838E-006	-1.619E-005*
	Equity Per Employee	4.517E-006	4.603E-005*
	Age	0.02	0.56
	Small Dummy	4.12	5.65
	Medium Dummy	1.03	9.99
	Short Dummy	8.50	11.45
	Pure Dummy	0.16	-12.47
	Cascades Dummy	2.55	11.42

*significance of 0.05, ***significance of 0.1

Even though this table shows that circular business models have no effect on circular business performance, there could be other reasons why this table does not show significant results. The model summary presented information relating to the fit of the model. The R-Square measures how much of the variability is accounted for. The model with the current ratio as dependent variable, when all variables are included, accounts for 17.5% variance of the current ratio. The adjusted R-square should be somewhat the same ratio, but is in this case negative. This occurs when the model includes terms which do not predict the outcome, or the sample is too low. The change statistics also shows that adding extra variables does not explain a significant larger part of the model. In addition are these changes not significant as is shown at the significance of the F-change statistics which are higher than 0.05. The Durbin-Watson test shows us whether the assumption of independent variables is met. The rule of thumb is that this number should be close to two. For the current ratio the assumption is met. The F-values in the ANOVA are not significant which indicates that the model has low predictive power. The predictability of the regression model relating to the solvency ratio is better, in this case it accounts for 53% and the adjusted R Square is not negative anymore. With regard to the ANOVA, the model shows significance of the F-value (below .1 in third block).

5. Discussion, Conclusion & Recommendations

The main objective of this research is to analyze the business performance of Dutch circular companies and compare their performance with Dutch linear companies. This research is divided into three sections. First, a literature review is performed to answer the first research question providing an overview of how circular business models work and in what way they differ from linear business models. The first research question builds the theoretical framework of the second- and third research question. The second research question compares the business performance of circular businesses with the business performance of linear companies in Dutch industries. Third, regression analyses have been conducted in order to identify the main contributing factors to the profitability of the circular businesses operating in the Netherlands.

5.1. Discussion

In accordance with the literature, the first hypothesis states that circular business models are more profitable than non-circular business models. In order to analyze which business model is more profitable, independent sample t-tests are performed: one with the current ratio as test variable and one with the solvency ratio as test variable. Two different variables are used in order to test different types of business performance. Even though it is assumed that the current- and the solvency ratio are both measures of financial health and should therefore have the same results, the outcomes prove otherwise. The results vary from which dependent variable is used and how the circular companies are categorized and compared. The result section shows three different tests comparing circular companies with linear companies. Comparing the business performance using two broad groups –circular versus linear- did not show any significant results. The second comparison of circular- and linear companies grouped and compared according to company size did show one significant result: circularity has a negative impact on the solvency ratio of small companies. Extensive investment costs and funding issues make it difficult for circular SMEs to compete with linear companies which could explain the negative effect of circularity on small companies' solvency. For medium to large companies, no significant impact is found. The negative impact of circularity on the solvency ratio of small companies is not reflected in the outcomes of the third tests. The third test compares circular business performance with linear business performance according to sector type and company size, but does not show any significant (negative) impact on small companies in any specific sector.

This outcome is in sharp contrast with the literature review in which an in general positive link was found between environmental performance and business performance. There are three reasons for these differences in outcomes. First of all, past literature is focused on 'environmental performance' and not on circular performance. Environmental performance is referred to as a nominal rate, in which a high or low rating indicates better or worse environmental performance. This research does not have such a measurement, and only full circular companies where used for this research. Second, literature is based on stock listed companies of which more data is available relating to profits and financial sources. Third, only one year is taken into account for this research, paying no attention to growth rates and future possibilities. As discussed in the literature review, there are numerous opportunities in the Circular Economy proven by the increasing interest of institutions, governments, banks and investment funds. These organizations could provide a competitive benefit of circular companies over linear companies in the near future.

Two critical notes have to be made regarding the choice of dependent variables. First, even though the current ratio provides an insight into the companies' financial health, it does not necessarily mean that a low ratio represents bad business performance. On the other hand, a very high ratio (above 3) could indicate that a company does not manage its assets, financing or working capital efficient as it should. Looking at the current ratio of both circular companies and the sector's mean, one could see that these are higher than 3. In addition, the mean of the solvency ratio of circular companies is 22.8% which is defined as a financial healthy ratio. The second limitation of the current and solvency ratios relating to this research is that it should be compared per sector and not throughout the whole economy. In order to work with this limitation, the circular companies are divided into separate groups according to company size and sector. Then the means of these groups are used and compared with the mean of the whole industry with the same characteristics. This way, every group has its aggregated average of the ratio with the sample and it is put against the aggregated mean of the whole sector with the same company size.

This brings us to the next issue where some sample groups in the third independent t-test are not representable for all circular companies operating in that specific industry. For example, the average of circular, small gas, water and electricity group shows a negative solvency ratio but is based on one sample. According to the method used, the circular companies operating in this sector are performing worse than linear companies, even though this is based on only one company. In order overcome this problem, more Dutch small circular companies in this specific sector had to be identified or this group

had to be omitted. Omitting the small gas, water and electricity group could have provided us a more positive number and therefore a positive effect of circularity on the business performance. Another issue relating to the comparison of circular- with linear companies is the following. The financial performance of the circular companies is not necessarily compared with only linear companies, but is compared with all companies existing in the ORBIS database with the described characteristics. This means that the current- and solvency ratio mean also includes the ratios of the circular companies. Especially using sectors such as: 'Waste collection, treatment and disposal activities' could include a great deal of circular companies. Notable is that the current ratio's (for small, medium and large) and solvency ratio (for large) are very different. This could mean that the data used for circular companies is not representative for the whole industry. One source of this bias is misspecification where unintentionally some subgroups are left out of the research because they could not be identified due to time and money constraints.

The third research question attempts to identify if, and what type of circular business model causes better business performance based on the dependent variables of current ratio and solvency ratio. The assets per employee, equity per employee, company age, and company size are used as control variables and the exploratory variable is the type of circular business model. Literature does not explicitly state that one business model could outperform the other, but when looking at the different types of costs or revenue creation methods, one could assume that there is a difference between the business performance of Dutch circular businesses. For example, looking at the group division of circular companies into sectors we see that 'Waste collection, treatment and disposal activities; materials recovery' is a large group of 20 companies. This companies fall into the circular business model category 'Cascades'. Due to the fact that there are so many circular companies with this business model, one could assume that this is a profitable business model.

The regression analysis shows significance of the assets per employee, equity per employee and age (in the first block) meaning that the control variables have a significant influence on solvency. The weak positive effect of company size on business performance is not proven by this model. According to the model, the circular business models do not prove to have any impact on circular business performance. Two conclusions can be drawn from this data: (1) this model shows that the type of circular business model does not have any significant influence on the current- and the solvency ratio of a circular business and (2) this model does have a low explanatory value in order to predict the current- and solvency ratio. It could be the case that the type of circular business models does not have any impact on the profitability of a circular business. It could also be the case that the profitability of a circular business is dependent on qualitative characteristics such as company structure, management decisions and company know-how. When using a stronger measurement of business performance such as return on investment or return on equity, the model could provide a more concrete outcome resulting in stronger conclusions. More generally, a cross-sectional design study is known to be relatively weak in making causal inferences and is instead mostly used for descriptive research. Longitudinal study could have been more ideal for explanatory research as it deals with companies' performance over time. This type of study should be more applicable further in time, when circular companies are more mature.

In general, a note has to be made regarding the sample selection of this research. While probability sampling should have been employed, convenience sampling is used. This means that the samples taken are not necessarily representative for the Dutch Circular Economy. It cannot be concluded whether any sample is as no clear estimation is yet made of the total size of the Dutch Circular Economy (amount of companies with a circular business model). A larger sample size probably will draw better conclusions regarding this this research.

5.2. CONCLUSIONS

The main objective of this research is to analyze the business performance of companies operating in the Dutch Circular Economy and compare this with the business performance of Dutch linear companies. The analysis of the business performance of circular companies entails the identification of the decisive variables contributing to the profitability of circular companies. Conclusions will be drawn per research question.

Research question 1: How does the circular business model work and how does this differ from the linear business model?

A circular business model is a model with the aim of reducing waste, the re-usage of material and the maximization of profitability in the long run. This in sharp contrast with the linear business model characterized by a short-term focus and a take-make-waste system. The costs and revenue structure of the circular business models can, in theory, compete with linear business models but funding issues, consumer behavior, additional investment costs and unstable demand and supply could bring circular companies in trouble.

Research question 2: How does the business performance of circular companies differ from the business performance of linear companies in the Netherlands?

In the literature, a positive link was found between environmental performance and business performance. The same conclusion cannot be drawn from this research. On the contrary, circular business models have a negative effect on the solvency ratio of small companies. For all other tests no strong positive nor negative link is found between the circular business model and its profitability. From these tests, I conclude that circularity has a negative impact on the solvency ratio of small companies.

Research question 3: Which business characteristics are decisive in explaining circular business performance?

The analysis shows that the control variables assets, equity and company age have an effect on the business performance of the company. The model did not prove any significant impact of circular business models, positive or negative, on the business performance of the company. However, due to the low reliability of the model based on the current ratio and implications with the measurement of business performance I can only conclude that the circular business models have no effect on the solvency ratio.

5.3. RECOMMENDATIONS FOR FURTHER RESEARCH

The conceptual framework presented in section 3.1. could form the basis for future research on the profitability of circular businesses. As this framework is mainly based on SMEs and quantifiable business characteristics, it would be interesting to also include qualitative business characteristics such as management performance and flexibility within the company. In addition, different types of data sources could be used besides ORBIS such as Sustainalytics and other environmental ratings. Particularly when focusing on profit creation within a firm, questionnaires and interviews could be used in order to gain more insight into the specific choices made by firms with regard to management styles, innovation methods and company structures. Sensitive information relating to financing and intellectual property could be retrieved from companies via anonymous data gathering methods wherefrom the outcomes benefit the whole circular industry. For quantitative research it is important to make an estimation of the total amount of Dutch circular businesses and base the sample on this estimation. When the researcher is sure of the representativeness of its sample, it can draw conclusions for the whole Dutch Circular Economy.

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