



# **CIRCULAR BUSINESS MODELS**

**ALIGNING TYPOLOGIES  
AND BUILDING BLOCKS**

**A LITERATURE AND PRACTICE STUDY OF CIRCULAR BUSINESS MODELS:  
ALIGNING BMCE TYPOLOGIES AND BUILDING BLOCKS IN ORDER TO  
ACHIEVE AN UPDATED LIBRARY**

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A MASTER THESIS IN STRATEGIC MANAGEMENT

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## **PREFACE**

In front of you lies the master thesis '*Circular business models: aligning typologies and building blocks*', which was written under the supervision of Prof. dr. Jan Jonker. Without doubt, this thesis has been one of the most challenging products I have worked on so far. Coming from the higher professional education (HBO), followed by a pre-master course, finishing this master's course was a personal challenge.

During the selection phase for thesis topics, circular business models immediately gained my attention. As a relatively novel topic in research that is also becoming increasingly important in the future, I was very eager to learn more about the Circular Economy as a whole. At the outset, I was not aware what the Circular Economy entailed and I had a different attitude towards sustainability in organizations. However, a lot of reading, research, and sessions with Jan showed me the necessity of a transition and the importance of business models in this process.

This preface offers a good opportunity to express my gratitude to the people who have helped me with this thesis. First, I would like to thank Jan for his supervision, time, and feedback. I would like to thank him for giving me the opportunity to work on this project; it really broadened my perspective and interests. At last, I would like to thank the people in my direct environment who have helped and supported me.

## ABSTRACT

The debate about sustainable development is not new and has a long history. Several authors (London, 1932; Meadows, Meadows, Randers, & Behrens, 1972) and commissions (World Commission on Environment and Development, 1987) have emphasized the need for sustainability. Based on the notion that our planet's resources are not unlimited, and with an increasing world population (UN, 2015), our demand as a population will further exceed the planet's ability to provide resources (WWF, 2016). A transition towards a Circular Economy, which aims to improve resource inefficiency by eliminating waste (Despeisse, et al., 2016) and a circular flow of materials (Yuan, Bi, & Moriguchi, 2006) becomes more important. Instead of our current linear economy, which is characterized by a *take-make-waste flow* (Lacy & Rutqvist, 2015), a Circular Economy would demand a different way doing business.

In this respect, there is a growing need for organizations to search for business models for the Circular Economy (BMCE's), which is also urged by academics and practitioners. A wide range of sources provide BMCE typologies with their own characteristics or building blocks. As a result, typologies have become vague, overlapping, and do not clearly explain their underlying logic. Furthermore, it is uncertain how these notions exist in business practice.

This research is aimed to explain the above-mentioned issues. In order to do this, a twofold research approach was conducted, combining a literature study with a qualitative data study, following a grounded theory approach. This is done to research the phenomenon in-depth. Throughout the literature study, BMCE typologies were analyzed and summarized based on their contents. Also, an underlying logic of circular business models was constituted and a number of building blocks were identified that describe how BMCE typologies are configured.

Subsequently, a qualitative study following a grounded theory approach was conducted to assess theoretical findings in business practice. By analyzing public business documents, the appearance of BMCE typologies and building blocks among organizations was studied. The results provided an additional BMCE typology, two new building blocks, and a revision of building blocks per BMCE typology. Moreover, the study illustrates the dominant logic that lies at ground in organizations that endeavor circularity. Results show some very promising cases, but also illustrate that there is still a lot of work to be done in the debate of a Circular Economy.

## DUTCH ABSTRACT

Het debat over duurzame ontwikkeling is niet nieuw en heeft een lange historie. Verscheidene auteurs (London, 1932; Meadows, Meadows, Randers, & Behrens, 1972) en commissies (World Commission on Environment and Development, 1987) benadrukten de behoefte aan duurzaamheid. Het idee dat de middelen van deze planeet niet oneindig zijn, plus een groeiende wereldpopulatie (UN, 2015), leiden tot een situatie waarin onze vraag als populatie het vermogen van de planeet om ons te voorzien van middelen steeds verder overstijgt. Een transitie naar een Circulaire Economie, welke beoogt om inefficiëntie van hulpbronnen te verbeteren door afval te elimineren (Despeisse, et al., 2016) en een circulaire stroom van materialen te realiseren (Yuan, Bi, & Moriguchi, 2006) wordt steeds belangrijker. In plaats van onze huidige, lineaire economie, welke gekarakteriseerd is door een *take-make-waste* stroom (Lacy & Rutqvist, 2015), vraagt een Circulaire Economie om een andere manier van bedrijfsvoeren.

In dit opzicht is er een groeiende behoefte voor organisaties om te zoeken naar business modellen voor de Circulaire Economie (BMCE's), waarop ook wordt aangedrongen door academici en praktische beoefenaars. Een breed scala aan bronnen bieden BMCE typologieën welke hun eigen karakteristieken en bouwstenen kennen. Als gevolg zijn dergelijke typologieën vaag en overlappend geworden, en is er geen duidelijke uitleg over hun onderliggende logica. Bovendien is het onzeker hoe dergelijke begrippen tot uiting komen in de zakelijke praktijk.

Dit onderzoek is erop gericht de bovenstaande kwesties te verklaren. Om dit te doen wordt een tweeledige aanpak uitgevoerd, waarin een literatuurstudie gecombineerd wordt met een kwalitatieve datastudie, welke een grounded theory benadering volgt. Dit wordt gedaan om het fenomeen in diepte te onderzoeken. Door de literatuurstudie heen zijn BMCE typologieën geanalyseerd en samengevat op basis van hun inhoud. Ook een onderliggende logica van BMCE's werd vastgesteld, en een aantal bouwstenen zijn geïdentificeerd die beschrijven hoe typologieën kunnen worden geconfigureerd.

Hierop volgend is een kwalitatieve studie, gebaseerd op een grounded theory benadering, uitgevoerd om theoretische bevindingen te toetsen in de praktijk. Door het analyseren van openbare bedrijfsdocumenten is de verschijning van BMCE typologieën en bouwstenen bestudeerd. De resultaten leverden een additionele BMCE typologie, twee nieuwe

bouwstenen en een revisie van bouwstenen per BMCE typologie op. Bovendien illustreert de studie het bestaan van een dominante logica die ten grondslag ligt in organisaties die streven naar circulariteit. De resultaten laten veelbelovende gevallen zien, maar illustreren ook dat er nog steeds veel werk nodig is in het debat over de Circulaire Economie.

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# 1. CHAPTER 1. INTRODUCTION

This introduction chapter describes the logic of the Circular Economy (hereafter CE) and its characteristics. The first subchapter focuses on a brief topic introduction and the historical roots of the CE. The second and third subchapters formulate the problems that are involved with our current, linear economy and the need for a transition towards a CE. Finally, the chapter ends with a problem statement, relevance of this research and the research objectives.

## ***1.1 TOPIC INTRODUCTION AND HISTORY OF A CE***

The CE is a phenomenon that has made its entry to both society and business throughout the years. Based on the notion that our planet's resources are not unlimited, and with an increasing world population that is expected to reach 9.7 billion in 2050 and 11.2 billion by 2100 (UN, 2015), we will find ourselves in a situation in which our demand as a population will further exceed the planet's ability to provide resources (WWF, 2016), ultimately up to a point where we are not able to maintain our current situation of living and producing. Throughout the last decades, an increased need for new, sustainable solutions regarding our way of living have originated.

The debate about sustainable development is not new and has a long history; for example, Meadows et al. (1972) described the extent and impact of human activities on the natural environment. The limits to growth which they described showed how increasing human actions may cause depletion. Furthermore, the concept of *obsolescence*, which is one of the key problems in a linear economy and will be elaborated in this chapter, probably was introduced first by Bernard London (1932) in his paper '*Ending the Depression Through Planned Obsolescence*'. The essence of his paper described the stimulation of consumption and production in order to boost the economy during the Great Depression. It shows the concepts that are encompassed in a CE are not novel.

Not the initiator, but probably one of the most important stimulator for sustainable development was the Brundtland Commission. In their report "*Our Common Future*" in 1987 (World Commission on Environment and Development, 1987), they called for sustainable development in response to global environmental issues. Mentioned in the Brundtland Report, our generation should search for "*development that meets the needs of the present without*

*compromising the ability of future generations to meet their own needs.*” (World Commission on Environment and Development, 1987, p. 43).

## **1.2 THE PROBLEMS OF A LINEAR ECONOMY**

The above-mentioned circumstances ask for an alternative way for societies of producing and consuming. It means moving away from our current, so-called ‘linear’ economy, which is characterized by a *take-make-waste* flow (Lacy & Rutqvist, 2015); in other words: raw materials are extracted, products are produced, used and ultimately disposed at the end of their economic- and technical lifecycle. In a linear economy, natural resources are being overused and ultimately depleted, pollution is increasing, and existing eco-systems are threatened to destabilize. Also, the growing population by 2100 that was mentioned earlier makes it evident that we as a society will grow ahead from our natural resources, ultimately to a point in which we cannot maintain our current situation. Therefore, there is an increase in pressure on the legitimacy of a linear economy and it becomes obvious that sustainability should be embraced now.

Probably the most important characteristic of the linear economy is the concept of ‘product obsolescence’ (Jonker, Stegeman, & Faber, 2017). This concept involves the planned annihilation of products in their use or design. Rather said, it describes the planned maximum lifetime of a product in order for accelerated replacement by consumers. Accordingly, Jonker, Stegeman and Faber (2017) argue that planned obsolescence has led to an economic design of *hyper-consumption*, also defined as consumption for the sake of consumption (Sirgy, 2001, p. 140). Consequently, planned obsolescence is embedded in nearly all fields of society, businesses, and not importantly, consumer behavior. Hence, in our traditional economic system, we could argue that planned obsolescence i.e. consuming as much as possible is an indicator for concepts like Gross Domestic Product (GDP), and Gross National Product (GNP), making it a measurement for our welfare. Thus, our current economic system is driven by the pace of throughput from manufacturers and retailers. This results in the notion that the linear economy is problematic in light of a CE as these concepts differ fundamentally. Therefore, a total transition is required to reach a CE.

## **1.3 A TRANSITION TOWARDS A CE**

An alternative way for societies should thus be found to organize sustainability at various levels of society. This could be achieved by moving towards a CE. The characteristics of a

linear economy, for instance planned obsolescence, illustrate the scope of how a linear economy is embedded in our world. A transition towards a CE would therefore require fundamental changes in societies for organizations, consumers, and, also governments. One of the core assumptions of a CE is the aim for improving resource inefficiency by eliminating waste (Despeisse, et al., 2016), and realizing a circular flow of materials (Yuan, Bi, & Moriguchi, 2006), also described as ‘closing loops’, rather than a ‘take-make-waste’ flow that is currently accompanying the linear economy. This concept of ‘closing loops’ refers to the complete cycle of design, production, use, and re-use of products, materials, and resources in order to re-use and exploit these continuously. According to Jonker and Faber (2015), the profound idea of this is that products are designed in a way that materials can be retrieved and, most importantly, maintain their intrinsic qualities, so these materials can be used again in the same way as the initial material is used. In other words, the material’s function or purpose remains. The CE is largely focused on restoring, since a CE is not only about preventing waste, but it also aims to restore caused damage. This is confirmed by the Ellen MacArthur Foundation (2013, p. 8), who argue the CE is restorative by intention and design, and the end of annihilation through superior design of materials, products, systems, and, within this, business models. It is a concept of redesigning systems of manufacture- and service supply, and focuses on achieving value from such redesign rather than simply improving resource utilization (Murray, Skene, & Haynes, 2017).

Whereas in a linear economy resources are considered to be cheap and plentiful, resources in a CE are considered to be scarce and precious. Lacy and Rutqvist (2015) therefore argue resources in a linear economy serve as volume-based resources for market revenue, while resources in a CE serve more as market investments and performance-based assets for organizations. This difference in perspective on resources illustrates that a CE asks for a different viewpoint from organizations on the use of resources. Furthermore, an important aspect of a CE is that production systems are designed in a way that focus lies on value preservation of these products, materials and resources (European Commission, 2015; Jonker, Stegeman, & Faber, 2017). Value preservation of products, materials and resources implicitly means it should be done cooperative, since it requires inter-organizational efforts between multiple parties. For instance, suppliers of e.g. semi-finished products hold a responsibility in terms of value preservation, as well do their customers, who finally sell them to consumers. Ultimately, moving towards a CE also creates new opportunities for organizations, in terms of products- and services innovation, but also in terms of business model innovation. According

to Lacy and Rutqvist (2015), one of the major implications hence lies in strategies, structures, and operations of organizations, which are currently built on principles of a linear economy to strive for growth.

#### ***1.4 PROBLEM STATEMENT***

Throughout the years, the concept of and the urge to move towards a CE has been recognized, among others, by academics, policymakers and organizations (Rizos, et al., 2016). Regarding organizations, a transition towards a CE would also require a transition towards new business models and value chains, of which the focus for a large extent should lie on a different nature of value. This stimulates the search of organizations for new business models that fit in a CE. Rather said, while having an eye on the future, there is a growing need for organizations to search for business models for the CE (hereafter BMCE's). Previously conducted research on BMCE's focused on identifying and classifying CE characteristics according to a linear business model structure (Lewandowski, 2016), and the enablers and impediments of implementing CE business models for SME's (Rizos, et al., 2016), very little is yet known about what constitutes the building blocks and value-creating logic of these business models. Thus, while some insight is yet available on the features of BMCE's, insights on how these business models emerge and take shape are still at its early stages. Existing literature provides confusing and ambiguous terms that lead to vague and – probably – overlapping typologies (Jonker, Stegeman, & Faber, 2017). As a result, there are a few solid fundamentals for archetypes of BMCE's. In current literature, various classifications of BMCE's can already be distinguished (Lacy & Rutqvist, 2015; Bocken N. , Short, Rana, & Evans, 2014; Bakker, den Hollander, van Hinte, & Zijlstra, 2014), but it is unclear how these businesses models emerge in business practice. Some authors (Bocken, de Pauw, Bakker, & van der Grinten, 2016) offer potential business model strategies for a CE, and others (Bocken N. , Short, Rana, & Evans, 2014) also provide sustainable business model archetypes, to describe mechanisms that possibly support to building up sustainable business models. However, as mentioned, current literature offers very little insight in the fundamentals of BMCE's, making it unclear what logic constitutes these typologies of business models.

#### ***1.5 RELEVANCE***

This master thesis aims to contribute to both the academic- and practical field. In terms of the academic field, this topic contributes as it provides new insights in the building blocks and logic that constitute BMCE's. As mentioned, prior research mainly focused on the features,

enablers, and impediments of BMCE's, while little insight is yet provided on the profound logic behind these business models. The extent of literature that is available on the nature of BMCE's are minimal. It thus seeks to provide deeper understanding of this topic in a rather undiscovered territory, and filling a gap in missing research knowledge.

In terms of practical relevance, this master thesis contributes as it aims to investigate how BMCE's emerge in practice. This could potentially benefit business community that is seeking to implement circular business models by providing them possible guidelines and directions in realizing this. Furthermore, it is argued that development and innovation in the field of business models of CE and its typologies may contribute to an increase in experimentation and implementation of these business models in practice (Bocken N. , Short, Rana, & Evans, 2014).

## **1.6 RESEARCH OBJECTIVES**

The purpose of this master thesis is to seek and describe the configuration of building blocks and value-creating logic of BMCE's, according to existing literature, and to review how they emerge in business practice. There is a lack of mature fundamentals for archetypes of these business models, resulting in vague and overlapping typologies of businesses models for the CE. In order to realize the purpose of this master thesis, the following research question is formulated: *“What are fundamentals (building blocks and value-creating logic) of business models for the Circular Economy, and to what extent and how do these fundamentals emerge in business practice?”*.

In order to answer the above research question, the following sub questions are formulated and will be used as guidelines in this research:

1. *What are BMCE's, why, and how do they differ from conventional business models?*
2. *What is the perception of value in BMCE's?*
3. *What configurations of building blocks are at basis for BMCE typologies according to current literature?*
4. *To what extent and how do BMCE typologies and building blocks emerge in business practice?*

This thesis is structured as follows: first, a study of professional literature will be conducted to explain a CE and its value logic to distinguish pre-existing typologies of BMCE's and to

identify and describe their most important building blocks. Second, a practice study of public organizational reports will be used to assess what building blocks are at basis for BMCE's in practice. Third, it will be reviewed to what extent and how the building blocks of BMCE typologies found in literature correspond with practical findings.

Figure 1 shows an extensive research design, covering the chapters that will be included in this report plus the most important questions that should be answered in these chapters.

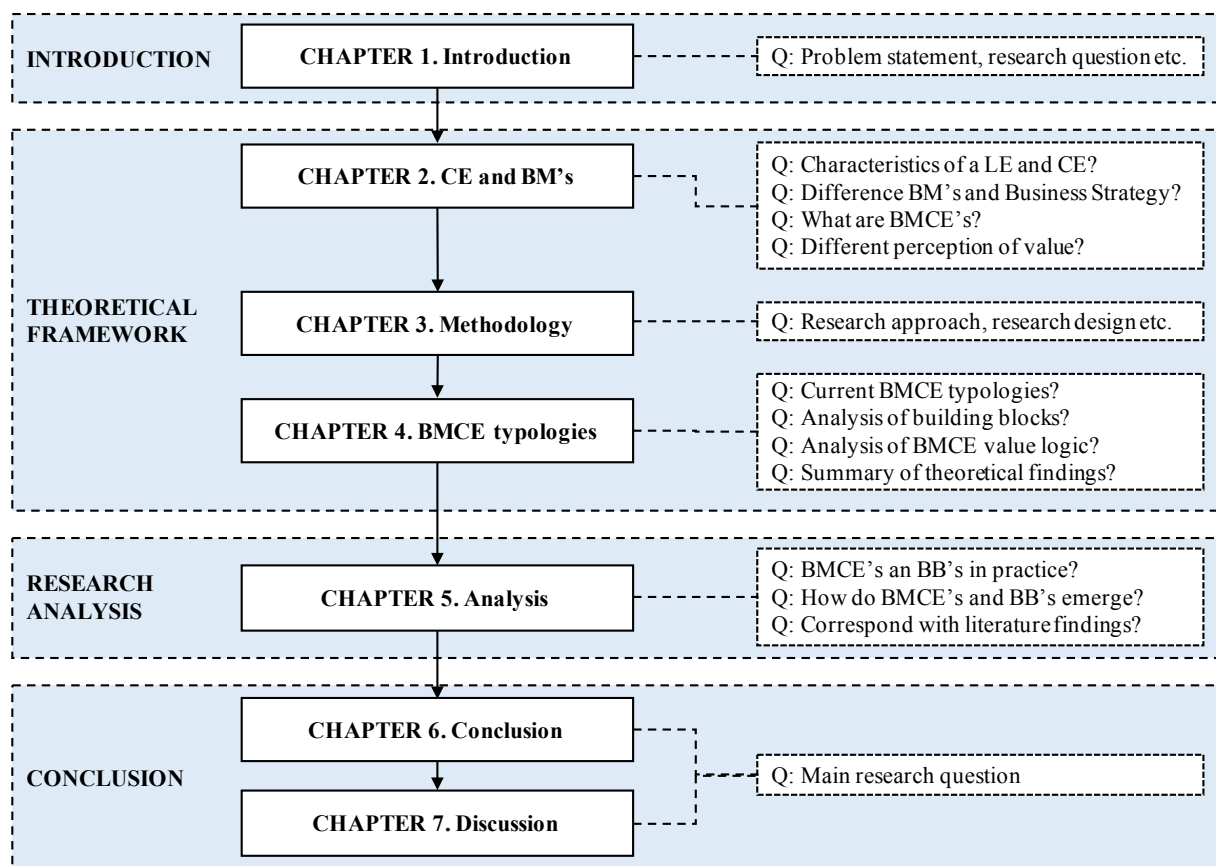


Figure 1: Visualization of research design

## **2. CHAPTER 2. THEORETICAL FRAMEWORK**

This chapter aims to describe the theoretical background that underlies this research. In order to do so, the CE and its most important characteristics are described in the first subchapter. The second subchapter formulates the boundaries of a CE. The third subchapter describes the need for new, circular business models and describes how conventional business models fail in a CE. The fourth subchapter explains the changing value logic that comes with a CE. The fifth and sixth subchapters describe business strategy and how it is related to circular business models.

### ***2.1 A CIRCULAR ECONOMY***

As described in the introduction of this report, past- and contemporary developments have created an urge to seek for new ways of producing and consuming. In a linear economy products, materials, and resources follow a ‘take-make-waste’ flow (Lacy & Rutqvist, 2015), as resources are extracted, products are manufactured, used, and, ultimately disposed. As a consequence, these products, materials, and resources are sometimes not being used to their full potential.

Our current, linear economy is built on a principle of unlimited presence of cheap and abundant resources, in which organizations focus on supplying consumers with a maximum throughput of goods. As a result, Jonker, Stegeman, and Faber (2017) argue the linear economy is driven by ‘product obsolescence’. Accordingly, Jonker, Stegeman and Faber (2017) argue that planned obsolescence has led to an economic design of *hyper-consumption*, also defined as consumption for the sake of consumption (Sirgy, 2001, p. 140). Hence, the linear economy is benefitted by aspects such as technological innovation, as this increases the pace of product replacement by consumers. According to Jonker, Stegeman, and Faber (2017) a CE is built on a couple of main principles:

1. Closing loops to use or re-use materials and products and to utilize their potential.
2. Products are replaced by services, organizations remain responsible for products.
3. Products, materials, and their components can be disassembled to serve as resource of a new product.

## **2.2 BOUNDARIES OF A CE**

Nonetheless, a full transition towards a CE is also an erroneous idea, and an illusion. Although a complete CE as a replacement for a linear economy would be an ideal image, it is also impossible to fully realize this when being realistic; the CE has to struggle with some boundaries and limitations on different fields. The Dutch social economic council, *Sociaal-Economische Raad* (SER) (Sociaal-Economische Raad (SER), 2016) identified some limitations and barriers. For instance, institutional-, legislative-, economic-, and societal limitations prevent our economy to become fully circular. Although the focus of their report is on The Netherlands, most limitations apply to a global area. For example, societal limitations such as the value of possession or lack of awareness, -knowledge, -urgency, and -enthusiasm, are present across the globe and embedded in societies (Preston, 2012). Whereas normative limitations can be amended and/or adjusted, realizing a change in society requires fundamental changes in people's minds. Furthermore, the CE could be limited in the notion that not all products or components are appropriate for reuse. Additionally, a CE may come with tradeoffs, to give up one thing in return for another. For example, products that are designed in a way to increase longevity may be more difficult or energy consuming to breakdown for reuse; the benefit of a long-lasting product may be nullified by the energy that is required to breakdown a product for reuse. One of the objectives of a CE is to prolong the lives of products and components. One of the limitations of a CE therefore is innovation; due to innovation, products that are developed ultimately lose their economic value, which makes it unattractive and not feasible to keep these products viable for as long as possible. Conclusively, although a CE is an ideal image for societies, there will be boundaries and limitations (e.g. institutional, legislative, economic, and societal, but also the pace of innovation) that prevent it from fully replacing a linear economy.

### ***Closing Loops and Value Preservation***

Based on the above, one of the most important characteristics of a CE is its intentions to close the loops of materials, resources, and products. A CE therefore is about regenerative designs and realizing a circular flow of, among others, materials (Yuan, Bi, & Moriguchi, 2006). According to Jonker and Faber (2015), the profound idea of this is that products are designed in a way that materials can be retrieved and, most importantly, maintain their intrinsic qualities, so these materials can be used again in the same way as the initial material is used. In other words, the material's function or purpose remains. Furthermore, an important aspect of a CE is that production systems are designed in a way that focus lies on value preservation



of these products, materials and resources (European Commission, 2015) (Jonker, Stegeman, & Faber, 2017). Instead of disposal, product parts or materials are retrieved and re-used in a CE in order to utilize their maximum value potential.

Value preservation of products, materials and resources implicitly means it should be done on a cooperative basis, since it requires inter-organizational efforts between multiple parties. For example, the waste of one organization serves as the resources for another organization. Accordingly, this enables loops to be closed. Hence, we emphasize that collaboration between parties is a key element in the CE. As Kraaijenhagen, van Oppen and Bocken (2016, p. 11) define in their book *'Circular Business: Collaborate and Circulate'*: *"It's about creating value out of waste and basically redefining waste as feedstock, so it can be used as a resource for the next product or process."* Thus, the CE is about materials and resources that should cycle for as long as possible. A CE proposes materials and components to return to manufacturers and/or retailers in order to close loops and to keep these materials and components into a cycle for as long as possible, utilizing their full potential.

### ***Collaborative Interactions***

According to Lacy and Rutqvist (2015), in order for a society to reach a CE, the supply- and demand logic of a linear economy needs to be changed radically. On the supply-side, organizations should search for product designs in which recovered materials and resources can be used to close the loop. Probably the most important driver for a CE is the demand-side; it is about the interaction between organizations and consumers throughout the full process of purchase, product use, and after-use. Vermeulen and Witjes (2016) elaborate on this, saying customers move away from their role of being a transactional actor, towards a role of being involved throughout the entire life cycle of goods to preserve value. In other words, consumers and/or customers become an important link within a CE. This process shows another important aspect of a CE: cooperative value creation and -preservation. Lacy and Rutqvist (2015) argue that organizations have a responsibility, when going circular, for a product's use and return. Realizing this, thus requires cooperative intentions and inter-organizational efforts between multiple parties. Kraaijenhagen, van Oppen and Bocken (2016) therefore emphasize collaboration to be an important building block in transitioning towards a CE. However, truly developing circularity in practice would require new business models. According to Planing (2015), these business models find themselves in a complex system of multiple actors.

### 2.2.1 COMPLEXITIES IN A TRANSITION TOWARDS A CE

Reaching a CE, while living a linear environment, comes with some complexities. First, a key proposition of a CE is its collaborative nature; sustainability should be organized between organizations, stakeholders, and consumers (Jonker, 2012). Compared to a linear economy, this asks for new ways of organizing based on co-creation. The problem of a linear economy is that it is not designed to be co-creative to a full extent; it assumes an organization-centric situation in which one organization is taking as a starting point (Jonker, Stegeman, & Faber, 2017). Hence, this organization-centric perspective does not allow for full collaboration within a chain, and should change to a network-centric perspective for realizing collaborative efforts of organizing between multiple parties. This network-centric approach assumes participation in a continuously evolving community of people and businesses which endeavors optimal achievement, in any field of expertise. Relating with a CE, a network-centric approach assumes collaborative efforts between communities to be successful. Several scholars mention business models as the phenomenon that describes how an organization is organized in order to add value. For example, Amit and Zott (2001, p. 493) define it as: *“A business model depicts the design of transaction content, structure, and governance so as to create value through the exploitation of business opportunities”*. Osterwalder, Pigneur and Tucci (2005, p. 3) define business models as *“...a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm”*. Teece (2010, p. 1) defines a business model as something *“...that describes the design or architecture of the value creation, delivery, and capture mechanisms it employs”*. But as mentioned earlier, a CE differentiates from a linear economy as it enables itself to organize in a different, co-creative manner. Since organizing is intertwined with an organization's business model it is necessary for organizations to search for new business models in order to reach a CE.

Second, an important characteristic of a CE is multiple value creation by means of collaborative action. Multilateral efforts in a CE allow for new types of value to be created; one of the problems of a linear economy is its inability to create multiple values. This is caused by the observation that a linear economy is centered around a ‘take-make-waste’ flow (Lacy & Rutqvist, 2015) which encourages maximum throughput and, thus, consumption. On the consumers' side, value in conventional business models is described as a product or service that can fulfill an unserved need (Allen, 2014). Accordingly, an important element of this fulfilling of an unserved need is the customer's willingness to pay for this offered product

or service (Chesborough & Rosenbloom, 2002). The problem is that focus on the organization's side lies predominantly on its endeavor for financial value. This is a major difference in comparison with a CE, which proposes value creation and -preservation of products, materials and resources throughout an entire cycle or loop. So, the problem with our linear economy is that, from the organization-side, financial value is supreme above other types of value. In a CE, organizations are driven by pursuing multiple value creation and -preservation. As this should be realized in a cooperative manner, multiple values are created in cycles, causing value cycles to arise.

Based on the above, there are two important aspects of a linear economy that emphasize why this current situation is unsuitable when in a transition towards a CE. It shows two aspects: first, a CE would require new ways of organizing and thus, new business models, often called BMCE's, and second, value should be created in multilateral sense, allowing multiple types of value to be created and preserved.

### ***2.3 THE NEED FOR DIFFERENT BUSINESS MODELS***

In the previous section, the urgency for BMCE's is described. The definitions of conventional business models that were given hold an important implication, namely a different value logic that can be distinguished between organizations and consumers (Kallasides, 2017); whereas organizations pursue economic value in terms of increased revenue and profit, consumers pursue value by fulfilling their needs. Thus, from the organization's point of view, current business models are centered on transactional thinking based on earning money, resulting in production models of *take-make-waste* (Lacy & Rutqvist, 2015). So, conventional business models yet seem, in the first instance, to be centered on accomplishing economic value, rather than accomplishing multiple values. This shows a 'one-way street' in value delivery of these conventional business models, as it lacks the creation of true shared value between organizations and consumers.

Additionally, as Teece (2010) describes, conventional business models are entailed and benefitted by technological innovations. This serves a twofold purpose: first, it calls for new discoveries that can be introduced on the markets, and, second, it offers a possibility for organizations to fulfill unserved needs. Both are necessary for organizations to increase throughput in their supply chain and to make revenue, emphasizing the linear characteristics that are so deeply embedded in conventional business models. Since conventional business

models are mainly focused on achieving economic value, realizing sustainability in these conventional business models is often done from the viewpoint of ‘eco-efficiency’ (Jonker, 2012), which basically means that organizations deliver greener products (i.e. less resources, less energy). However, a suchlike approach does not debate the essence of business models, neither does it debate the value logic that is accompanied with it. Therefore, the dominant way of thinking still lies in a transaction model that is based on monetary value. Business must free themselves from the constraints of linear thinking that are currently rooted in all their activities throughout the supply chain (Lacy & Rutqvist, 2015).

#### **2.4 THE PROBLEM OF CONVENTIONAL BUSINESS MODELS**

Conventional business models consist of different elements that allow an organization to create and deliver value to their customers. For example, Boons and Lüdeke-Freund (2013) distinguish four elements that together constitute a business model: (1) value proposition, (2) supply chain, (3) customer interface, and (4) financial model. The *value proposition* explains what value is added by an organization’s offered product or service. The *supply chain* describes the relationships an organization has in their chain with suppliers and how these are managed. The *customer interface* describes the relationship an organization has with their customers and how these are managed. Finally, a *financial model* shows the dispersal of economic costs and benefits among actors that are involved in the business model.

However, this thinking of Boons and Lüdeke-Freund (2013) deviate strongly from the CE’s profound characteristics, which emphasizes why conventional business models are unsuitable for a CE. For example, the *value proposition* (1) proposed by Boons and Lüdeke-Freund (2013) focuses on value that is added by a product or service, but it does not acknowledge multiple values and the way value is preserved, which is a profound notion in a CE. Additionally, the *financial model* (4) highlights the importance of earning money and the transactional nature of conventional business models, a notion that is not central in CE. On the other hand, Osterwalder and Pigneur (2010) provide the Business Model canvas, a well-known framework or blueprint that consists of nine elements or building blocks, which explains the logic of how an organization makes money based on four main areas: (1) customers, (2) offer, (3) infrastructure, and (4) financial viability. Accordingly, the Business Model canvas consists of the following nine building blocks divided over the four areas:

Customers	Offer	Infrastructure	Financial viability
Customer segments	Value proposition	Key activities	Cost structure
Channels		Key resources	Revenue streams
Customer relationships		Partner network	

Table 1: Building blocks of conventional business models per main area (Osterwalder & Pigneur, 2010)

Although Osterwalder and Pigneur (2010) manage to successfully identify building blocks of conventional business models, which is still a challenge for BMCE's, their model also comes with an impediment in light of a CE. The problem of their thinking, and thus the problem of conventional business, is its organization-centric perspective. It perceives a business model and its building blocks a means for organizations “...that the show logic of how a company intends to make money” (Osterwalder & Pigneur, 2010, p. 15). However, it does not assume the importance of a network-centric perspective and realizing collaborative organizing between multiple parties. This illustrates how a conventional business model fail to fit within a CE and thus emphasizes the need for BMCE's.

This research seeks to describe the building blocks and value-logic that are underlying BMCE's. However, in order to arrive at an understanding of these building blocks, we should analyze where these building blocks occur in the process of a business model. In this thesis, it is assumed to have to following structure, of which the concepts will be elaborated:

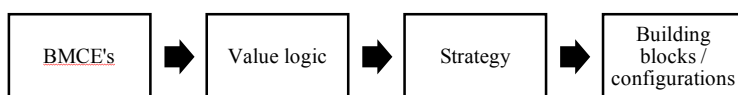


Figure 2: Visualization of underlying BM/BMCE logic

Initially, BMCE's are expected to consist of a value logic. Whether it is financial-, ecological-, social-, single-, or multiple value, organizations strive to create, and possibly preserve, value that is originated from their circular business models. This is supported by some of the definitions on business models that were given earlier (e.g. Amit and Zott (2001)). Consequently, strategies are designed and actions are taken by organizations in order for them to achieve their perception of value, i.e. to reach their goals in terms of their desired contributions. Ultimately, the business models and BMCE's with their accompanying value logic and strategies consist of building blocks and configurations of these building blocks. Building blocks are generally defined as “the basic things that are put together to make

*something exist*” (Cambridge Dictionary, 2017). In other words, it describes the key elements of a concept or model; in terms of BMCE’s, building blocks describe the key elements that are configured in a BMCE typology. Additionally, the way building blocks are combined and configured should develop a certain BMCE typology. It is also relevant to determine whether BMCE typologies always contain of a fixed set of main building blocks, or whether these appear to be diversified.

## **2.5 A DIFFERENT VALUE LOGIC**

As explained briefly, the value logic in BMCE’s is different than that of a conventional business model, where value is mostly created, captured, and delivered by the organization to realize financial results. On the consumers’ side, value in conventional business models is described as a product or service that can fulfill an unserved need (Allen, 2014). However, focus lies predominantly on the organizations’ endeavor for financial value. In BMCE’s this perception on value-creation lies differently. A CE strives for creation of multiple values, in addition to solely financial value in a linear economy. For instance, this multi-issue value could comprise of financial, environmental, and social value (Witjes & Lozano, 2016). Furthermore, this value is ought to be created and shared collaboratively, as closing loops in a CE is an inter-organizational task that requires inter-organizational efforts. Since loops have to be closed, meaning products have to be kept into their lifecycle for as long as possible, organizations deliver value (either financial, ecological, social etc.) when being able to do so. Also, in a CE, it is in the interest of these organizations to produce sustainable products (Jonker, Stegeman, & Faber, 2017). This causes a shift towards ‘servitization’, a situation in which organizations deliver their products as a service (e.g. through rental, lease, loan). In this, customers rather purchase a desired function or performance than a specific product (Lacy & Rutqvist, 2015). An important element of this notion is that organizations retain ownership, and it therefore stimulates organizations to enhance a products’ technical performance (Vendrell-Herrero, Bustinza, Parry, & Georgantzis, 2017). Servitization is one of the ways circular business models arise; by selling a product as a service, organizations remain responsible for, among others, the service’s performance and maintenance. This is assumed to lead to products of higher quality standards which are designed to last as long as possible. Hence, servitization stimulates organizations to close loops, which leads to new types of value to be created and preserved.

By analyzing circular strategies proposed by different authors it is presumed that it enables to identify the value logic that lies at ground for BMCE's. For example, Despeisse and Ford (2015) propose a model, as can be seen in figure 2, which includes circular strategies to extend product and material life cycles. In this figure, Despeisse and Ford (2015) identify seven strategies which are located at the bottom: (1) repair, (2) reuse, (3) remanufacture, (4) refurbish, (5) upcycle, (6) recycle, and (7) downcycle. Despeisse and Ford (2015) framework is appropriate to use, as it provides multiple, comprehensive strategies used within a CE.

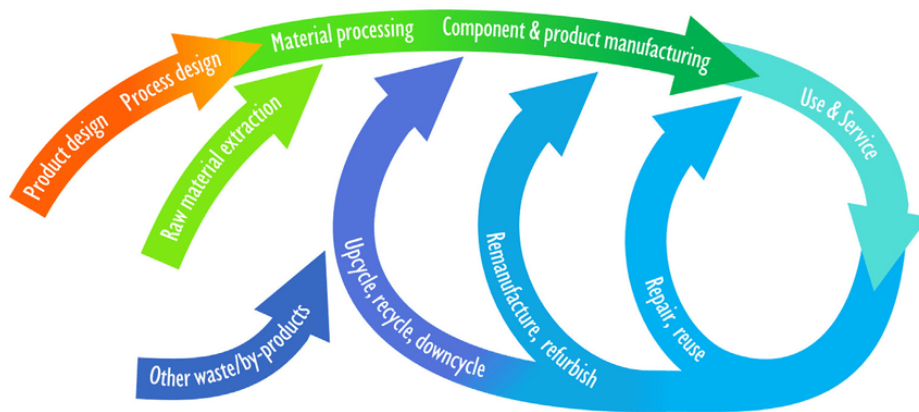


Figure 3: Product and material life cycle stages (Despeisse & Ford, 2015)

Based on the above strategies, we conclude that BMCE's have three main types of values that lie at base for circular strategies: value creation, -preservation, and -destruction. Value creation assumes a logic in which products, materials, and components are handled in a way they are improved and provide additional capabilities than beforehand. Hence, additional value is created. Value preservation neither assumes improvement nor deterioration of products, materials, and components, but rather retaining of the latter, meaning value is preserved. Value destruction, finally, assumes that products, materials, and components become of less value and quality after being handled. In this way, value is destructed compared to the initial situation.

Reviewing the strategies as proposed by Despeisse and Ford (2015), the purpose of *repair* is to put products back to a condition in which they have a working function (Thierry, Salomon, van Nunen, & van Wassenhove, 1995). In terms of a value logic, a repair strategy is centered around value preservation, to utilize the value potential of a product or material. *Reuse* defines itself as to use something again, without any strings attached or edits. Hence, this is centered around value preservation of a product or material. A *remanufacturing* strategy is focused on

improving the quality standards of used products to a level similar of new products (Thierry, Salomon, van Nunen, & van Wassenhove, 1995). Products are disassembled, and necessary parts are replaced with new ones. Value logic-wise, this identifies with value creation, as products are improved and therefore new value is generated. Similar to remanufacturing is a *refurbish* strategy. This distinguishes itself as its main purpose is to bring used products up to a specified quality, but not as high as new products (Thierry, Salomon, van Nunen, & van Wassenhove, 1995). Therefore, this strategy's value logic is about value-preservation.

An *upcycling* strategy is defined as a process in which materials that have been used are transformed into new materials or products of better quality (Sung, 2015). It is a strategy designed to give products better quality in their second life. In terms of value logic, an upcycling strategy is based on value creation. The purpose of *recycling* is to reuse materials originated from used products and components (Thierry, Salomon, van Nunen, & van Wassenhove, 1995). However, in recycling, the identity of a product is not always retained, and materials could be used as components in the same product, or as components in production of other parts. Thus, based on value logic, recycling is about preservation of the materials' value, either in the same product, or in a new product or component. A *downcycling* strategy, finally, is characterized by McDonough and Braungart (2002) as a process of recycling of waste in which the recycled material is of lower quality and functionality than the original material. Hence, the value potential of such products and components is lower than in its initial situation. In terms of value logic, this strategy is therefore driven by value destruction.

Value creation	Value preservation	Value destruction
Remanufacturing	Repair	Downcycling
Upcycle	Reuse	
	Refurbish	
	Recycling	

Table 2: Value logic of lifecycle strategies. Based on Despeisse & Ford (2015)

The Ellen MacArthur Foundation (2013) illustrates the proposition of a CE in their figure of the CE, which can be found in appendix 2. However, this report solely focuses on the **right** side of the figure. This side of the figure is relevant to this report, as it displays strategies for technical materials and components to return to manufacturers and/or retailers in order to



close loops and to keep these materials and components into a cycle. Compared to Despeisse and Ford (2015) the Ellen MacArthur Foundation (2013) distinguishes four circular strategies: (1) maintain, (2) reuse & redistribute, (3) refurbish & remanufacture, and (4) recycle. It could be argued that some of these strategies (e.g. reuse & redistribute) are merged into one strategy, whereas separated with Despeisse and Ford (2015); yet the proposed strategies correspond in their essence. Although the figure provides good insight in the essence of a CE and corresponding strategies, it is not used in relationship with value logic, because the strategies show some shortcomings. For example, the Ellen MacArthur Foundation (2013) assumes some strategies to be of similar nature (e.g. refurbish & remanufacture), whereas it is showed that these are different in their underlying value logic based on their definition. Refurbishment implies value to be preserved, while remanufacturing implies value to be created. As a result, the figure provided by Despeisse and Ford (2015) will be leading in this research, as it proves to be more comprehensive in their strategies.

Conclusively, the logic of value in a CE on which business models are based transform to a large extent. Financial value is not solely the most important pillar in value creation, as other types of values, explained earlier, become essential as well. Three types of value have been distinguished on which BMCE's are built, and from which strategies arise: value creation, -preservation, and –destruction. These types of value can originate on different levels (e.g. financial-, ecological-, and social- value).

## **2.6 BUSINESS STRATEGY**

An important distinction is to be made between a business model and a business strategy, which is also of interest for this report. This distinction is important as it is assumed that strategies are a result of the business model and value perception of an organization. In order to understand the building blocks of BMCE's, the difference between a business model and business strategy should therefore be highlighted, as both take different shape in practice.

As acknowledged by scholars, the concept 'business model' appears to be similar to that of 'strategy' (Casadesus-Masanell & Ricart, 2010) A business model explains the abstract way organizations create and capture, or deliver value to their customers and the means it uses to accomplish that goal. However, a business model is often generic (Teece, 2010) and lacks the mentioning of specific actions or activities. Business strategy therefore is defined by Porter (1996, p. 8) as “...*the creation of a unique and valuable position, involving a different set of*

*activities*". As this definition also seems to be quite abstract and generic, some scholars highlight the *choice* aspect in strategy. For example, van den Steen (2013, p. 1) defines strategy as "*the smallest set of (core) choices to optimally guide the other choices*", emphasizing the intended course of action that is involved in business strategy. Ghemawat (1991) and Caves (1984) both acknowledge the latter by adding that these intended courses of action are a result of choices made by top management within an organization. Mintzberg, Ahlstrand, and Lampel (2009) and Mintzberg (1987) elaborate on strategy merely being a plan of actions by introducing five definitions: strategy as (1) Plan, (2) Ploy, (3) Pattern, (4) Position, and (5) Perspective. With his five different definitions of business strategy, Mintzberg (1987) shows the broad aspects which are interrelated with strategy and does not solely limits strategy as an intended course of action. Summed up, we can conclude that a business model is used to generically describe the different elements an organization utilizes to create value with their product or service, whereas business strategy traditionally describes the intended elements of choices made by top management within an organization in order to create a unique and valuable position. Related to the previous part of this report, we have seen circular strategies that emerge from a certain perception of value. Such strategies are the intended choices of an organization for pursuing the value perception of an organization, basically the core for which it stands. In a CE, it would therefore be best to describe circular strategies as the intended choices that are made collaboratively in order to pursue its value perception. Differently from the traditional definitions of strategy, circular strategies evolve more around collaborative action-taking and pursuing a certain value perception.

## **2.7 BUSINESS MODELS FOR THE CIRCULAR ECONOMY**

This report is centered around a different perception of value that arises with business which are conducting circular activities and have circular business models. This perception of value, that is different from that is present in organizations build on linear principles, are at basis for circular business models and their strategies. The urgency for BMCE's is already described in the previous parts of this report. However, to fully understand what drives these BMCE's and what factors constitute their building blocks it is indisputable that we define this phenomenon. Several authors have already engaged in this process, delivering us some useful definitions. Linder and Williander (2017, p. 183) define a circular business model as "*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*". However, this definition solely focuses on value creation based on utilizing the economic value that is retained from

products that have found a new application. Yet, this definition does not focus on two important aspects of a CE: collaboration and multiple value creation, two notions that are of great importance within a CE. A CE encourages new business models that enables working with closed loops and collective value creation as well as sharing this created value together (Jonker, Stegeman, & Faber, 2017). Mentink (2014, p. 24) defines circular business models as “...*the rationale of how an organization creates, delivers and captures value with and within closed material loops*”. Although this definition appears to be more complete, it also lacks the concepts of collaboration, and multiple value creation. The problem of this definition is that it still assumes an organization-centric perspective. Kallasides (2017, p. 29) proposes a broader definition om BMCE’s: “*Circular Economy Business Models provide the logic of how organizations (in collaboration with partners and stakeholders) creates, delivers, and captures values with and within closed material loops while maintaining and regenerating the health of ecosystems*”. As this definition is provides a comprehensive understanding of circular business models in which the most important aspects of a CE are included, this definition will be leading in this report.

This chapter illustrates the core assumptions of a CE and why a transition towards a CE is needed in light of our current, linear economy. However, this theoretical framework also illustrates how conventional business models fall short in a CE and why there is a need for new, circular business models. It is furthermore described how BMCE’s are assumed to be structured (i.e. value logic, strategies and building blocks) and how these concepts are interrelated. One of the current theoretical problems is that literature describe vague typologies and that it is not sure what logic and building blocks constitute these typologies. By having established the framework as in figure 2 it becomes clear how BMCE’s are structured. Accordingly, research of typology literature and document analysis will have to use this framework to come to a conclusion.

### **3. CHAPTER 3. METHODOLOGY**

This chapter discusses how the research will be carried out and to elaborate on the methods that are used to do so. A research objective, approach and design will be described, followed by a subchapter which describes how data is collected. Within this subchapter, a distinction between the literature research and document analysis is made. This chapter will also provide arguments and reflection with regard to the validity and reliability of this research.

#### ***3.1 RESEARCH OBJECTIVE***

As described, circular business models are emerging, but it remains unclear what building blocks and value-creating logic form these circular business models. While some insight is yet available on the features of BMCE's, insights on how these business models emerge and take shape are still at its early stages. As a result, there are a few solid fundamentals for archetypes of BMCE's; there is a lack of fundamentals for archetypes of these business models, resulting in vague and overlapping typologies of businesses models for the CE. The purpose of this master thesis is therefore to seek and describe the building blocks and logic of BMCE's, as they emerge in business practice.

#### ***3.2 RESEARCH APPROACH***

Since there is little literature available on this research matter, and research is conducted to primarily discover a relatively new phenomenon, a qualitative research method is eminently suitable to conduct this research. Not unimportantly, this type of research is extremely suitable for investigating fields about which is little known (Stern, 1980), which is the case in this research. The building blocks of BMCE typologies have appeared to be a relatively novel and unknown subject. Conducting qualitative analysis is predominantly a process of interpreting, for the motivation of discovering concepts and relationships in data in order to construct these in a theoretical explanation (Strauss & Corbin, 1990). As mentioned in the introduction of this report, this research is focused on contributing to the academic field as it hopes to provide new insights in the building blocks and logic that constitute BMCE's. In other words, it hopes to contribute to a better understanding of theory in order to fine-tune this.

### ***3.3 RESEARCH DESIGN***

In order to describe the fundamentals or building blocks, and logic of BMCE archetypes, this research follows a twofold approach. First, an extensive literature research will be conducted to gain better understanding of BMCE's, the characteristics and differences between conventional business models and BMCE's, and ultimately a description of current BMCE typologies, as introduced in contemporary literature. Second, after constructing a BMCE typology summary, this research is followed by an analysis, which is conducted to explore to what extent and in what way BMCE's emerge in business practices. This is realized by collecting and analyzing business documents that are present on the Internet. It is assumed that organizations who are engaged in circular activities and follow circular business models use to communicate and share this information by distributing it online in the form of public business documents. Additionally, it is therefore assumed that suchlike documents may contain arguments and notions describing the underlying logic of BMCE's.

### ***3.4 DATA COLLECTION***

For conducting a literature research as the first part of this report, a twofold approach is taken in selecting appropriate literature. First, in describing the general characteristics of a CE, conventional business models and BMCE's, business strategies, and the amending value perception of BMCE's, literature and information will be gathered from (1) sources that were provided beforehand by the supervisor, and (2) building on this provided literature by using 'snowball sampling', a technique at which initial data sources serve as a starting point for finding additional data sources (Given, 2008). In this research, initially provided literature will be used to scan through reference lists to find matching, key documentation on the subject matter. By using a suchlike method, it is assumed that the most important and prevailing authors and literature will be gathered. Second, to describe the building blocks and value-creating logic of BMCE's, a selection of appropriate literature will be made. In consultation with the supervisor of this master thesis, the selection of BMCE typology literature is reduced to three authors whose typologies will be analyzed. It is assumed that three typologies provide a comprehensive view on BMCE building blocks according to different authors. The typologies that will be used in this report are constituted by three authors: Lacy and Rutqvist (2015), Bocken et al. (2014) and Bakker et al. (2014). The choice for these authors is based on considerations. Probably the most important consideration and criterion is that the selected authors must have given typologies that are extensively described and fully elaborated. It is assumed that full elaborated typologies offer the best possibility in

describing the building blocks. Furthermore, the authors manage to provide their typologies with practical examples, showing the typologies do appear in business practice.

In terms of the sources that will be used, this literature is based on some well thought criteria to ensure its comprehensiveness. However, the selection of three authors is made, which may cause the exclusion of other academic literature. Therefore, validity may be weakened, as literature is possibly not fully comprehensive.

### 3.4.1 LITERATURE RESEARCH

As mentioned earlier in this thesis, building blocks are simply defined as “*the basic things that are put together to make something exist*” (Cambridge Dictionary, 2017). In other words, it describes the key elements of a concept or model; in terms of BMCE’s, building blocks describe the key elements that are configured in a BMCE typology. Additionally, the way building blocks are combined and configured should develop a certain BMCE typology. It is assumed that building blocks can be characterized and analyzed in professional literature by keywords. In this report, building blocks are considered to be groupings of the activities, technologies and stakeholder relationships that organizations utilize to shape their BMCE’s.

Visualized in table 3, it is presumed BMCE typologies hold a value perception (from which strategies originate). As a result, building blocks (e.g. groupings of activities, technologies and stakeholder relationships) describe how these typologies are constituted, yet little is still known about this subject. By searching for specific keywords that are present in description of typologies, we are able to constitute their most important building blocks.

BMCE typologies (based on literature)	Value logic and strategies	Building block 1	Keyword 1
			Keyword 2
		Building block 2	Keyword 3
			Keyword 4

Table 3: Operationalization of research

Hence, a grouping of keywords that exist in literature can help determine the building blocks of different typologies that have been proposed by authors. In order to do so, the following is relevant: typologies have to be described and elaborated to gain understanding of their essence. Consequently, these typologies that are present in literature have to be analyzed extensively.

This will be done by searching for keywords that illustrate the specific activities of organizations within these proposed typologies. By assembling the different keywords that belong to a typology we are able to describe the relevant building blocks of these typologies. By means of table 4, the differences between keywords, building blocks and are explained.

<b>Expression</b>	<b>Characteristic</b>
Keyword	Description of specific activities, technologies, and stakeholder relationship organizations utilize and are related to a CE. Keywords must be specific and explain how these can be implemented in BMCE's.
Building block	Aggregate groupings of keywords.
BMCE typology	Description of circular business models and their essence.

Table 4: Distinction between keywords, building blocks and BMCE typologies

The literature research will be conducted by following a grounded theory approach (Corbin & Strauss, 1990). As building blocks will be identified, this approach assumes systematic, continuous comparison of data to identify similarities and differences among the data. Ultimately, this comparison allows us to allocate certain labels to similar phenomena (i.e. to categorize similar keywords into building blocks).

By thoroughly analyzing the typologies on their contents, it is possible to research the typologies in depth and develop solid conclusions with regard to the overlap of typologies and the building blocks that constitute these typologies. Hence, it has a positive effect on both the reliability and validity of this research.

### **3.4.2 DOCUMENT ANALYSIS**

To successfully conduct an analysis on BMCE's and how these emerge in business practice, online documents collected from the Internet will be used to gather data and information. These documents should consist of business documents such as organizational brochures, case studies, industry reports, consulting reports, governmental reports et cetera. The collection of documents is targeted to find as much as possible documents on international websites; this, since the research mainly focuses on organizational practices within international organizations. By means of a metasearch engine, relevant documents are extracted and collected from different websites. Suchlike metasearch engines use input generated from the

user to send out queries to a set of search engines (Glover, Lawrence, Birmingham, & Giles, 1999). Accordingly, the results from these search engines are returned. One of the advantages of metasearch engines is their ability to increase coverage by searching in multiple search engines simultaneously, which allows more information to be found. Secondly, metasearch engines use an architecture of ranking to rank the most relevant information. In light of this research, this search method is both useful and beneficial as one of its main goals is to identify the occurrence of BMCE's typologies in practice. As mentioned, this occurrence should be found in public business documents; the more information that is gathered, the better results this could provide for this research. It is argued that results retrieved from multiple sources have a higher probability of being relevant to the researcher's needs (Gauch, Wang, & Gomez, 1996). However, one of the disadvantages that may occur is that the metasearch engine draws irrelevant documents from its search, which could compromise the validity of the research. Although metasearch engines try to prevent this as much as possible by filtering and ranking information, a second filter process will be conducted to ensure reliability and validity of the data. To ensure validity it is important, when using this research technique, that the documents that are collected are reviewed and analyzed on the level of their contents to judge their appropriateness and relevancy in light of this research. In this way, the data is judged to ascertain the information that is found is valid in light of this research.

### ***3.4.3 DOCUMENT COLLECTION USING A METASEARCH QUERY***

By using a metasearch technique for gathering public business documents the appearance of BMCE typologies in practice is researched. Furthermore, by collecting empirical data it seeks to describe any new typologies or building blocks that are not currently existing according to literature.

Several metasearch engines are appropriate for collecting relevant documents (e.g. MetaCrawler, DogPile, Google, IxQuick). However, some metasearch engines (MetaCrawler and DogPile) lack the ability to assign specific search operators to the search (e.g. setting instructions to only search for pdf documents within the last year), which is, however, important in this research study since current pdf documents are required for this analysis. One of the advantages that, for instance, Google offers, is that Google makes the searcher able to choose your own search operators, and that Google in advance indexes .pdf files as normal text websites, making it able to search the contents of pdf documents directly from the search



query. In other words, the search operators provided by the searcher are directly being searched within .pdf documents. This gives the advantage that it will most likely increase the relevance of the document, since the contents should match the search query of the user. Similar to Google, metasearch engine IxQuick uses the same technique.

Spink et al. (2006) conducted a study across several, large web search engines to identify the proportion of overlap of search results generated by the different search engines. Their results concluded a small degree of overlap (1,1 percent) when combining the four search engines., which shows that a single search engine is not effective when the aim is to find as much as data on the web. Because of the abovementioned characteristics of these search engines, documents will be collected using a combination of search engines (e.g. Google and IxQuick). This should provide the searcher with the most information available from different (meta)search engines. One of the risks that may be involved when only using Google as a metasearch engine for documents will hereby be eliminated as well: the reach of data. When only using Google, it may be doubtful if the results are ‘complete’ (i.e. how does the searcher ensure there are no more results elsewhere?). By using multiple search engines, of which one is a metasearch engine, the results are expected to be more extensive.

After collecting relevant documents for this research and judging these on their contents, a coding process will be conducted to identify how BMCE typologies found in professional literature emerge in business practice. By means of the keywords that will be identified in the typology overview, documents will be coded using Atlas.ti software for qualitative data analysis. The content of the relevant documents will be analyzed by searching for the keywords of BMCE typologies. In this way, the emergence of these BMCE typologies in practice can be determined. Furthermore, keywords that might be unknown or not yet identified will be included to possibly establish new BMCE building blocks or typologies. Summarized, this approach is twofold: first, this document analysis seeks to describe to what extent BMCE typologies from professional literature emerge in practice, and second, this analysis hopes to identify new possible building blocks or typologies that are being missed in current literature.

By coding the documents in-depth and thoroughly searching for the existence of phenomena in practice, this qualitative research delivers a high extent of validity as it enables the researcher to fully measure that phenomenon that was intended at the outset.

## **4. CHAPTER 4. ANALYSIS AND FINDINGS LITERATURE REVIEW**

In this chapter, the BMCE typologies that are provided by the three chosen authors will be analyzed and the findings regarding their overlap and constituting building blocks will be provided. The first subchapter formulates the typologies that are used. The second subchapter will provide conclusions regarding the typologies, which are based on the analyses that are conducted and can be consulted in appendices 3-7. Finally, the third subchapter presents the building blocks that are established from conducting the literature review.

### ***4.1 BMCE TYPOLOGIES PROVIDED IN LITERATURE***

To identify the building blocks that are at basis for different BMCE typologies, three authors that each provide different BMCE typologies will be analyzed in depth: Lacy and Rutqvist (2015), Bocken, et al. (2014), and Bakker et al. (2014). It is best to emphasize again that building blocks will be constituted by searching for specific keywords in the typologies' descriptions. However, these keywords should at all time describe specific activities, technologies, and stakeholder relationships organizations utilize; they must explain how these can be implemented in BMCE's. All typologies provided in literature have been analyzed extensively according to the following steps: first, the BMCE typologies are read and analyzed thoroughly. The typologies are introduced by authors by starting with a brief conclusion on their core assumptions and ideas. These conclusions are used to determine the most important characteristics of each typology and can be consulted in appendices 3-5.

Second, the pieces of text belonging to these typologies are carefully reviewed and the most important dimensions of the typologies are noted. Third, based on the key dimensions of the typologies, the key indicators or keywords of these dimensions are collected from which the main building blocks can be derived. Starting with Lacy and Rutqvist (2015), they describe five BMCE's that were identified by Accenture (2014) after conducting an analysis of more than 120 case studies of companies:

1. Circular Supply-chain
2. Recovery and Recycling
3. Product Life-extension
4. Sharing Platform
5. Product as a Service

One of the advantages of the BMCE's provided by Lacy and Rutqvist (2015) is that they manage to fully elaborate on- and extensively describe these typologies. However, one of the disadvantages, and what Lacy and Rutqvist (2015) do not take into account, is that although

they successfully identify five BMCE's, these five typologies are viewed from an organization-centric perspective, which is in contradiction with a CE. Nonetheless, their typologies in essence are suitable as they manage to fully elaborate these, making them suitable for analyzing and identifying building blocks.

Bocken et al. (2014; 2016) introduce eight archetypes or typologies for BMCE's which are, in their research, classified into groupings based on types of innovations (e.g. technological, social, organizational). However, this research solely focuses on the following eight typologies and their elaboration explaining their characteristics and building blocks:

- |  |  |
|--|--|
| 1. Maximize Material and Energy Efficiency (MMEE)          | 4. Deliver Functionality rather than Ownership |
| 2. Create Value from Waste                                 | 5. Adopt a Stewardship Role                    |
| 3. Substitute with Renewables and Natural Processes (SRNP) | 6. Encourage Sufficiency                       |
|  | 7. Repurpose for society/environment           |
|  | 8. Develop Scale up Solutions                  |

Finally, Bakker et al. (2014) provide five different BMCE typologies in their book *'Products that Last'*. One of the downsides of the typologies described by the authors, and a phenomenon that appears to be a negative aspect for more authors (e.g. Lacy and Rutqvist (2015)), is that the typologies all assume an organization-centric perspective that are embedded in linear principle thinking. For example, both Lacy and Rutqvist (2015) and Bakker et al. (2014) come up with BMCE typologies that are suitable for organizations that endeavor circularity; therefore, they may contribute to practice of organizations, but they still assume transaction thinking as the foremost objective of these business models, although theoretical explanation of a CE assumes different objectives. Nonetheless, Bakker et al. (2014) manage to describe the following five typologies:

- |                                |                          |
|--------------------------------|--------------------------|
| 1. The Classic Long-Life Model | 4. The Access Model      |
| 2. The Hybrid Model            | 5. The Performance Model |
| 3. The Gap Exploiter Model     |                          |

All BMCE typologies above were analyzed on their contents, and building blocks are constructed by allocating certain labels to similar phenomena (i.e. to categorize similar keywords into building blocks). The text contents of the BMCE typologies were read extensively to subtract their most important characteristics and their key indicators or

keywords, which are noted in appendices 3-5. The BMCE typologies that have been analyzed show to some extent overlap. Therefore, some typologies have been merged to ultimately reach a number of truly distinct typologies. For instance, some BMCE typologies that were similar in essence (e.g. Sharing Platform and Access Model) have been merged into one BMCE typology; to prevent their small distinctions are being missed in analyses, the most important keywords of the typologies have been merged as well. This process is justifiable as the authors provide complementary insights and keywords according to their analyses. Additionally, some of the BMCE essences and core assumptions correspond with each other, making it justifiable as well to regard them as similar BMCE typologies.

Based on the BMCE typology analysis, in which the core assumptions of each BMCE typology proposed by different authors have been identified and described along with the key dimensions and keywords belonging to those typologies, a classification of nine different BMCE typologies has been established. One BMCE typology found in literature has been removed: The *Hybrid Model* proposed by Bakker et al. (2014). This model assumes a long-lasting product that is dependent upon a replaceable part with limited functional lifespan; when the two products in this model are not combined, the product is considered useless (e.g. razor and blades or printer and cartridges). This model is generally known and described as the *Razor Blade model* (Teece, 2010; Johnson, Christensen, & Kagermann, 2008). Yet, Teece (2010) argues a suchlike model is an example of a business revenue model, which is just a component of a traditional, linear business model. In terms of Osterwalder and Pigneur (2010), a suchlike model would classify as the '*revenue stream*' in their Business Model Canvas. Schmalensee (2015) even argues the Razor Blade model is a pricing strategy for specific products.

Based on the above, the Hybrid Model proposed by Bakker et al. (2014) is hence regarded as either a component of a linear business model in terms of revenue streams, or as a pricing strategy for product market combinations. Therefore, the Hybrid Model is viewed as an insufficient stand-alone BMCE typology. Not unimportantly, its main characteristic shows vast correspondence with a linear business model. After this iteration, the below nine BMCE typologies remain. Note: BMCE typologies 1 up to 7 are constituted from multiple typologies due to overlap among these in literature. All typologies are elaborated in appendix 6.

1 Lacy and Rutqvist (2015), 2 Bocken et al. (2014), 3 Bakker et al. (2014)

1	Circular Supply Chain <sup>1</sup>	SRNP <sup>2</sup>	
2	Recovery and Recycling <sup>1</sup>	Create Value from Waste <sup>2</sup>	
3	Product Life Extension <sup>1</sup>	Classic Long-Life Model <sup>3</sup>	
4	Sharing Platform <sup>1</sup>	Access Model <sup>3</sup>	
5	Product as a Service <sup>1</sup>	Functionality over Ownership <sup>2</sup>	Performance Model <sup>3</sup>
6	MMEE <sup>2</sup>	Encourage Efficiency <sup>2</sup>	
7	Stewardship Role <sup>2</sup>	Repurpose <sup>2</sup>	
8	Scale up Solutions <sup>2</sup>		
9	Gap Exploiter Model <sup>3</sup>		

Table 5: BMCE typologies traced in literature, organized according to their similarity

#### **4.2 LITERATURE SHOWS OVERLAPPING TYPOLOGIES**

Based on the previous table it becomes evident that a majority of BMCE typologies proposed in literature show overlap in their essence, key dimensions, and key indicators (i.e. keywords). This is visible in appendices 3-7, which shows an analysis of BMCE typologies based on their essence, dimensions and indicators. Ultimately, appendix 7 shows a number of building blocks that are identified and how often these appear per typology.

Conclusively, the findings of this literature- research demonstrate that a wide range of academic literature on BMCE typologies initially may appear to be diverse, yet when researching their essence and building blocks these BMCE typologies show a lot of overlap. This confirms the notion that current BMCE typologies provided in academic literature are rather vague and overlapping. It shows that there is little uniformity among authors and BMCE typologies, resulting in a lack of academic standards and structure on BMCE typologies. These results highlight that future discussion is needed for developing industry standards when it comes to BMCE typologies among academics.

#### **4.3 IDENTIFIED BUILDING BLOCKS**

Within the nine typologies that are ultimately constituted, a number of building blocks are identified which are built from multiple keywords that describe specific activities, technologies, and stakeholder relationship organizations utilize and consisted of an interrelated meaning. The building that blocks have been identified are mentioned and explained on the following page.

<b>Building block</b>	<b>Keywords</b>	<b>Description</b>
1. <i>Pure inputs</i>	<i>Renewable, recyclable, non-toxic, bio-based, nature-based, biodegradable inputs, regenerative materials, certified materials, fair products/trade, ethical trade, certifications.</i>	Illustrates the decision for ‘clean and pure’ resource inputs originating from fair sources.
2. <i>Waste as input</i>	<i>Waste as resource input, waste as energy input, compost.</i>	Activities that describe how waste is used as input for new resources and/or energy.
3. <i>Waste management</i>	<i>Waste management, waste handling, capture and transfer waste, sorting, separating, separate products.</i>	Activities for optimally handling waste to make it usable for post-use purposes.
4. <i>Renewable input sources</i>	<i>Renewable energy sources, renewable power, new energy systems, solar, wind, water.</i>	Involves ways to use or generate renewable energy.
5. <i>Efficient design</i>	<i>Compatibility, durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use design, prolonging life, enhancing performance.</i>	Describes product characteristics that can extend product life’s and after life can easily be reprocessed into new products and materials.
6. <i>Hybrid manufacturing</i>	<i>3D printing, additive manufacturing.</i>	Technique to combine additive manufacturing (i.e. 3D printing) and subtractive manufacturing (e.g. polish).
7. <i>Stakeholder engagement</i>	<i>Collaboration, circular networks, collective efforts, industrial symbiosis, value networks, partnerships, exchanging feedstock, exchanging by-product, network reconfiguration, consumer care, consumer contact,</i>	Collaborative efforts organization undertake within their environments for collective actions, decisions, and

	<i>community building, community integration, relationships.</i>	influences.
<i>8. Take-back</i>	<i>Return chains, two-way supply chain, drop-off points, take-back, trade-in, buy-back, return points, return and collect, return-services.</i>	Activities to simplify the collection of post-consumer products and materials.
<i>9. Rewards</i>	<i>Incentives, credits, paid in return.</i>	Incentives or rewards that consumers or others may receive for efficient using or returning products.
<i>10. High quality products</i>	<i>Product quality, testing, inspecting, quality assurance, monitoring.</i>	Efforts taken by organizations to ensure high product quality to prolong life and keep them viable for as long as possible.
<i>11. Information sharing</i>	<i>Knowledge sharing, open-source initiatives, crowdsourcing.</i>	Initiatives to share knowledge and expertise.
<i>12. Digital technologies</i>	<i>Online platforms, HUB's, 3D HUB's, Peer-2-Peer, mobile, apps, track and trace, Internet, digital communication.</i>	An umbrella term for online-based products and solutions that allow parties to communicate easier and to efficiently monitor resource flows (e.g. online car sharing).
<i>13. Recycling</i>	<i>Recycling, advanced recycling.</i>	Value preservation by reusing materials originated from used products and components; identity of a product is not always retained.

<i>14. Upcycling</i>	<i>Upcycling, performance improvement, remanufacturing, remarketing.</i>	Value creation by transforming used materials into existing or new materials or products of better quality.
<i>15. Maintenance</i>	<i>Maintenance, repair, replacement, component replacement, refurbishing.</i>	Value preservation by bringing used products up to a specified quality again, but not as high as new products.
<i>16. Insurance</i>	<i>Guarantee, warranty, after-sales support, extended warranty, insurance, extended insurance.</i>	Assurance that certain conditions will be fulfilled relating to a product, service, or transaction, and otherwise will be repaired or replaced.
<i>17. Reuse</i>	<i>Recovery and reuse, reuse, second-hand.</i>	Value preservation by using products or services again, without any amendments.
<i>18. Shared ownership</i>	<i>Share, sharing, co-use, multiple users, shared ownership, full utilization, collaborative consumption.</i>	Allows users to share products and services to ensure their full utilization and reduce underutilization.
<i>19. Servitization</i>	<i>Service providing, access, function, performance, performance agreement, intermediary service, organization retains ownership, solution provider, product as a service, through-life and end-life responsibility.</i>	Organizations providing services instead of products to ensure effective use of assets.
<i>20. Alternative revenue model</i>	<i>Leasing, renting, swapping, lending, payment fee, commission, no promotions, pay-per-use.</i>	Alternative models for earning revenue than compared to traditional transactions.



21. <i>Eco-efficiency</i>	<i>Less energy use, reduce emissions, minimize environmental footprint, zero-emissions, reduce consumption, less waste generation, lean manufacturing.</i>	Activities to minimize ecological damage while maximizing efficiency through the lesser use of energy, material, and water, and more recycling.
22. <i>Consumer education</i>	<i>Transparency on environmental and social impact, eliminating unhealthy products, providing information, advising consumers, discourage overselling, discourage obsolescence.</i>	Increase awareness among consumers to improve their well-being and reduce environmental and social impact of production.
23. <i>Scale-up initiatives</i>	<i>Franchising, licensing, mergers, acquisitions.</i>	Arrangements or activities to scale up circular activities.

After analyzing the building blocks that originate from the professional typologies provided in literature, the appearance of these building blocks per BMCE typology has been reviewed. The appearance of these building blocks can be consulted in appendix 7. The keywords that were ultimately aggregated into building blocks appeared in several typologies. For example, keywords such as ‘*guarantee, warranty, and after-sales support*’, aggregated into building block ‘*Insurance*’ only appeared in the PLE/CLLM and PAAS/FO/PM typologies. This process is executed for all keywords (i.e. building blocks) to determine which building blocks constitute which typology.

Some building blocks appear to a larger extent in some BMCE typologies, and some of the building blocks are more dominant than others. For example, the *digital technologies* building block may be important in a Sharing Platform (Lacy & Rutqvist, 2015) and Access Model (Bakker, den Hollander, van Hinte, & Zijlstra, 2014), which focuses on shared products for full utilization. To establish this, digital technologies such as apps and online platforms play an important role in providing this access to consumers. For instance, apps have great function in showing available cars in a car sharing model. Yet, this same building block also emerges in a Product Life Extension typology (Lacy & Rutqvist, 2015), in which digital technologies can be used as tools for instantly upgrading products in a way they become viable again (e.g. software upgrades). In a suchlike BMCE typology, digital technologies have a less important role which is not dominant, but it shows an example of how building blocks emerge in different BMCE environments.

The results of the building blocks review can be seen in appendices 3, 4, 5, and 7. Based on the number of appearances of the building blocks in all BMCE typologies, a few, main important building blocks in professional literature have been identified. These building blocks are most present, which implies their relative importance in all BMCE typologies traced back in literature:

- Efficient design
- Stakeholder engagement
- Rewards
- Information sharing
- Digital technologies
- Maintenance

An important notion of building blocks is that they do not represent a fixed solution for the different BMCE typologies. The BMCE typologies proposed in literature show a specific configuration of building blocks. Yet, building blocks are ought to be combined and

configured in a specific manner to endeavor a certain BMCE typology. In addition, BMCE's should consist of a certain value perception that is leading for actions and principles. Summed up, there are some matters that are still unaddressed after the literature study. First, it is unclear how the BMCE typologies proposed by the authors emerge in business practice. Second, it is relevant to determine the existence of different or new BMCE typologies in business practice through document analysis, to see if current literature can benefit from new insights.

## **5. CHAPTER 5. ANALYSIS AND FINDINGS DOCUMENT ANALYSIS – BUILDING BLOCKS**

This chapter will elaborate on the analysis that was conducted on internet documents and presents the findings. Due to the extensive analysis, this chapter focuses on building blocks first. The first subchapter will briefly review the results of the metasearch query. The second and third subchapters will review the appearance of the predetermined building blocks in the document analysis and introduce new concepts that were identified in documents. Subchapter four will give a conclusion regarding the building blocks in document analysis.

### ***5.1 RESULTS FROM USING A METASEARCH QUERY***

An initial search using a metasearch query delivered a result of approximately 150 documents. These documents were automatically downloaded by creating a download script. The documents that were retrieved included a range of diverse documents such as sustainability reports, annual reports, company presentations, organizational documents (both for internal and external use), memo's, policy documents, case studies and more. After extracting all documents, these were analyzed briefly on their lay-out and content to assess their appropriateness. Hereafter, a selection of 110 usable documents remained that were used to analyze the appearance of BMCE typologies and building blocks in practice. A list of these documents is listed in appendix 9. This selection was based on the contents of the documents; the documents that were deleted for instance, either were corrupted files, academic articles, legal contracts with no relevant content or information papers of conferences and speakers.

Consequently, the 110 documents were coded according to the keywords that were initially identified in the professional typologies overview. Furthermore, content was also analyzed to identify new keywords or building blocks that are missing in current literature. The overall qualitative analysis served two main purposes: first, it was used to review the appearance of BMCE typologies and building blocks with their underlying value logic in business practice, and second, it was used to assess to what extent and in which manner the BMCE typologies appeared in practice. First, the appearance of (new) building blocks will be analyzed, followed by an analysis of (new) BMCE typologies.

### ***5.2 BUILDING BLOCK APPEARANCE IN DOCUMENT ANALYSIS***

After coding all documents based on the keywords that were identified in the professional typologies overview, the overall appearance of these keywords on an aggregate level (i.e. the

building blocks determined in chapter 4) were analyzed to review which individual building blocks actually appeared in business practice, and in addition, which building blocks appeared to be most or least dominant. By taking this initial step, it is easy to highlight the relative importance of building blocks, but also to possibly eliminate building blocks that were retrieved from literature, but simply do not appear in business practice, based on the document analysis. The overview of these appearances can be consulted in appendix 10.

Based on the initial analysis of building block appearance in business practice an overview is configured, as can be seen in table 6. The overview shows a categorization of building blocks based on their number of appearances. Four building blocks appear less than ten times throughout the documents. A majority of ten building blocks that were retrieved from the typologies overview appear between 11 and 49 times throughout the documents. The remainder of nine building blocks appeared more than fifty times throughout the documents.

<b>Number of total appearance</b>	<b>Building block and exact number of appearance</b>
<b><math>\leq 10</math></b>	Hybrid manufacturing (2) Scale-up initiatives (3) Insurance (6) Shared ownership (8)
<b>11-49</b>	Rewards (11) Alternative revenue model (13) High quality products (16) Information sharing (25) Upcycling (26) Digital technologies (34) Servitization (35) Maintenance (39) Reuse (45) Waste management (46)
<b><math>\geq 50</math></b>	Consumer education (56) Take-back (59) Waste as input (69)

	Renewable input sources (74)
	Efficient design (77)
	Recycling (84)
	Pure inputs (127)
	Stakeholder engagement (138)
	Eco-efficiency (153)

Table 6: Number of building block appearances in document analysis

The previous table shows the relative importance of building blocks (i.e. specific business activities, technologies, and stakeholder relationship organizations utilize and are related to a CE) in business practice. The outcome shows few overall appearances of the building blocks *hybrid manufacturing*, *scale-up initiatives*, *insurance*, and *shared ownership*. On the other hand, outcome shows many overall appearances of the building blocks *consumer education*, *take-back*, *waste as input*, *renewable input sources*, *efficient design*, *recycling*, *pure inputs*, *stakeholder engagement*, and *eco-efficiency*. Specific, the appearances of these building blocks show a trend that can be observed in contemporary businesses. In other words, the building blocks show us that certain activities, technologies or relationships are dominant in current business activities within organizations that endeavor circular principles. The results of this first analysis, and the underlying logic of this will be discussed and elaborated later in this report.

### 5.3 NEWLY ANALYZED CONCEPTS

The qualitative analysis that was conducted on the business documents did not only review the occurrence of the predetermined building blocks in these documents, but also reviewed the possible existence of building blocks that were not yet derived from professional typologies. In the end, the analysis initially revealed seven concepts that were not yet established; it has to be reviewed whether these concepts qualify merely as keywords, building blocks, or even stand-alone BMCE typologies. The following keywords were identified in addition to the predetermined ones, ranked by their number of appearance in the document analysis:

- Downcycling (1)
- Predictive maintenance (2)
- Green products (11)
- Reverse logistics (14)
- Influence suppliers (18)
- Diversity (25)
- Internet of Things (28)

### ***Downcycling***

Found only one time throughout the document analysis, but not mentioned as a keyword in professional typologies is *downcycling*. Although downcycling was mentioned by Despeisse and Ford (2015) as a product and material life cycle strategy, its minimal occurrence in business documents illustrates that downcycling is not a preferred strategy for organizations to utilize while endeavoring circular activities. Downcycling was found in Nike's sustainability report: *"Through recycling, down-cycling, closed-loop materials and clean energy recovery opportunities, we realized a 6% increase in our footwear manufacturing diversion rate from FY11. In 2016, NIKE expanded the definition of Nike Grind to include multiple recycled and regenerated materials across the company, including recycled polyester."* In downcycling, materials undergo a process of recycling in which the recycled material is of lower quality and functionality than the original material (McDonough & Braungart, 2002). In practice, a suchlike strategy is not often not preferred and therefore utilized by organizations for a simple reason: product quality. Downcycling in practice means providing products with materials of lesser quality, which is not attractive for consumers, who naturally expect high-quality products. As Amer Sports mentions in a business document: *"Quality specifications and quality assurance are of prime importance to Amer Sports production processes."* Hence, the importance of quality is preferred over realizing a closed material loop, making downcycling insufficient as a stand-alone building block.

### ***Predictive maintenance***

A relatively new concept and phenomenon is *predictive maintenance*, which turns to have connections with the Internet of Things (IoT), which will be elaborated in a following section. Predictive maintenance assumes a technology in which products are connected to monitor their status and, for example, notice future maintenance which might be necessary. For instance, Philips uses technology to monitor the status of products: *"...the consumer does not have to return a defect product but can take apart the relevant module and sent it back. This can be facilitated by smart appliances that indicate which module is broken or the 'internet of things' through which Philips can monitor devices from a distance."* Also, Cisco utilizes technologies to predict possible errors in products: *"Cisco implements IoT technologies for improved asset tracking, maintenance tracking, and operations."* As predictive maintenance is relatively novel, it is not yet utilized on a large scale. However, it is a way of technology-using that offers great potential for organizations in the future and already constitutes a part of the Internet of Things.

### ***Green products***

Mentioned regularly in business documents is the concept *green products*, which assumes products or materials that are considered environmentally-friendly. For example, DHL Logistics mentioned: *“Under the name GoGreen Services we offer environmentally-friendly products and develop individualized logistics solutions for green optimization.”*. Additionally, PostNL mentioned the use of green gas: *“The improvement in our CO2 efficiency index in 2016 was helped by our decision to use 100% green gas for the heating of our buildings in the Netherlands from 2017 on.”*. Although green products were noticed as a new concept it defines itself as a possible new keyword under the building block ‘pure inputs’, which describes the decision for ‘clean and pure’ resource inputs originating from fair sources.

### ***Reverse logistics***

A concept that was found fourteen times throughout documents is *reverse logistics*, which is defined by Fleischmann et al. (1997) as *“...the process of planning, implementing, and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal.”*. It assumes a process in which organizations operate for closing resource loops by establishing networks and infrastructures. For example, organizations may collect products that are disposed and redistribute these in alternative markets for other purposes. For example, DHL uses practices to enable a stream of reverse logistics: *“Leveraging existing and under-used forward logistics network capacities to enable recovery of returned goods and waste (e.g. packaging)”*.

Also, Owens Illinois conducts similar activities: *“To maximize the volume of recycled glass we obtain, there needs to be an infrastructure to collect the glass, which is often mixed with other recyclables and waste, and transport it to material recovery facilities (MRFs).”*. Finally, Philips Healthcare offers suchlike practices: *“Reverse Logistics include the de-installation of systems by Philips trained workers, and transportation to a Refurbished Systems factory by third party logistics.”*. The examples are characterized by organizations which establish infrastructures themselves to enable a reversed stream of disposed products, to ultimately ensure loops to be closed. Reverse logistics offers new value as it establishes social- and environmental flows of resources. Reverse logistics can therefore be characterized as a new BMCE typology. However, as this concept does not solely involve logistics, but also activities throughout a chain, this typology will be called Inverted Supply Chain.



### ***Influence suppliers***

Relatively many business documents revealed the activities of organizations to influence suppliers in their environment to engage in sustainable practices. Yet, examples show that this is often done by organizations within their own supply chain and therefore has limited reach. Nonetheless, it is shown that some organizations put pressure on their suppliers, often by setting criteria, to engage in sustainable practices. For example, ASML mentions: *“Our QLTCS process includes sustainability criteria, which are based on the EICC Code of Conduct. Meeting these criteria is a long-term prerequisite for doing business with ASML.”*. In addition, T-Mobile takes into account a weighting percentage when considering bids for new suppliers: *“A ten percent sustainability-weighting factor has been included in all bids for proposals since 2014. This creates strong incentives for suppliers to offer more sustainable products and services in the bidding process.”*. It illustrates the efforts of relatively many organizations to realize sustainable solutions within their entire chain by, among others, setting terms. As this concept is mainly focused on collective actions taken by organizations to improve an entire chain it may be considered as a keyword for the *stakeholder engagement* building block, which was defined as collaborative efforts organization undertake within their environments for collective actions, decisions, and influences. Influencing suppliers within their chain corresponds to this description.

### ***Diversity***

A concept that appears often throughout business documents is *diversity*, which relates to diversity in the workforce of organizations. Most likely every document that was analyzed mentioned diversity as a sustainable practice, while in practice this is often translated as an equal distribution of gender within the workforce or a percentage of women in a senior management role; in terms of circularity, this is unrelated to this concept. However, several organizations utilize diversity as a principle to include e.g. disabled people in their workforce. For example, BNP Paribas employs disabled people in their workforce: *“This year, entities in 22 countries have signed collective agreements on disability or taken measures in favor of disabled people above legal requirements. In almost 50 countries legally authorized to record workers with disabilities and following this indicator, there were 3,237 disabled employees in 32 countries, including 176 recruited in 11 countries in 2015.”*. Furthermore, Group Beaumanoir *“...promote the integration and safeguarding of jobs for disabled people.”*. Cenovus has an active policy to include veterans in society by offering them career

opportunities: *“Hire a veteran: assists people with the transition from military careers to civilian careers in the private sector.”*.

Diversity is a concept that is not often mentioned when talking about the CE. However, as mentioned in the beginning of this thesis, a core concept of the CE is closing loops, which aims to re-use and exploit products and materials continuously, and keeping them viable of useful for as long as possible. However, this focuses solely on products and materials, whereas closing loops can also apply on a societal level. By offering people with, for instance, disabilities an opportunity to engage in society again by working, these people who initially did not have a function in society are brought back into a cycle where they become viable and useful for society again. From this perspective, people who may not have a function are utilized in a way they serve a purpose, which is circular in essence. Hence, this concept may be seen as a building block that is suitable in the Stewardship Role/Repurpose-typology, which assumes organizations proactively engage with all their stakeholders to ensure their long-term health and well-being and to deliver social and environmental benefits rather.

### ***Internet of Things***

A new concept that was found the most throughout the document analysis is *Internet of Things*, which is explained as the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data. The Internet of Things is about people who are interconnected with things, and things that are interconnected among each other. In this interconnectedness, real-time data is used to monitor the object's status and determine any proactive actions that may need to be taken.

With an increase interconnectedness, organizations are discovering the benefits of interconnected objects and are utilizing this to enhance their products and services or prolonging their lifetime. For example, Konecranes *“has invested in the Industrial Internet of Things (IIoT) and Big data technologies, converting collected data into information, and using it for predictive maintenance. Konecranes TRUCONNECT® Remote Monitoring provides visibility to crane usage and operating data, helping with decisions about maintenance investments and productivity. The data is utilized to estimate the remaining theoretical design working period (DWP) and service life of selected components.”*.

Furthermore, the Internet of Things is used for providing insight in e.g. consumption, like T-Mobile offers: *“We offer our customers numerous benefits by connecting machines digitally. The technology optimally synchronizes the work processes of the various customer devices and cars or even entire industrial plants. This increases industrial productivity, makes transportation more reliable (and more accurate) and helps reduce energy consumption and conserve resources.”*. Philips uses Internet of Things to monitor their products and provide customers with a solution: *“The consumer does not have to return a defect product but can take apart the relevant module and send it back. This can be facilitated by smart appliances that indicate which module is broken or the ‘internet of things’ through which Philips can monitor devices from a distance.”*. The Internet of Things is a phenomenon that offers organizations new possibilities in terms of product design, insurance and maintenance, service providing and more. It is therefore seen as a broad concept that will become more important in the future. Based on the above examples it can be analyzed that organizational activities evolve around the Internet of Things, making it a central concept for day-to-day activities to deliver new value while using it at the same time as a tool for closing loops. However, the Internet of Things is a trend that does not necessarily provide consumers with new value, but rather feeds existing BMCE typologies by becoming a tool to improve current BMCE’s. For example, the Product as a Service typology is capable of delivering new value by offering a function (e.g. light) as a service. The Internet of Things is a concept that is closely involved in PaaS-models, as organizations utilize it to optimize services. For example, another quotation of Konecranes regarding of their use of Internet of Things mentioned: *“This allows Konecranes to optimize their service operations so that components are changed only when it is necessary: maintenance decisions are based on data, not calendar.”*.

This quotation illustrates the following: Konecranes offers her clients a service for their cranes. The value logic that underlies this example is that the client does not pay for the cranes or one-time repairs, but pays for a service, for which Konecranes in return manages the cranes. In doing this, Konecranes utilizes the possibilities that the Internet of Things offers to optimize their service. However, the Internet of Things itself does not solve such value gaps.

Furthermore, the Internet of Things may be regarded as similar to the building block ‘digital technologies’, which was defined as an umbrella term for online-based products and solutions that allow parties to communicate easier and to efficiently monitor resource flows. However, the Internet of Things distinguishes itself from traditional digital technologies as it its

interconnectedness enables objects (i.e. devices, Machine-2-Machine etc.) to talk directly to each other, make decisions, and exchange data. Digital technologies, on the other hand, are solely intended to offer an online-based product (e.g. platform) that allow parties to communicate (e.g. eBay, Uber, and Airbnb). Based on the above examples and characteristics, the Internet of Things is regarded as a new building block that, for example, returns in a Product as a Service model to improve the service.

#### **5.4 CONCLUSIONS FROM DOCUMENT ANALYSIS – BUILDING BLOCKS**

Conclusively, the concepts that were found in the document analysis described new phenomena that can be classified into different categories. Several conclusions can be drawn from the concepts *downcycling*, *predictive maintenance*, *green products*, *influence suppliers*, *diversity*, and *Internet of Things*. The remaining concept, Reverse Logistics, will be elaborated later, as this is regarded as a new BMCE typology: The Inverted Supply Chain.

The concept *downcycling* appeared in practice, but was found only one time, from which we can conclude that this concept does exist in a very low degree, making it an insignificant concept that cannot be categorized as a building block or keyword. Document analysis does not provide clear examples of downcycling and keywords that constitute this concept.

*Predictive maintenance* also appeared to a small extent, but it shows that this concept is highly connected to the building block ‘Internet of Things’. Predictive maintenance uses technology, data and interconnected devices to forecast possible problems, allowing organizations to proactively repair, maintain or replace components or products. Its characteristics make it a keyword that is connected to the Internet of Things.

*Green products* were described as the decisions that organizations make for ‘clean and pure’ resource inputs originating from fair sources. As this is similar to the existing building block ‘pure inputs’, it is classified as an additional keyword for this building block.

One of the key characteristics of the *influence suppliers* concept is that organizations are focused on influencing their suppliers to take collective actions (i.e. creating products with pure inputs or efficient design together) in order to improve the existing chain. This shows high correspondence with the existing building block ‘stakeholder engagement’, which was described as collaborative efforts organization undertake within their environments for

collective actions, decisions, and influences. This concept is therefore considered as an additional keyword for this building block.

*Diversity* is a concept that shows circular characteristics, but is insufficient as a BMCE typology. It can be seen as a building block for the Stewardship Role/Repurpose-typology, which assumes organizations proactively engage with all their stakeholders to ensure their long-term health and well-being and to deliver social and environmental benefits rather. This concept illustrates the existence of closing loops on a societal level, by offering people who would normally not have a societal function anymore the opportunity to become viable again and utilize their full potential.

The Internet of Things describes the interconnectedness of objects in order to monitor the object's status and determine any proactive actions that may need to be taken. The Internet of Things is considered a building block that can be utilized by organizations to enhance their products lives, optimize their service or proactively detect errors or maintenances.

#### **5.4.1 NEW KEYWORDS AND BUILDING BLOCKS**

Ultimately, the document analysis gave new insights in terms of the building blocks that were established from the document analysis. Based on this, two new building blocks have been determined that were not derived from professional literature (Internet of Things and Diversity). Additionally, three new keywords were derived that enable better identification of BMCE building blocks: predictive maintenance, green products, and influence suppliers.

<b>Concept</b>	<b>Keywords</b>	<b>Description</b>
Internet of Things	Interconnection, predictive maintenance, big data, data-to-information, analyze and predict, decisions, data-exchange, smart objects, Machine-2-Machine.	The interconnectedness of objects in order to monitor the object's status to improve products and services by leveraging this data.
Diversity	Workforce, disability, veterans, societal function, integration, full potential, career, hiring.	Offering people who normally would not have a societal function anymore the opportunity to become viable again and utilize their full potential on a societal level.

Table 7: New identified building blocks from document analysis

<b>Keywords</b>	<b>Corresponding building block</b>
Predictive maintenance	Internet of Things
Green products	Pure inputs
Influence suppliers	Stakeholder engagement

Table 8: New identified keywords from document analysis

Ultimately, the new established building blocks lead to a total of 25 building blocks that are identified from professional typologies and document analysis:

- |                         |                           |                          |
|-------------------------|---------------------------|--------------------------|
| 1. Pure inputs          | 9. Rewards                | 19. Servitization        |
| 2. Waste as input       | 10. High quality products | 20. Alternative revenue  |
| 3. Waste management     | 11. Information sharing   | model                    |
| 4. Renewable input      | 12. Digital technologies  | 21. Eco-efficiency       |
| sources                 | 13. Recycling             | 22. Consumer education   |
| 5. Efficient design     | 14. Upcycling             | 23. Scale-up initiatives |
| 6. Hybrid manufacturing | 15. Maintenance           | 24. Diversity            |
| 7. Stakeholder          | 16. Insurance             | 25. Internet of Things   |
| engagement              | 17. Reuse                 |                          |
| 8. Take-back            | 18. Shared ownership      |                          |

## **6. CHAPTER 6. ANALYSIS AND FINDINGS DOCUMENT ANALYSIS – BMCE TYPOLOGIES**

In addition to the previous chapter, this chapter will discuss the appearance of BMCE typologies in business documents and will present the findings of this analysis. In the first subchapter, the appearance of the BMCE typologies is described. introduce a newly identified BMCE typology. At the end, a conclusion will be presented.

### ***6.1 GENERAL NOTION ON THE APPEARANCE OF BMCE TYPOLOGIES***

Only highlighting the appearance of building blocks tells too little about the appearance of BMCE's in practice. Therefore, the appearance of the BMCE typologies, derived from professional literature, was analyzed. Based on the building block appearance per BMCE typology, which was determined (see appendix 7) by analyzing which aggregate groupings of keywords appeared in which BMCE typology, quotations from the document analysis were consequently allocated to the right building blocks per BMCE typology.

While doing this, both the context and underlying assumption of the BMCE typologies as described in appendix 6 were taken into account. This is done to prevent that a quotation from the document analysis was wrongly allocated to a building block in a typology. For example, the building block *waste management* appeared in both the Circular Supply Chain/Substitute with Renewables and Natural Processes (CSC/SRNP) as the Gap Exploiter Model (GEM). However, the way this building block appears in practice is not similar in both typologies (e.g. GEM assumes organizations that feed on value gaps in pre-existing models by solely being a service provider in these gaps, while CSC/SRNP assumes otherwise). Hence, these differences were considered when allocating quotations to building blocks in BMCE typologies. Ultimately, this enables us to assess if BMCE typologies and their corresponding building block actually appear in practice.

### ***6.2 THE APPEARANCE OF EXISTING BMCE TYPOLOGIES***

In addition to the Inverted Supply Chain typology that was derived as a new BMCE typology from the document analysis, this analysis was also used to review the appearance of the existing typologies that were derived from professional literature. An overview of this analysis can be found in appendix 11, which shows quotations from the document analysis per BMCE typology.

### 6.2.1 BMCE TYPOLOGIES APPEAR PARTIALLY IN PRACTICE

Based on the analysis it is recognized that, to a large extent, the BMCE typologies do appear in practice. As mentioned earlier, the appearance of typologies was assessed by researching the occurrence of building blocks in the documents that correspond with the essence of the typologies. However, the typologies provided by professional literature mostly appear partially, as there are very few examples of organizations that fully engage in one dominant BMCE.

The below figure provides a simplified representation of building blocks per BMCE typology and their appearance in practice. When there was no evidence in document analysis that a building block was present in a certain BMCE context, it was labeled as ‘*no quotation*’. The figure shows that there are some typologies (e.g. CSC/SRNP, RR/CVW, PLE/CLLM, and SR/R) that do fully appear in practice. With regard to other typologies, it can be noticed that some of the building blocks that constitute these typologies do not – in the context of the typology’s essence – appear in practice. For example, the building block ‘stakeholder engagement’ does not appear in the context of a PAAS/FO/PM typology, whereas it does appear in the context of a MMEE/EE typology, as the following quotation illustrates: *"To improve water efficiency on cotton farms, we're working in partnership with C&A Foundation and CottonConnect to pilot finance schemes giving farmers greater access to drip irrigation technology."*

This example shows how stakeholder engagement is embedded in a MMEE/EE (Maximize Material & Energy Efficiency/Encourage Efficiency) typology, whereas the document analysis does not provide specific examples or evidence for this same building block to appear in a PAAS/FO/PM typology. As the building blocks per BMCE typology show overlap, the above example applies to more building blocks throughout the typologies.



BMCE	Building Block	Appearance
CSC/SRNP	Pure inputs	✓
	Waste as input	✓
	Waste management	✓
	Renewable input sources	✓
	Efficient design	✓
	Hybrid manufacturing	✓
	Stakeholder engagement	✓
	Maintenance	✓
	Reuse	✓
RR/CVW	Waste as input	✓
	Waste management	✓
	Renewable input sources	✓
	Efficient design	✓
	Hybrid manufacturing	✓
	Stakeholder engagement	✓
	Take-back	✓
	Rewards	✓
	High quality products	✓
	Information sharing	✓
	Digital technologies	✓
	Recycling	✓
	Upcycling	✓
	Shared ownership	✓
	Eco-efficiency	✓
PLE/CLLM	Efficient design	✓
	Take-back	✓
	High quality products	✓
	Information sharing	✓
	Digital technologies	✓
	Recycling	✓
	Upcycling	✓
	Maintenance	✓
	Insurance	✓
	Reuse	✓
SP/AM	Stakeholder engagement	✓
	Rewards	No quotation.
	High quality products	No quotation.
	Information sharing	✓
	Digital technologies	✓
	Maintenance	✓
	Reuse	No quotation.
	Shared ownership	✓
	Servitization	✓
	Alternative revenue model	No quotation.
BMCE	Building Block	Appearance
PAAS/FO/PM	Efficient design	✓
	Stakeholder engagement	No quotation.
	Take-back	No quotation.
	Rewards	No quotation.
	High-quality products	No quotation.
	Information sharing	No quotation.
	Digital technologies	✓
	Upcycling	✓
	Maintenance	✓
	Insurance	No quotation.
	Reuse	No quotation.
	Servitization	✓
	Alternative revenue model	✓
	Eco-efficiency	No quotation.
MMEE/EE	Efficient design	✓
	Hybrid manufacturing	No quotation.
	Stakeholder engagement	✓
	Rewards	✓
	Digital technologies	✓
	Alternative revenue model	No quotation.
	Eco-efficiency	✓
	Consumer education	✓
SR/R	Pure inputs	✓
	Stakeholder engagement	✓
	Consumer education	✓
SUS	Information sharing	✓
	Digital technologies	✓
	Scale-up initiatives	No quotation.
GEM	Waste management	✓
	Take-back	✓
	Rewards	No quotation.
	Recycling	✓
	Upcycling	No quotation.
	Maintenance	No quotation.
	Servitization	✓

Figure 4: BMCE typologies and building block appearance

### 6.3 BMCE TYPOLOGIES NEED SIMPLIFICATION

Based on the previous table, some important conclusions can be drawn. First, it shows that some BMCE typologies should be narrowed down to a smaller essence and to even more specific characteristics. For instance, the PAAS/FO/PM typology initially contained many different building blocks according to the elaborations of the authors, which in practice makes

these typologies vague, and overlapping with other typologies. It illustrates that, in practice, some BMCE typologies show to be more specific, consisting of lesser building blocks. Therefore, a simplified table with a reduced number of building blocks per BMCE typology, based on findings from the document analysis, has been included in appendix 12.

### **6.3.1 THE LEGITIMACY OF BMCE TYPOLOGIES**

Second, which applies for example to the SUS (Scale Up Solutions) typology, reducing the building blocks of typologies may question the legitimacy of certain typologies. The SUS typology assumed organizations that entirely focus on delivering sustainable solutions at a larger scale. This is, among others, achieved through franchising, licensing, mergers, acquisitions, crowd-sourcing, and localized adaption to ultimately maximize the benefits for society and the environment; it introduces activities for expanding existing sustainable practices.

Document analysis shows however that this process is partially achieved through information sharing (*"We have shared our restricted substance list to help create an industry-wide manufacturing restricted substances list (MRSL) and shared a water-based solvent formula to enable the industry to eliminate the use of toxic chemicals in a key footwear process."*), and digital technologies (*"Deutsche Telekom and other key players together created the qiViCon platform on which any company, regardless of their industry or size, can offer their solutions."*).

However, analysis does not provide any concrete evidence of organizations who utilize scale-up initiatives (i.e. franchising, licensing) for the benefit of expanding own practices; it is solely limited through sharing initiatives. Yet, this insight questions the legitimacy of, for example, the SUS typology. However, document analysis provides insufficient data to determine whether suchlike typologies appear in individual organizations completely. Future research should show this.

### **6.3.2 PRACTICES ARE SCATTERED AROUND ORGANIZATIONS**

In addition of the latter lies a third conclusion, which also covers the value logic that is dominant within organizations regarding circular business models. It is noticed that a very small extent of contemporary organizations engages in a complete, circular business model. The document analysis shows many examples of organizations that have adopted circular

practices. However, the diversity and comprehensiveness of these circular practices, and combining all these practices into a circular business model, remain incredibly limited. It shows that the majority of organizations are struggling with the process of closing loops and integrating this in their business. Consequently, it can be concluded that the majority of organizations engage in individual practice, but still fail to fully integrate circularity.

Analysis also shows exceptions; there are examples of organizations that have made closing loops a core element of their business. A good example found in the document analysis is Interface, a Dutch manufacturer of carpet tiles. Interface applies several principles to establish circularity. For example, they design their carpets for easy reassembly, prolonging their life, and choosing for materials that are recyclable. However, the core feature of their business model is to close loops. Interface realizes this by providing fishers in the Philippines with a source of income, while cleaning up beaches and seas of disposed fishing nets: *“Interface also incorporates local communities in their ambition to be restorative to nature”*. These fishing nets are collected and ultimately used as input for new carpet tiles. This example shows a business model that is deeply intertwined with a RR/CVW (Resource Recovery/Create Value from Waste) typology.

Another example of an organization that adopts circular principles in their business model is Philips Lighting, who currently incorporates product as a service models for lighting. While offering this service, Philips strives for efficient product design, ability to improve products and maintains them. As document analysis found: *Philips Lighting have recognized the need to increase the ‘value’ of their lighting components to encourage reuse, i.e. redesigning them to be accessible, fully repairable or upgradable to potential new functions (future-proofing and extending the economic lifetime of the product)*. These practices of Philips Lighting demonstrate an embodiment of the PAAS/FO/PM model in practice.

The examples of Interface and Philips Lighting show organizations that embody BMCE typologies in practice. However, as mentioned, the majority of organizations do not have circular business models to a full extent, but rather conducts individual practices which lead to a conclusion that the adoption of circular business models is still in its infancy. These individual, circular practices seem to be intertwined in current business models, which are most of the times still based on a linear, transactional model.

#### 6.4 NEW BMCE TYPOLOGY FOUND IN DOCUMENT ANALYSIS

As briefly mentioned in the previous section, a new BMCE typology has been identified in addition to the nine typologies that were established from professional literature. The new BMCE typology that was derived from the document analysis is the ‘*Inverted Supply Chain*’ typology.

1	Circular Supply Chain	SRNP	
2	Recovery and Recycling	Create Value from Waste	
3	Product Life Extension	Classic Long-Life Model	
4	Sharing Platform	Access Model	
5	Product as a Service	Functionality over Ownership	Performance Model
6	MMEE	Encourage Efficiency	
7	Stewardship Role	Repurpose	
8	Scale up Solutions		
9	Gap Exploiter Model		
10	Inverted Supply Chain		

Table 9: Existing BMCE typologies plus new typology

#### Inverted Supply Chain

The Inverted Supply Chain model describes business models that evolve around activities organizations who move disposed products or components from the location of use, back to the location of producing. This is done in order to recycle, reprocess or dispose these products or components and ultimately to close the loops of these products and components to keep them viable for as long as possible. To realize this, these organizations establish networks and infrastructures to create reversed streams. This is, for example, realized by establishing collection points (e.g. drop-off locations) where products or components can be returned, possibly in return for an incentive. Initially, this BMCE typology is similar to the ‘take-back’ building block, which was described as activities to simplify the collection of post-consumer products and materials. The BMCE typology Inverted Supply Chain however distinguishes from the building block as it emphasizes the processing of collected products and components after collection, including the logistic network to consolidation centers and recovery facilities, whereas the ‘take-back’ building block merely focuses on the activities that are used to collect post-consumer products and components. Below figure provides a visual representation of the Inverted Supply Chain typology. The figure illustrates an entire process in which products are

components are collected from the consumer (or organization) and ultimately are returned to a supplier. Often this requires collaboration with multiple stakeholders to simplify the collection process and redistribution of products and components.

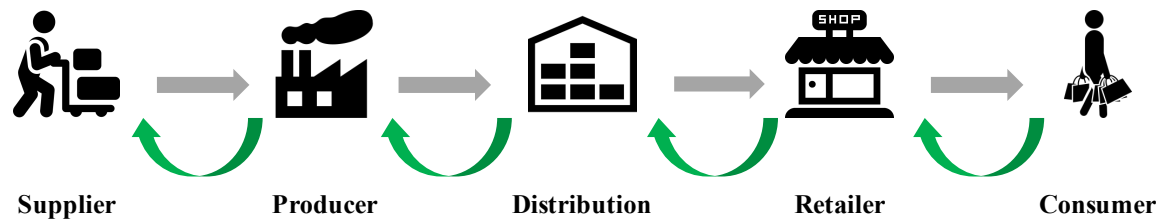


Figure 5: Visual representation of Inverted Supply Chain typology

The Inverted Supply Chain typology is constituted and characterized by a combination of several building blocks, from which most are based on the building blocks that were predetermined. Below table identifies the most relevant building blocks, including practical examples, of the Inverted Supply Chain typology:

Inverted Supply Chain	Building block	Quote
	Take-back	<i>“Ragn Sells collects, treats and recycles waste and residual products from businesses, organizations and households.”</i>
	Waste management	<i>“Veolia handles waste in all forms and at all stages of the waste cycle. Veolia manages waste from collection to recovery, on behalf of both industrial and service sector customers, as well as local communities.”</i>
	Rewards	<i>“DHL is implementing incentives for consumers to return products (including ease of access and transparency on drop points).”</i>
	Stakeholder engagement	<i>“External transport companies collect the tires on behalf of Ragn Sells. They deliver the tires at our sites where they are sorted and treated.”</i>
	Recycling	<i>“When a BlackBerry smartphone has truly reached the end of its life, BlackBerry provides its recyclers with instructions on how best to dismantle and recycle it in order to maximize the recovery of material and avoid any exposure to hazardous substances.”</i>
	Upcycling	<i>“By co-creating with recycled materials organizations, Philips can use expertise to improve the quality of materials.”</i>

The above quotations illustrate different activities that organizations undertake and give shape to an Inverted Supply Chain typology. This typology is implemented in practice by, for instance, DHL. As a specialist in logistic solutions and package deliveries, DHL offers reverse logistics services for businesses. They offer de-installation of finished goods, returns management, receiving, sorting, verifying and managing returned products on behalf of other organizations (DHL, 2017).

### **6.5 A DOMINANT WAY OF THINKING IN CIRCULARITY**

Most organizations of which documents were analyzed show a certain value logic that is guiding for them when applying circular practices. This dominant way of thinking is among others reflected in the appearance of building blocks throughout business documents. The appearance of building blocks, which was briefly discussed earlier, showed a dominant presence of the following building blocks:

- Consumer education
- Take-back
- Waste as input
- Renewable input sources
- Efficient design
- Recycling
- Pure inputs
- Stakeholder engagement
- Eco-efficiency

The appearance of these building blocks illustrate that these have become increasingly important for organizations that endeavor circular principles. In terms of consumer education, organizations mostly encourage transparency towards consumers and advise them how they can contribute to sustainability. For example, T-Mobile quoted: *“We also keep our customers informed about environmental aspects, manufacturing conditions, safe, low-energy and demand based usage, and resource-conserving disposal options at the end of the product life cycle.”*. In addition, Target advises consumers what products can be recycled at their disposal: *“How2Recycle™ Label, a clear, simple value chain committed to developing way to communicate to our guests what ways to sort flexible plastic packaging is recyclable and what isn’t.”*.

Many organizations realize the urgency of avoiding waste going to landfill, which is why lots of them have engaged in take-back initiatives to collect disposed materials or products, often for recycling or reuse. For example, La Place quoted: *“About 2,500 kilograms of coffee*

*residue is collected weekly from around 100 La Place restaurants in the Netherlands.”. In extension of take-back initiatives is the waste as input building block. Waste as input is an often-utilized method for organizations to use waste that was collected as a source for energy or resources: “NC Miljø transforms 120.000 tons of food waste to green energy each year. NC Miljø has since 2005 collected used cooking oil from restaurants and commercial kitchens to use and sell it as biomass for Biogas plants.”.*

Renewable input sources are an often-used practice for organizations to increase their circularity, but is often limited to renewable energy sources only. For example, Coca Cola European Partners quoted: *“Solar photovoltaic panels on our sites generated more than 300 MWh of electricity in 2015.”.*

Circularity is often embodied in practice by efficiently designing products and components. Many organizations search for product designs are easily recyclable and have a prolonging life. Most of the times this is motivated by reducing impact on the environment and to increase efficiency and performance. For example: *“ASE Group has a “3R” Design for components (Reduction, Reuse, and Recycling).”.* Also, ASML quoted: *“ASML systems are built in a modular way and can be upgraded to a higher performance level in the field without needing to replace the entire machine with a new one.”.* In addition, efficient design is sometimes combined with building block pure inputs. Many organizations actively search for products with non-toxic materials or those that originate from fair sources. For example: *“BlackBerry carefully tracks and evaluates the materials we put into our products, taking into consideration durability and performance, as well as toxicity and environmental impact.”.*

The efficient design building block is often linked to the following building block that appears many times throughout documents: recycling. It is a concept that most of times comes first to the mind of organizations that endeavor to close to loop. As Linde, for instance, quoted: *“We want to get to the place where less new raw material is needed because we have closed the loop through recycling.”.* Also, Cisco quoted: *“We are using circular economy principles to: increase used product returns for reuse, resale, or recycling”.* Organizations that endeavor circularity often initiate this with recycling. Yet, it is a false notion that circularity is predominantly realized by recycling, as the two concepts differ from each other. In recycling, waste is redeployed based on the residual value it has. However, circularity mainly aims to

minimize waste or, in a utopia, eliminate waste entirely. It is a difference that lots of organizations have not yet recognized.

Another building block that is often embodied in practice is stakeholder engagement. It is shown that many organizations are establishing partnerships and collaboration agreements to increase circular practices. For example, Schiphol Group acknowledged: “*Schiphol Group has joined forces with home carrier KLM, biofuel supplier SkyNRG and several other partners to promote the large-scale use of biofuels in aviation.*”. Furthermore, networks are established between parties to increase joint benefits, such as DHL: “*We work together with our customers to develop environmentally friendly logistics solutions guided by the concept of “shared value” – the idea that we can create business value by contributing to society and the environment.*”. However, the problem that comes to light when analyzing this building block, is that most organizations do stimulate collaboration and engagement, but at the same time, these efforts often remain in-house with known stakeholders within their own chain. Outsiders often remain excluded from these efforts. Hence, although stakeholder engagement does exist on a relatively large, organizations seem to be struggling with finding the right partners and networks in other sectors.

## **6.6 THE VALUE LOGIC OF ORGANIZATIONS IN PRACTICE**

The building block that appeared most times throughout the documents was the eco-efficiency building block, which is briefly defined as “doing more with less”. In this thesis, this building block was described as ‘*all activities to minimize ecological damage while maximizing efficiency through the lesser use of energy, material, and water, and more recycling.*’. It is not just a coincidence that this building block appeared 1.4 times per document on average. In terms of circularity and sustainability, it is assumed in this thesis that organizations have intrinsic motivations to amend their practices to more environmental-friendly standards. In other words, it is assumed that BMCE’s are driven by a certain value logic.

However, based on the frequency of this building block and data derived from documents it becomes evident that the vast majority of organizations conduct circular activities based on the logic of this same eco-efficiency. Most activities that organizations apply are centered around concepts like less consumption, less energy use, less waste generation, and minimizing footprints. ‘Doing more with less’ on the long term is a phrase that evolves as a core logic at a majority of organizations that apply circular practices. This notion is illustrated at TD Bank:



*“But all of these forces share one thing in common: a realization that we need to do more with less. Less waste. Less resource and materials use. Less harm to the environment.”*

Lindex stated to have a long-term strategy to improve their eco-efficiency: *“Lindex’s long-term sustainability ambition is to minimize the environmental impact in all parts of our design and production chain, and to create a positive impact together with our suppliers, partners and customers.”*

Also, Bosch has declared to be motivated to improve their eco-efficiency levels: *“The company is committed to reducing harmful CO<sup>2</sup> emissions, continuously improving technical systems, and developing new applications for the future. All Bosch divisions offer customers energy-efficient solutions, such as energy-efficient refrigerators and state-of-the-art heating systems and machine tools.”*

Furthermore, ASE Group has included carbon emissions as a threshold for business performance: *“Carbon management is an integral part of ASE’s overall business performance. We track our carbon footprint in terms of the amount of greenhouse gas emissions.”*

Finally, Ricoh expressed their long-term company vision in terms of circularity: *“Our ‘tall order’ target to reduce CO<sub>2</sub> emissions by 20% was achieved in 2010 and we are on track to fulfil our long-term vision to reduce environmental impact by 87.5% by 2050.”*

The above examples reflect the core logic that is dominant within contemporary organizations regarding sustainability and circularity. As discussed, the concept eco-efficiency is not solely a building block for BMCE typologies, but it appears that circular business in practice mostly takes place by taking eco-efficiency as a dominant guidebook. This implies difficulties for organizations to shape and implement full circular strategies and to have a full circular business model.

## **6.7 CONCLUSIONS FROM DOCUMENT ANALYSIS – BMCE TYPOLOGIES**

Document analysis with regard to the BMCE typologies shows several outcomes. First, it shows that BMCE typologies do return in practice, yet not always to a full extent. Circular practices are often scattered around organizations and are barely integrated as a set of

activities that constitute a circular business model. Second, it shows that some BMCE typologies may be too extensive in terms of building blocks according to literature and that these need revision. Also, the legitimacy of some BMCE typologies (e.g. the SUS typology) may be questionable based on document analysis. Third, document analysis shows the introduction of a BMCE typology that was not included in used literature: The Inverted Supply Chain model.

Finally, and probably the most important conclusion lies in the underlying logic of organizations regarding circularity. Whereas it is illustrated that in some organizations circularity is their core business and lead themselves based on new value creation (e.g. by providing Product as a Service models and retaining ownership of the product in order to prolong product life and keep it viable as long as possible), it can be concluded that the majority of organizations is struggling with implementing circularity in its organizational components and hence adopting a full BMCE. This is illustrated and confirmed by the following observations:

- A majority of organizations are predominantly applying recycling- and eco-efficiency activities as their core logic to create multiple values.
- Collaboration, as a core concept within a circular economy, exists to a large extent among organizations that are applying circular activities. However, engaging with partners and other stakeholder mainly takes place within existing supply chains, with known parties. In this respect, cross-sector collaboration still remains behind.
- Circular activities that are applied by most organizations are often still based on transaction-thinking.

## **7. CONCLUSION**

At the outset, this research attempted to answer the following research question: *“What are fundamentals (building blocks and value-creating logic) of business models for the Circular Economy, and to what extent and how do these fundamentals emerge in business practice?”*. This final chapter aims to summarize the findings of this research regarding BMCE typologies and building blocks. The limitations of this research, in terms of methodology, analysis, and data, and directions for future research, will be elaborated in the discussion section of this thesis.

### **7.1 APPROPRIATENESS OF THE STUDY**

To a large extent, it is considered that this research enabled the researcher to answer the main research question: *“What are fundamentals (building blocks and value-creating logic) of business models for the Circular Economy, and to what extent and how do these fundamentals emerge in business practice?”*. The results clearly showed the vagueness and overlapping problems of BMCE typologies in existing literature. By thoroughly conducting a literature study, the essence and logic of BMCE typologies was found, and it enabled the researcher to constitute building blocks that describes the main activities that are applied in BMCE typologies.

Furthermore, the document analysis enabled the researcher to review the current state of business practice regarding BMCE's. It showed that BMCE typologies do return in practice, however not often to a full extent and comprehensive manner. It illustrated that circular practices are mostly scattered around organizations and proved that there is a dominant logic of eco-efficiency in contemporary organizations. One of the challenges in this research is the description of value logic in practice; as it is demonstrated that the dominant logic of organizations lies in eco-efficiency, it is not fully clear what value logic is leading for businesses.

### **7.2 BACKGROUND AND RESEARCH GAP**

The thesis started with discussing the problems of our current, linear economy and the need for a transition towards a CE. It illustrated how the linear economy follows a principle of a ‘take-make-waste’ system, which is an unsustainable process. The CE has been introduced as an opportunity to incorporate sustainability within the economy. This asks for new ways of

doing business, and therefore, new business models. One of the main findings is that conventional business models fail to accommodate the creation of multiple values, which is key in a CE. It is shown that conventional business models are solely centered around achieving economic value.

The literature analysis illustrated that the fundamentals of BMCE's was vague. It was not clear what building blocks constituted BMCE's and what the underlying logic of BMCE's entailed. Additionally, there was little insight in the appearance of building blocks and BMCE typologies in business practice. These research gaps were addressed in this thesis.

### ***7.3 METHODOLOGY***

In order to research the above gap, a thorough literature study, followed by a qualitative practice study, were conducted. A grounded theory approach was used to conduct this research, and data was systematically, and continuously compared to identify similarities and differences among the data. This qualitative study gives the possibility to conduct in-depth research to fully explore a phenomenon. By looking at a phenomenon in-depth, new findings and knowledge could be constituted.

First, the literature study was conducted by summarizing and comparing pre-existing typologies from different authors. The literature that was chosen was based on some well thought criteria to ensure its comprehensiveness. Based on the literature study, a number of building blocks and keywords were established and the overlapping characteristics of BMCE typologies was illustrated. Second, analysis on 110 documents was conducted, which were collected iteratively by using metasearch queries using a combination of relevant terms. The documents were downloaded and imported in analytic software Atlas.ti. The documents were analyzed on their contents to confirm and extend the findings from the literature study. Properly analyzing the documents on their contents appeared to be a difficult and challenging process, since terms that appear throughout documents can sometimes be interpreted in more than one way. It was challenging to find balance in this process.

### ***7.4 FINDINGS***

Literature study tells us there is a wide range of BMCE typologies provided by different academic sources. As it was not clear what constituted these BMCE typologies and their underlying logic, a comparison was made to organize these typologies. BMCE's are expected

to have a value logic, from which strategies are designed by organizations to achieve this value, i.e. to reach their goals in terms of their desired contributions. Ultimately, BMCE's with their accompanying value logic and strategies consist of building blocks and configurations of these building blocks. By reversely analyzing circular strategies, provided by academic literature, we conclude there are three main types of values that lie at base for BMCE's: value creation, -preservation, and -destruction.

The results of the literature study show that the BMCE typologies provided by different academics show overlap in their essence and characteristics. By thoroughly analyzing this, a summarization of nine BMCE typologies was made. This shows there is little uniformity among authors and BMCE typologies, resulting in a lack of academic standards and structure on BMCE typologies. Subsequently, the nine typologies that were established were thoroughly analyzed on their contents to identify the building blocks that constitute them. Accordingly, 23 different building blocks were identified in literature, which were built from keyword aggregation that described specific circular activities, technologies, and stakeholder relationships. Then, the building blocks that constituted each BMCE typology were described to highlight their most important characteristics.

After conducting a literature study, a qualitative practice study was conducted to review the appearance of BMCE typologies, building blocks, and underlying logic in practice. To do so, metasearch techniques and built search queries were used to collect public organizational documents, which were thereafter analyzed and coded. The results showed a dominance of some building blocks in practice, and in addition to the predetermined building blocks, practice study revealed the occurrence of two additional building blocks: Internet of Things and Diversity. The BMCE typologies appeared to return in practice for a large extent. Contrary to literature findings, the BMCE typologies with their corresponding building blocks sometimes did not return fully in practice, which resulted in a revision of some BMCE typologies and their corresponding building blocks. In addition, document analysis showed the existence of a new BMCE typology that was not yet included in used literature: The Inverted Supply Chain model, which describes business models that evolve around activities organizations who move disposed products or components from the location of use, back to the location of producing.

Document analysis showed very few examples of organizations that fully engage in one dominant BMCE. Although some cases showed the practical existence of Product as a Service- and Circular Supply Chain models, it appeared that circular activities are mostly scattered around organizations. This insight furthermore explains the logic that lies at ground for organizations that engage in circular activities. Dominance of building blocks, partial appearance of BMCE typologies, and examples from business documents show a trend of organizations that engage in a recycling- and eco-efficiency models that is mostly still based on transactional thinking.

Notwithstanding the fact that organizations are increasingly engaging in circular practices, this research shows that, with exceptions, organizations are struggling with successfully applying circular practices in their strategies and organizational model. It turns out that BMCE typologies mainly return in practice as individual activities that are based on a logic of eco-efficiency (doing more with less), which is mostly translated into recycling, less consumption and waste, and within-chain collaboration with known parties. All in all, practice shows some promising examples of organizations with full BMCE's, but also shows that a majority of organizations are struggling with implementing BMCE's. Future will tell if such organizations succeed in adopting full circular business models.

## ***7.5 CONTRIBUTIONS TO THEORY***

This research may contribute to theory regarding BMCE typologies and their fundamentals. It was showed that the typologies provided by different authors showed overlap, and vagueness in terms of the building blocks that constitute them. The literature study showed there is little uniformity among authors and BMCE typologies, resulting in a lack of academic standards and structure on BMCE typologies. The findings of this research gave a revised overview of BMCE typologies and contributes to a better theoretical overview of BMCE typologies and their characteristics, built on the work of several authors (Bakker, den Hollander, van Hinte, & Zijlstra, 2014; Bocken N. , Short, Rana, & Evans, 2014; Lacy & Rutqvist, 2015). Furthermore, 25 building blocks were identified that represent organizational practices for a CE. The document analysis furthermore showed evidence of the use of these building blocks. Results showed that BMCE typologies are constituted by different configurations of building blocks.

## ***7.6 PRACTICAL CONTRIBUTIONS***

This study was able to recognize ten different BMCE typologies that organizations may use to strive for multiple value creation. Furthermore, the building blocks that were established may serve as a guidebook for organizations to apply new practices and to use them for the formation of a BMCE. For all typologies in this study, the corresponding building blocks were established, which can help organizations to understand the nature of BMCE's and to find a comprehensive set of activities for these BMCE's.

Throughout the study it was found that building blocks can be used differently in several contexts, depending on the essence and nature of the BMCE; It was shown that building blocks appear different in several contexts. For practice, this may suggest that some building blocks can possibly be seen as 'best practices', meaning that they can be useful in multiple contexts or organizational environments. Following this notion, it can enable business practice to improvise and experiment with building blocks to review their applicability. This may stimulate BMCE innovation and can lead to the emergence of new BMCE typologies in the future.

## DISCUSSION

The purpose of this master thesis was to seek and describe the configuration of building blocks and value-creating logic of BMCE's, according to existing literature, and to review how they emerge in business practice. There is a lack of mature fundamentals for archetypes of these business models, resulting in vague and overlapping typologies. To conduct the research in this thesis, a twofold approach has been used. First, to make a comparison and summarization of existing academic literature with regard to BMCE typologies and their building blocks. Second, a qualitative practice study has been used to assess the appearance of theoretical findings in business practice.

With regard to the academic literature study, a comparison of BMCE typologies provided by three authors (Bakker, den Hollander, van Hinte, & Zijlstra, 2014; Bocken N. , Short, Rana, & Evans, 2014; Lacy & Rutqvist, 2015) was made to research the existence of overlap among BMCE typologies and the building blocks that constitute them. By thoroughly analyzing the typologies on their contents, it was possible to research the typologies in depth and develop solid conclusions with regard to the overlap of typologies and the building blocks that constitute these typologies. Hence, it has a positive effect on both the reliability and validity of this research. The outcomes of the literature study showed little uniformity in academic literature regarding BMCE typologies, which was also initially expected.

In terms of the academic sources that were used, this literature was based on some well thought criteria to ensure its comprehensiveness. However, a selection of three authors was made, which may cause the exclusion of other academic literature. Therefore, validity may be weakened, as literature was not fully comprehensive. Future research may have to prove whether this is the case.

For conducting the practice study by analyzing business documents a search query was built for a metasearch engine to collect public business documents. This query was based on a set of parameters that were chosen by the researcher after experimenting for an appropriate combination. However, this way of collecting documents is characterized by a certain level of subjectivity as the researcher determines the parameters. This may have a negative effect on reliability when the structure of this research is reproduced, as different researchers are likely to collect different business documents. By coding the documents in-depth and thoroughly



searching for the existence of phenomena in practice, this qualitative research delivers a high extent of validity as it enabled the researcher to fully measure that phenomenon that was intended at the outset.

This research can be reproduced by using different data. However, in the opinion of the researcher, the structure of this research (i.e. combination of literature and practice study) is the only appropriate way to construct a comprehensive conclusion in this matter. This combination allowed the researcher to research the phenomenon in-depth. Possibly, other data sources can be used when reproducing this research, for example in the literature study. Also, as document analysis uses public documents, a great number of new sources can be used to research the phenomenon under different circumstances.

The results of this research illustrate that, although some organizations apply BMCE typologies in practice, a majority of contemporary organizations are struggling to include circular principles within their organizational model, and BMCE typologies are mainly limited in practice to activities based on eco-efficiency. A possible explanation of this result may be due to the distribution of company documents that were collected; this included documents from a diverse range of organizations of which most are still doing business based on a linear transaction model. Although the distribution of these organizational types may reflect the current, real business environment, not many documents of circular organizations were collected, which made it more difficult to assess the existence of BMCE typologies in organizational that truly declare themselves as circular. Future research may assess this with data of organizations that operate under different circumstances, to review the existence of BMCE typologies in suchlike organizations.

Additionally, it should be taken into account that this research was conducted using documents of 'only' 110 organizations, approximately. As there is an unlimited number of organizations out there, the possible research size on this subject is limitless. For example, future research could review the extent of BMCE typology appearance per country, to see if there are significant differences among countries and how these may be caused.

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## APPENDIX 1. RESEARCH PLANNING

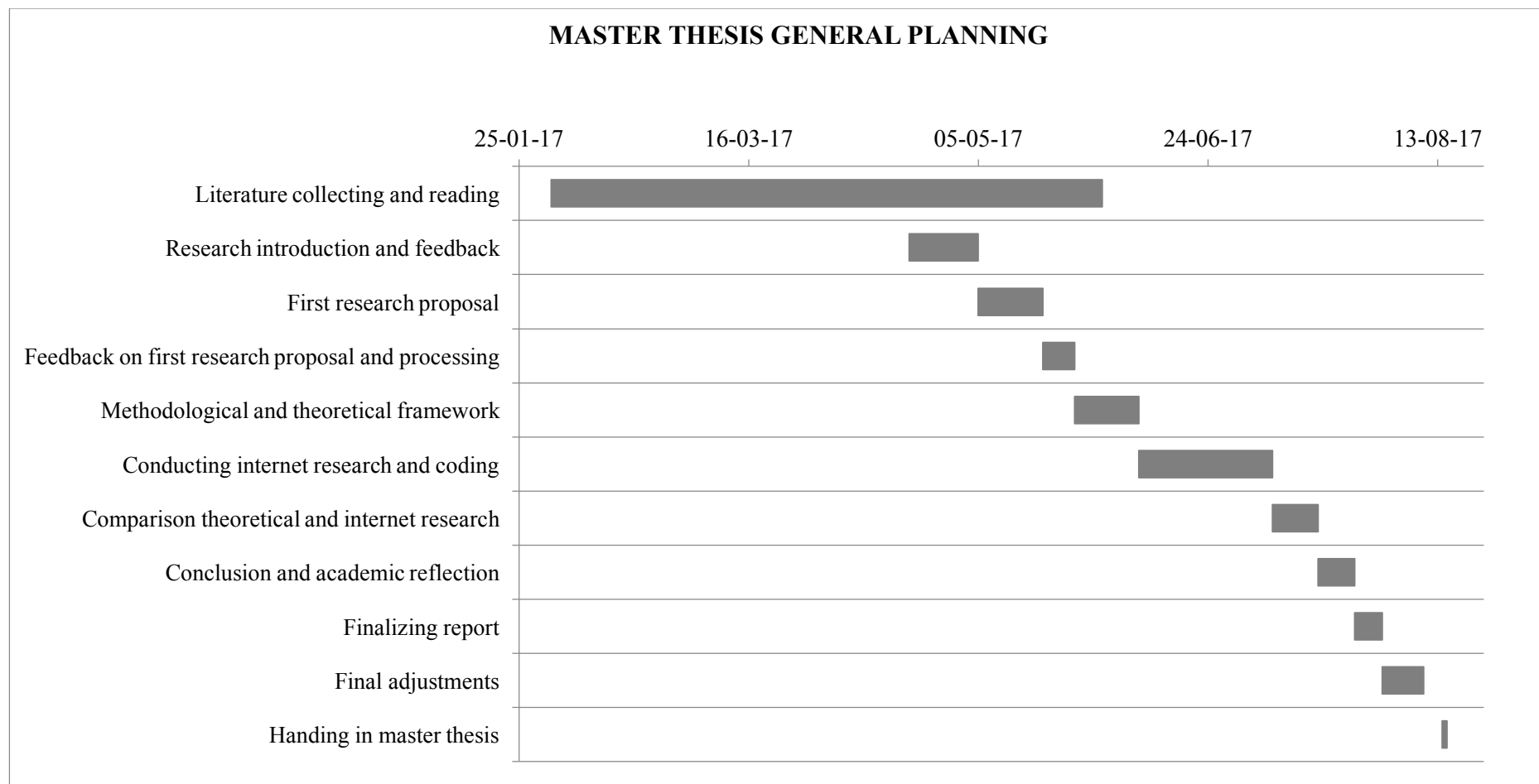


Table 10: General planning Master thesis

APPENDIX 2. CIRCULAR ECONOMY PROPOSITION

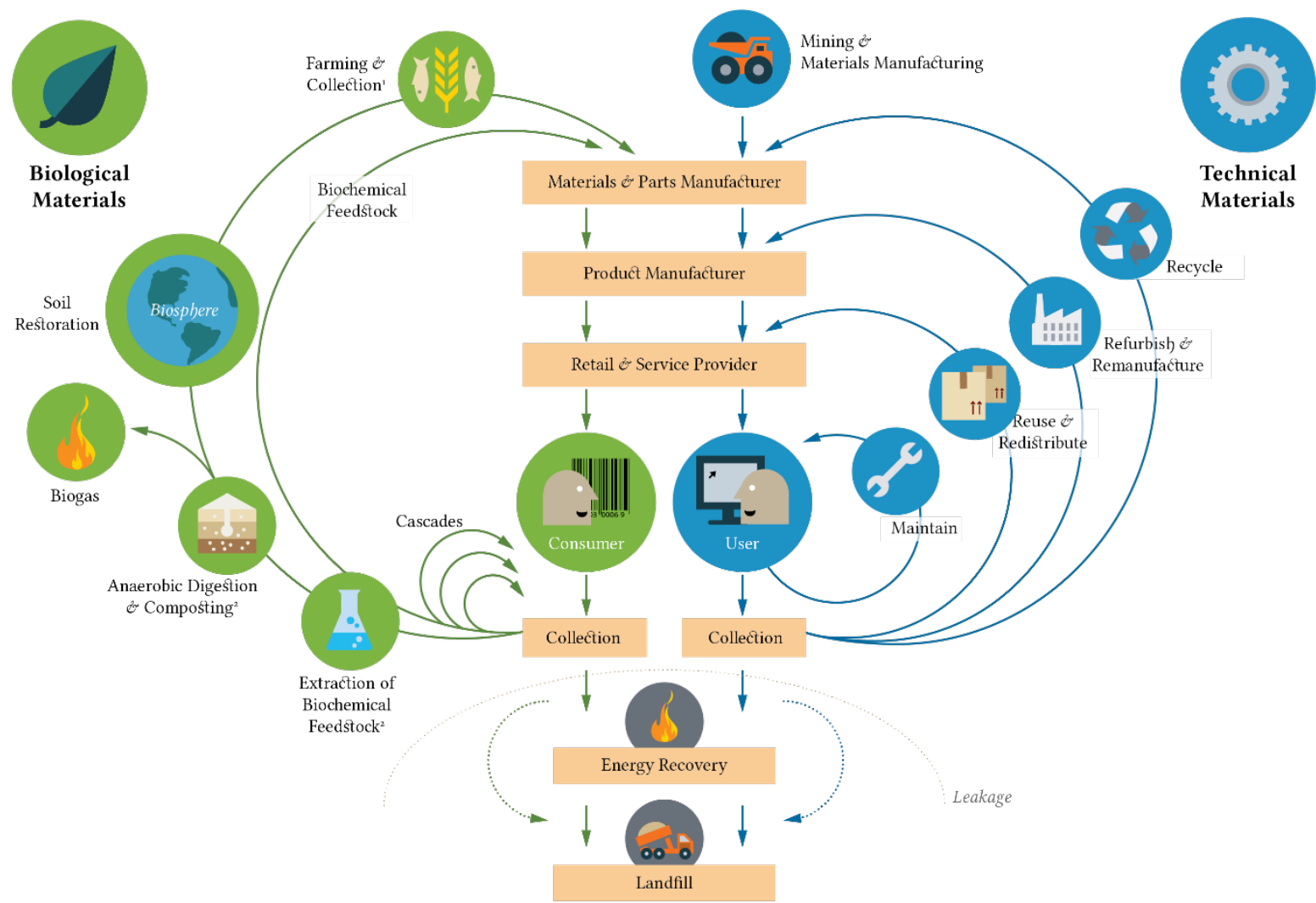


Figure 6: Visual representation of Circular Economy activities, focus is on the right side of this figure (Ellen MacArthur Foundation & McKinsey, 2013)



### APPENDIX 3. BMCE TYPLOGIES DESCRIBED BY LACY AND RUTQVIST (2015)

Table 11: BMCE typologies as described by Lacy and Rutqvist (2015)

BMCE typology	Circular Supply-chain	Recovery and Recycling	Product Life-extension	Sharing Platform	Product as a Service
<b>Core assumption</b>	Renewable, recyclable or biodegradable materials as alternative resources.	Production and consumption systems in which waste is revived for other uses. Every waste and by-product stream is optimized.	Recapture product value by maintaining and improving products through repairs, upgrades, remanufacturing or remarketing. Keeping products alive and relevant.	Relationships between consumers, companies and micro-entrepreneurs who rent, share, swap or lend their idle goods.	Manufacturers and retailers bore the 'total cost of ownership'. Consumers lease or pay for products.
<b>Key dimensions</b>	Renewable, recyclable, biodegradable, bio-based, nontoxic, recovery, reuse, collaboration. Circular network, provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs, supplying fully renewable, recyclable, or biodegradable resource inputs, fair trade products, composting. Modular products, easy to separate, disassemble.	Recycling, upcycling, two-way supply chain, maximize economic value, eliminate leakage, waste as resource, reuse waste, waste handlers, collective effort, online hubs, feedstock exchange, recover useful resources/energy out of disposed products or by-products, recovery of embedded value at the end of one product lifecycle to feed into another, return chains, recycling and upcycling services, industrial symbiosis, integrated closed loops recycling, cradle-2-cradle designs, disposed products reprocessed into new.	Product obsolescence, longevity, lengthening product lifecycle, higher up-front cost, build to last, refurbish, take-back/trade-in/buy-back to remarket, upgrade, refill, repair, product redesign, customer interaction points, interaction, channels, communities and platforms, maintenance players, preservation of embedded value, extend working lifecycle of products and components by repairing, upgrading and reselling, value is maintained or even improved by repairing, upgrading, quality, monitoring, remanufacturing or remarketing products, economically useful for as long as possible, components replaced, replaceable modules.	Platform, connect owners, multiple users, same resources, social component, community building, human relationships, underutilization, renting, sharing, swapping, lending, gifting, bartering, percentage fee, commission, exchange, co-use, sharing platform, technology, internet, C2C, cheap access, 3D printing, 3D hubs, collaborative production platform, enable increased utilization rate of products by making possible shared use/ access/ ownership, platform for collaboration across users, facilitate sharing of overcapacity or underutilization.	Function or performance, organizational ownership, use, maintenance, reuse, manufacture, recycling, pay for use, leasing, rental, performance agreement, performance improvement, high operating costs products, long payoff products, solutions provider, product design for optimal use, wishes aligned, enhancing performance on an ongoing basis, offer product access and retain ownership to internalize benefits of circular resource productivity, lease, pay-for-use, incentives for durability, upgradability, volume to performance.

<b>Key indicators</b>	Using renewable, recyclable, non-toxic, recycling, biodegradable, bio-based inputs, fair trade. Recovery and reuse of resource input material, composting, sorting, separating. Solar, wind, water energy. Cradle-2-Cradle. Modular product design, compatibility, 3D printing, disassemble and separate products. Collaboration, circular networks.	Using waste as resource for input. Renewable energy. Sorting waste, waste handling, waste management, two-way supply chain, return chains, drop-off points, incentives. Product quality. Collective efforts, knowledge sharing, industrial symbiosis, exchanging feedstock, by-product. Online platforms, HUB's. Modular product design, 3D printing. Recycling and upcycling services, advanced recycling.	Durability, longevity, lengthening product lifecycle. Product redesign, (dis)assembly, component replacement, spare parts, upgradability, modular products, compatibility, maintenance and repair, guarantee, warrantee, quality, testing, inspecting. Take-back/trade-in/buy-back, return products, return points. Reselling, remanufacturing, remarketing, replacing, reuse, second hand. Collective, platforms, HUB's, open-source	Re-use, share, product quality assurance, repair, maintenance, full utilization, access, service providing. Relationships, community building, multiple users, co-use, online platforms, open-source, HUB's, 3D HUB's, sharing knowledge, mobile, apps, peer-to-peer, access based. Intermediary services, percentage fee, commission, incentives, credits,	Function or performance, lease or pay, rental, performance agreement, access based. Organizational ownership, performance improvement, solutions provider, design for optimal use, enhancing performance, guarantee, warrantee. Return, collect, take-back. Durability, maintenance, upgradability, prolonging life, assembly. Big data, apps, track and trace. optimize efficiency, predictive maintenance. Reuse product. Online platform, HUB's, knowledge sharing, open-source. Quality assurance, monitoring, testing.
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## APPENDIX 4. BMCE TYPOLOGIES DESCRIBED BY BOCKEN ET AL. (2014)

Table 12: BMCE typologies as described by Bocken et al. (2014)

BMCE typology	Maximize Material and Energy Efficiency (MMEE)	Create Value from Waste (CVW)	Substitute with Renewables and Natural Processes (SRNP)	Functionality over Ownership	Stewardship Role	Encourage efficiency	Repurpose	Scale up solutions
<b>Core assumption</b>	Do more with fewer resources, generating less waste, emissions and pollution.	Waste is eliminated by turning waste into input to other production and making better use of under-utilized capacity	Reduce environmental impacts and increase business resilience by addressing resource constraints 'limits to growth' associated with non-renewable resources and current production systems	Provide services that satisfy users' needs without having to own physical products.	Proactively engaging with all stakeholders to ensure their long-term health and well-being.	Solutions that actively seek to reduce consumption and production.	Prioritizing delivery of social and environmental benefits rather than economic profit maximization, through close integration between the firm and local communities and stakeholder groups.	Delivering sustainable solutions at a large scale to maximize benefits for society and the environment.

<b>Key dimensions</b>	Low carbon manufacturing/solutions, lean manufacturing, additive manufacturing, dematerialization (of products/packaging), increased functionality (to reduce no. Of products required), eco-efficiency, cleaner production approaches, product and process redesign, regenerative, reducing energy demand, reduction of resource consumption.	Circular economy, closed loop, cradle-2-cradle, industrial symbiosis, reuse, recycle, re-manufacture, take back management, use excess capacity, sharing assets, extended producer responsibility, create new value from waste, closing material loops, resource efficiency, activities and partnerships to eliminate life cycle waste, partnerships across industries, knowledge creation, sharing, collaboration, capture and transfer waste streams, take-back waste, return waste, waste management.	Move from non-renewable to renewable energy sources, solar and wind-power based energy innovations, zero-emissions initiative, Blue Economy, Biomimicry, The Natural Step, Slow manufacturing, Green chemistry, benefits from nature-inspired innovations, better use of renewable resources, replacing materials, local renewable energy solutions, solar electricity, windmills, organic/benign dyes.	Product-oriented PSS-maintenance, extended warrantee, use oriented PSS-rental, lease, shared, result-oriented PSS Pay per use, private finance initiative, design, build, finance, operate (DBFO), chemical management services (CMS), Product service systems (PSS), servitization, combination of products and services offering, functionality on pay-per-use over ownership, change material throughput, usage volume, reduce resource consumption, manufacturers deal with through-life and end-of-life issues, manufacturer retains ownership, enhanced longevity/durability, reuse of materials, reparability, upgradability, integrated supply chains.	Biodiversity protection, consumer care and well-being, ethical trade, choice editing by retailers, transparency about environmental/social impact, resource stewardship, employee welfare and living wages, community development, production systems and suppliers selected to deliverer environmental and social benefits, network reconfiguration, eliminating products that are unhealthy or environmentally damaging.	Consumer Education, demand management, slow fashion, product longevity, premium branding/limited availability, frugal business, reduce overconsumption, reduce material and energy throughput, consuming less, wasting less, using longer, product redesign for durability, no promotion and sales, incentive to discourage over-selling/obsolescence.	Not for profit, hybrid businesses, alternative ownership: cooperative, mutual, localization, home based, flexible working, creating societal and environmental benefits, integrating business with stakeholders. Deliver well-being on social and environmental basis.	Collaborative approaches, sourcing, production, lobbying, licensing, franchising, open innovation (platforms), crowd sourcing/funding.
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<b>Key indicators</b>	Efficient product design, lean manufacturing, regenerative, clean production, eco-efficiency, 3D printing, additive manufacturing, dematerialization, modular products, modularity, compatibility, (dis)assembly, functionality. Less resource consumption. Less waste generation. Less energy demands. Product redesign, partnerships, value networks, reduce supply chain emissions, minimized environmental footprint, productivity improvement, efficient, material handling.	Waste as input, waste for energy, cradle-2-cradle. Industrial symbiosis, partnerships, collective efforts, collaboration, knowledge sharing. Take back management, waste-management, capture and transfer waste streams, sorting waste, take-back programs, return chains, drop-off. Partnerships to eliminate life cycle waste. Reuse, recycle, remanufacture, upcycle products, advanced recycling, sharing, shared ownership, collaborative consumption, reduce material throughput, peer-to-peer-sharing.	Renewable energy sources, solar, water, and wind-power, nature-based, substitution with renewable resources, replacing, recovering, reuse, fiber-based materials, renewable power. Zero-emissions. Bio-resources, organic and biodegradable resources, green chemistry, composting, natural processes, bio-based. Replacing unrenewable resources. Changing product process. Value network, new energy systems, partnerships, nature inspired solutions.	Product as a service, service offerings. Extended warrantee, guarantee. Renting, leasing, sharing, pay-per-use, contract, access model. Reducing material throughput, reduce resource consumption. Efficient product design, enhanced efficiency, quality, longevity, durability. Reparability, upgradability, Maintenance, service, manufacturer retains ownership, open-source, online platform, deal with through-life and end-of-life. Reuse of products, incentives, maintenance contracts. Consumer contact, integrated supply chains.	Consumer care and well-being, ethical trade, fair-trade, certifications, certified material, FSC, transparency about environmental and social impact. Eliminating unhealthy products. Engaging with all stakeholders, delivering stakeholder health, community development, \engaging consumer in supply-chain issues. Network reconfiguration,	Energy saving, paid in return, incentives, Product redesign. Enhance longevity, durability, using products longer. Stripping products, product fundaments, efficient product design and use, 3D printing, modular products, reuse. Reduce material and energy throughput. Reduce consumption, providing information, advising consumers, influencing consumption behavior, less waste generation, second-hand goods, online platforms, online facilitation. Discourage over-selling/obsolescence. No promotion and sales.	Integration between firm and communities, community building, stakeholder engagement, societal and environmental benefits, partners, partnerships, participatory businesses,	Franchising, licensing, localized adaption, financing, mergers, acquisitions, scaling up. Collaborative models, peer-to-peer models, crowd-sourcing. Internet, open innovation platforms,
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## APPENDIX 5. BMCE TYPOLOGIES DESCRIBED BY BAKKER ET AL. (2014)

Table 13: BMCE typologies as described by Bakker et al. (2014)

BMCE typology	Classic Long-Life Model	Hybrid Model	Gap Exploiter Model	Access Model	Performance Model
<b>Core assumption</b>	High quality products with a long lifespan. After-sales support contributes to quality perception and ensure that products maintain their long life.	When a long-lasting product is completely dependent upon a replaceable part with limited functional lifespan.	Model that does not propose on anything new but feeds on value gaps in pre-existing models by providing services in these gaps.	Providing access to a product, while its ownership remains with the access provider. Time limit and products are used in turns.	Leaves responsibility with the provider, who provides the performance. Users are only interested in the quality of the service. Services are consumed at the same time they are generated.
<b>Key dimensions</b>	Extending product life. Ensuring quality of products. Product maintenance. Durable design, build to last.			Platform, connect owners, multiple users, same resources, social component, community building, human relationships, underutilization, renting, sharing, swapping, lending, co-use, sharing platform, technology, internet, enable increased utilization rate of products by making possible shared use/ access/ ownership, platform for collaboration across users.	Functionality over product-own. Performance, provider takes care, user pays a fee in return. Service providing, renting, leasing, lending. Solutions provider. Service provider. Enhancing product performance. Provider retains responsibility.
<b>Key indicators</b>	Service, repair. Servicing organization, open-source initiatives. High quality products, durability, testing, monitoring quality, longevity, efficient product design. Guarantee, warrantee. Maintenance, upgrading, refurbishing, remanufacturing, recycling, reuse, upcycling. After-sales support, product support.		Maintenance, services, replacement, repair, upgrade, refurbishment, return-service, return-streams, sorting, return chains, waste streams, waste management, drop-off points, incentives to return. Returning products. Re-activities, remanufacture, recycling, upcycling.	Short-term ownership, access to a product, multiple users, co-use, underutilization. Sharing product, renting, swapping, lending. Developments in digital communication, internet, online platforms, connect users, technology, sharing platforms. Advise, maintenance, repairs, upgrading. Temporarily use a product. Affordability, product duration, quality, functionality, accessibility, long-lasting products, automated payment.	Functionality, performance, access to service. Provider owns product, provider maintains product, quality responsibility with provider. Provider benefits from products with endurance, efficient product design, efficiency, (dis)assembly, longevity, durability, prolonging life, functionality. Quality, monitoring, testing, maintenance, repair, upgrading, second hand parts traffic, recycling, upcycling, reuse. Material flows in producer's hands. No private ownership. Contracts, lease, renting, lending, financial arrangement, pay-per-use. Collaboration, knowledge, online providing.

## **APPENDIX 6. ELABORATION OF BMCE TYPLOGIES**

### ***1. Circular Supply Chain / SRNP***

One of the key assumptions of this typology is the use of renewable, recyclable or biodegradable materials as alternative input resources (Lacy & Rutqvist, 2015; Bocken N. , Short, Rana, & Evans, 2014). More important, the elimination of toxic and scarce inputs plays a crucial role in this typology for ensuring closed loops. Accordingly, this should be achieved through value networks, partnerships (Bocken N. , Short, Rana, & Evans, 2014), collaboration with other stakeholders and the establishment of circular networks (Lacy & Rutqvist, 2015). Ultimately, it assumes a distribution of circular products and an opportunity for end users to recapture value.

### ***2. Recovery and Recycling / Create Value from Waste***

This typology assumes production and consumption systems in which waste is revived for other uses (e.g. input and energy); every waste and by-product stream is optimized (Lacy & Rutqvist, 2015). Waste is eliminated and revived by turning waste into input to other production and making better use of under-utilized capacity (Bocken N. , Short, Rana, & Evans, 2014). Key in achieving this are collaborative efforts (e.g. partnerships) across industries to manage and return waste (i.e. return chains by take-back platforms and drop-off points) (Lacy & Rutqvist, 2015; Bocken N. , Short, Rana, & Evans, 2014).

### ***3. Product Life Extension / Classic Long-Life Model***

Whereas the latter typology assumes all waste is used for new input or energy, this typology endeavors to recapture value by maintaining and improving products (Lacy & Rutqvist, 2015) to extend products' lives (Bakker, den Hollander, van Hinte, & Zijlstra, 2014). This typology therefore strives for product improvement, value creation and - preservation through repairs, upgrades, remanufacturing, recycling, and refurbishing. Efficient product (re)design, modular products, upgradability, longevity, and extended guarantee are some of the key concepts of this typology. This leads to high quality products with a longer lifespan (Bakker, den Hollander, van Hinte, & Zijlstra, 2014). Additionally, maintaining and improving products requires more customer interaction points and even return points and take-back programs in forms of collective platforms to keep products alive and relevant (Lacy & Rutqvist, 2015).

#### ***4. Sharing Platform / Access Model***

This typology assumes short term or temporal ownership of and/or access to a product (Lacy & Rutqvist, 2015; Bakker, den Hollander, van Hinte, & Zijlstra, 2014). This BMCE is characterized by products or goods that are used in turns by renting, sharing, swapping, or lending. Both Lacy and Rutqvist (2015) and Bakker et al. (2014) emphasize underutilization of products as a motive for this typology. Accordingly, eliminating this underutilization is primarily done through developments in digital communication (e.g. use of online sharing platforms to connect users) and open-source initiatives or intermediary services through apps and internet.

#### ***5. Product as a Service / Functionality over Ownership / Performance Model***

This typology is identified by all authors and is characterized by providers of a function, performance, or need (Lacy & Rutqvist, 2015; Bocken N. , Short, Rana, & Evans, 2014; Bakker, den Hollander, van Hinte, & Zijlstra, 2014). Organizations become providers of a function for which users, in turn, rent, lease, lend, or pay per use of the function. Important are responsibility and ownership which retain at the providers, who have incentives to enhance product performance, efficiency, durability, and optimal use (Lacy & Rutqvist, 2015; Bocken N. , Short, Rana, & Evans, 2014; Bakker, den Hollander, van Hinte, & Zijlstra, 2014). Collaboration and value networks emerge from users that return the function or service after the leasing period.

#### ***6. Maximize Material and Energy Efficiency (MMEE) / Encourage Efficiency***

This typology assumes different types of manufacturing to do more with fewer resources, generating less waste, emissions and pollution. Product are designed eco-efficient, modular, and lean to improve efficiency of materials and energy and to minimize environmental footprint (Bocken N. , Short, Rana, & Evans, 2014). Whereas the *Circular Supply Chain / SRNP* typology assumes the use renewable, recyclable or biodegradable, this typology solely focuses on manufacturing efficiency to reduce waste and other supply chain emissions. The *Encourage Efficiency* typology, also provided by Bocken et al. (2014) focuses on efficiency from the consumer side that is stimulated by organizations. However, its essence is identical: reducing material and energy throughput and generation of waste through efficient product design, and improved durability. From the consumers side, it assumes discouraging overselling, promotions and obsolescence of products.



### **7. *Stewardship Role / Repurpose***

Introduced by Bocken et al. (2014), this BMCE typology assumes organizations proactively engage with all their stakeholders to ensure their long-term health and well-being and to deliver social and environmental benefits rather than economic profit. It focuses on efforts taken by individual organizations to, among others, stimulate healthy, and to eliminate unhealthy products. This is achieved through fair-trade, certified products (e.g. FSC), and transparency about environmental and social impact. Ultimately, organizations engaging in this strive for community development, alternative network configuration, and integrating firms and other communities, for example by engaging with stakeholders.

### **8. *Scale up Solutions***

When sustainable solutions are still existing, Bocken et al. (2014) assume a BMCE typology for organizations that entirely focus on delivering these sustainable solutions at a large scale. This is, among others, achieved through franchising, licensing, mergers, acquisitions, crowd-sourcing, and localized adaption to ultimately maximize the benefits for society and the environment. Hence, it does not introduce initial practices to reach sustainable business models, but rather introduces appropriate practices for expanding existing sustainable practices. According to Bocken et al. (2014), the internet, and open innovation platforms play a crucial role in achieving this.

### **9. *Gap Exploiter Model***

Whereas this BMCE typology shows some similarities with the *Product as a Service / Functionality over Ownership / Performance Model* typologies, it is yet different in essence, leading this BMCE to be seen as a stand-alone typology. Introduced by Bakker et al. (2014), the Gap Exploiter Model does not propose on anything new, but feeds on value gaps in pre-existing models by providing services in these gaps. In other words, organizations doing this do not provide services themselves (e.g. offering mobility), but rather offer intermediary services to keep the initial service alive, i.e. by offering replacement, maintenance, upgrades, refurbishment, remanufacturing, return-services et cetera. Organizations engaging in this BMCE could be seen as middlemen, who have a supporting role for service providers.

## APPENDIX 7. BUILDING BLOCKS PER BMCE

Building Block	CSC/SRNP	RR/CVW	PLE/CLLM	SP/AM	PAAS/FO/PM	MMEE/EE	SR/R	SUS	GEM	No.
1. Pure inputs	<u>X</u>						<u>X</u>			2
2. Waste as input	<u>X</u>	<u>X</u>								2
3. Waste management	<u>X</u>	<u>X</u>							<u>X</u>	3
4. Renewable input sources	<u>X</u>	<u>X</u>								2
5. Efficient design	<u>X</u>	<u>X</u>	<u>X</u>		<u>X</u>	<u>X</u>				5
6. Hybrid manufacturing	<u>X</u>	<u>X</u>				<u>X</u>				3
7. Stakeholder engagement	<u>X</u>	<u>X</u>		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>			6
8. Take-back		<u>X</u>	<u>X</u>		<u>X</u>				<u>X</u>	4
9. Rewards		<u>X</u>		<u>X</u>	<u>X</u>	<u>X</u>			<u>X</u>	5
10. High quality products		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>					4
11. Information sharing		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>			<u>X</u>		5
12. Digital technologies		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>		<u>X</u>		6
13. Recycling		<u>X</u>	<u>X</u>						<u>X</u>	3
14. Upcycling		<u>X</u>	<u>X</u>		<u>X</u>				<u>X</u>	4
15. Maintenance	<u>X</u>		<u>X</u>	<u>X</u>	<u>X</u>				<u>X</u>	5
16. Insurance			<u>X</u>		<u>X</u>					2
17. Reuse	<u>X</u>		<u>X</u>	<u>X</u>	<u>X</u>					4
18. Shared ownership		<u>X</u>		<u>X</u>						2
19. Servitization				<u>X</u>	<u>X</u>				<u>X</u>	3
20. Alternative revenue model				<u>X</u>	<u>X</u>	<u>X</u>				3
21. Eco-efficiency		<u>X</u>			<u>X</u>	<u>X</u>				3
22. Consumer education						<u>X</u>	<u>X</u>			2
23. Scale-up initiatives								<u>X</u>		1

## APPENDIX 8. METASEARCH PARAMETERS

all these words:	circular*, business
this exact word or exact phrase:	corporate responsibility
one or more of these words:	sustainability OR organization OR "closing loops" OR report OR brochure OR news OR presentation OR consulting OR case OR "industry report" OR project OR interview OR "CEO interview" OR corporate OR "business report" OR activities OR planet OR climate OR recycling OR service OR "sustainable business"
Language:	Engels
Region:	Every country
Site or domain:	-
Last updated:	Any time
Words that are displayed:	Somewhere on the page
File type:	Adobe Acrobat pdf (.pdf)

## APPENDIX 9. LIST OF DOCUMENTS DERIVED FROM METASEARCH

- P 1: 1. Commerzbank Annual Report 2014.pdf  
P 2: 10. TD Bank 2015 Corporate Responsibility Report.pdf  
P 3: 100. Lindex Sustainability Report 2014.pdf  
P 4: 101. Pakistan State Oil Annual Report 2014.pdf  
P 5: 102. Hershey 2014 CSR Report.pdf  
P 6: 103. Millicom CR Performance Review 2016.pdf  
P 7: 104. Ragn Sells Group Environmental Report 2015.pdf  
P 8: 105. Metro CR 2013.pdf  
P 9: 11. Lockheed Martin 2015 Sustainability Report.pdf  
P10: 12. Stantec Management Information 2015.pdf  
P11: 13. Target 2016 Corporate Social.pdf  
P12: 14. BCE Inc. 2016 Corporate Responsibility Report.pdf  
P13: 15. Wells & Fargo Notice of Annual Meeting of Stockholders 2016.pdf  
P14: 16. Dominican Diamond Corporation Annual and Special Meeting of Shareholders 2017.pdf  
P15: 17. KazMunaiGas 2016 Annual Report.pdf  
P16: 18. Woolworths Group Corporate Responsibility 2020 Strategy.  
P17: 19. RBC Corporate Integrity.pdf  
P18: 2. Schiphol Corporate Responsibility 2016.pdf  
P19: 20. ADEC - Water and Corporate Responsibility What Can Companies Do.pdf  
P20: 21. Credit Libanais Annual Report 2015.pdf  
P21: 22. Banco Popular Annual Report 2016.pdf  
P22: 23. ASE Group 2016 CSR Report.pdf  
P23: 24. Atea CSR Report 2016.pdf  
P24: 25. Barrick Gold Corporation Annual Shareholder Meeting 2017.pdf  
P25: 26. BASF Report 2016.pdf  
P26: 27. Baxter 2016 Corporate Responsibility Report.pdf  
P27: 28. Companies Commission of Malaysia 2013 Corporate Responsibility .pdf  
P28: 29. BMO Financial Group Corporate Governance 2008.pdf  
P29: 3. DHL 2016 SMU Logistics & Supply Chain Symposium.pdf  
P30: 30. Brambles 2016 Sustainability Review.pdf  
P31: 31. BSR GlobeScan State of Sustainable Business 2015.pdf  
P32: 32. BT Contribution to Corporate Responsibility 2015.pdf  
P33: 33. KPMG Business Responsibility Reporting 2017.pdf Business Responsibility Reporting  
P34: 34 CA European CR Report 2014.pdf  
P35: 35. Konecranes case.pdf  
P36: 36. CH2M Sustainability and Corporate Citizenship Report 2016.pdf  
P37: 37. BNP Paribas 2015.pdf  
P38: 38. CLG Circular Economy report.pdf  
P39: 39. Plunkett's Company Donations 2007.pdf  
P40: 4. Veolia CSR Performance Digest 2014.pdf  
P41: 40. BlackBerry CSR Report 2014.pdf  
P42: 41. PwC Corporate Responsibility Review 2016.pdf  
P43: 42. ASML Corporate Responsibility Report 2015.pdf  
P44: 43. T-Mobile CSR Report 2015.pdf  
P45: 44. PwC CR Report 2008.pdf  
P46: 45. Bank of Cyprus CS Report 2014.pdf  
P47: 46. Cisco CSR Report 2016.pdf  
P48: 47. Groupe Beamanour CSR Report 2015-2016.pdf  
P49: 48. Desso CSR Report 2014.pdf  
P50: 49. DHL Corporate Responsibility Fact Book.pdf  
P51: 5. Euskaltel Corporate Responsibility 2015.pdf  
P52: 50. Dustin 2016 Corporate Responsibility Report.pdf  
P53: 51. PGGM Circular Economy presentation.pdf  
P54: 52. Ekokem Group sustainability report 2015.pdf  
P55: 53. Desso Supplier Code of Conduct 2015.pdf  
P56: 54. Engie Environmental and Societal Responsibility 2016.pdf  
P57: 55. CIMA Ethics report 2010.pdf  
P58: 56. Sa Sa International Holdings Limited Annual Report 2008.pdf  
P59: 57. EY Business Responsibility and CSR insights.pdf  
P60: 58. Fazer Group CSR Review 2016.pdf  
P61: 59. Biffa CR Report.pdf  
P62: 6. Shaw Industries Sustainability Report 2015.pdf  
P63: 60. NRW Bank Financial Report 2013.pdf  
P64: 61. Arcelor Mittal Gent Corporate Responsibility Report 2015.pdf  
P65: 62. Stora Enso Global Responsibility Performance 2014.pdf  
P66: 63. Growmark CSR Report 2016.pdf  
P67: 64. ING Financing the Circular Economy.pdf  
P68: 65. Telefónica Integrated Report 2015.pdf  
P69: 66. Strandberg Consulting.pdf  
P70: 67. LAM Research Corporate Social Responsibility Report 2016.pdf  
P71: 68. Lexmark 2014 Corporate Social Responsibility Report.pdf  
P72: 69. Logitech Sustainability Report 2015.pdf  
P73: 7. CCE Corporate Responsibility Sustainability Report 2014-2015.pdf  
P74: 70. IT Annual Report 2015.pdf  
P75: 71. Lappeenranta.pdf  
P76: 72. Scotiabank Management Proxy Circular 2017.pdf  
Management Proxy Circular  
P77: 73. Husky Energy Notice of Annual Meeting of Shareholders 2016.pdf  
P78: 74. India Ministry of Corporate Affairs National Voluntary Guidelines 2011-2012.pdf {  
P79: 75. Nike Sustainable Business Report 2015.pdf  
P80: 76. Novia Scoita Meeting Shareholders 2014.pdf  
P81: 77. DS Smith Zero Waste Whitepaper.pdf  
P82: 78. Cellnex Telecom, S.A. Corporate Responsibility Policy 2016.pdf  
P83: 79. Bradford University Principles for Responsible.pdf  
P84: 8. Ericsson Sustainability and Corporate Responsibility Report 2015.pdf  
P85: 80. CIBC Notice of Annual Meeting of Shareholders 2017.pdf  
P86: 81. DHL Reverse Logistics.pdf  
P87: 82. CSR Guidelines 2013.pdf  
P88: 83. Amer Sustainability CR Report 2015.pdf  
P89: 84. Bosch Sustainability Report Benelux 2012.pdf  
P90: 85. GRI Sustainability and Reporting Trends in 2025.pdf  
P91: 86. The Home Depot Responsibility Report 2016.pdf  
P92: 87. UNICEF CSR Malaysia.pdf  
P93: 88. US Chamber of Commerce Trash To Treasure.pdf  
P94: 89. Weber Shandwick Corporate Citizenship 2015.pdf  
P95: 9. Cenovus 2015 Corporate responsibility report.pdf  
P96: 90. BBVA Information on Corporate Responsibility 2013.pdf  
P97: 91. Episurf Medical Annual Report 2015.pdf  
P98: 92. Ricoh UK Sustainability Report 2015.pdf  
P99: 93. MOIL Limited CSR Policy.pdf  
P100: 94. Recipharm 2014 Annual report.pdf  
P101: 95. LGIM Corporate Governance Policy.pdf  
P102: 96. PostNL Annual Report 2016.pdf  
P103: 97. Owens Illinois 2014 Sustainability Report.pdf  
P104: 98. SCA Annual Report 2016.pdf {  
P105: 99. Bellatrix CSR Report 2016.pdf  
P106: 106. Philips Healthcare Refurbishing solutions 2016.pdf  
P107: 107. Philips Closing Material Loop.pdf  
P108: 108. Philips Circular Economy Brochure.pdf  
P109: 109. Philips Sustainable Development Goals.pdf  
P110: 110. Philips CE.pdf

## APPENDIX 10. OCCURRENCE OF BUILDING BLOCKS IN DOCUMENT ANALYSIS

	Alternat	Consum	Digital t	Diversity	Downcy	Eco-effi	Efficient	Green p	High qu	Hybrid r	Influenc	Informa	Insuranc	Internet	Mainten	Predicti	Pure inp	Recyclin	Renewal	Reuse	Reverse	Rewards	Scale-up	Servitiza	Shared c	Stakehol	Take-ba	Upcyclin	Waste as	Waste m
P 1: 1. C	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0
P 2: 10. 7	0	0	1	1	0	6	0	1	0	0	1	0	0	1	0	0	2	0	1	0	0	1	0	0	1	9	0	0	0	0
P 3: 100.	0	0	0	0	0	4	1	0	2	0	0	0	0	0	0	0	2	5	1	0	0	0	0	0	4	0	0	1	2	
P 4: 101.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P 5: 102.	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	2	0	0	1	1	
P 6: 103.	0	1	2	1	0	2	0	0	0	0	0	0	0	0	0	0	2	2	1	2	0	0	0	1	1	3	0	2	2	2
P 7: 104.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	4	1	2	0	0	0	0	2	5	1	4	5	
P 8: 105.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	1	1	0	1	1	
P 9: 11. 1	0	1	0	0	0	2	2	0	0	0	1	1	0	0	1	0	5	0	5	0	0	0	0	0	0	0	0	1	2	0
P10: 12.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P11: 13.	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	3	3	1	0	1	0	0	2	2	0	2	1	
P12: 14.	0	0	1	1	0	2	0	0	0	0	1	0	0	0	0	0	1	1	1	2	0	0	0	0	1	2	0	1	2	
P13: 15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P14: 16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P15: 17.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
P16: 18.	0	4	0	1	0	3	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0
P17: 19.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P18: 2. S	1	0	0	0	0	4	0	1	0	0	1	0	0	0	0	0	3	0	2	1	0	0	0	1	0	1	0	0	0	0
P19: 20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P20: 21.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
P21: 22.	0	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	2	2	2	1	0	0	0	0	1	0	1	0	0	1
P22: 23.	0	2	4	0	0	3	1	0	0	0	4	0	0	0	0	0	4	1	3	0	0	0	0	0	2	0	0	1	1	
P23: 24.	0	1	0	1	0	1	2	0	1	0	0	0	0	1	1	0	0	2	0	2	0	0	0	0	1	1	1	2	1	
P24: 25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P25: 26.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	1
P26: 27.	1	3	1	0	0	8	3	0	0	0	0	0	0	1	3	0	2	1	2	3	0	0	0	4	0	4	1	0	1	1
P27: 28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P28: 29.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P29: 3. E	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	2	0	1	0	0
P30: 30.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	1	2	0
P31: 31.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P32: 32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P33: 33.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P34: 34. 6	0	3	1	0	0	2	1	1	4	0	0	2	0	0	0	0	3	2	0	0	0	0	0	0	4	1	0	1	0	0
P35: 35.	0	0	1	0	0	0	1	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
P36: 36.	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
P37: 37.	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1
P38: 38. 5	1	0	0	0	0	0	5	0	0	0	0	0	0	0	2	0	2	1	1	2	0	0	0	2	0	4	2	1	4	1
P39: 39.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
P40: 4. V	0	3	1	1	0	2	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	1	0	0	1	0	0	5	3	0
P41: 40.	0	2	1	1	0	5	7	0	0	0	1	0	0	0	1	0	5	1	1	1	0	0	0	2	1	2	2	0	0	0
P42: 41.	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
P43: 42.	0	2	0	1	0	3	4	0	0	0	1	2	0	1	1	0	1	1	0	1	0	0	0	0	4	0	1	0	0	0
P44: 43.	2	1	10	0	0	5	0	0	0	0	1	1	0	6	2	0	1	3	3	3	0	4	1	3	0	3	6	0	0	0
P45: 44.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P46: 45.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
P47: 46.	1	3	4	0	0	3	7	0	0	0	0	0	0	4	2	1	1	2	2	3	0	0	0	5	1	3	5	4	1	0
P48: 47.	0	1	0	1	0	2	0	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	2	0	0	0	0	0
P49: 48.	1	2	0	0	0	3	5	0	0	0	1	0	0	0	0	0	10	2	4	0	0	0	0	2	0	3	3	1	2	2
P50: 49.	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0
P51: 5. E	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0
P52: 50.	1	0	0	1	0	2	1	1	0	0	0	0	0	0	1	0	2	3	0	3	0	0	0	2	0	0	1	0	0	0
P53: 51.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

P54: 52.	0	2	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	3	0	0	0	0	0	1	0	3	1	0	4	3	
P55: 53.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
P56: 54.	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	0	0	0	1	
P57: 55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P58: 56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P59: 57.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P60: 58.	0	0	0	0	0	4	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	
P61: 59.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	2	2	
P62: 6. S	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	3	0	0	2	0	
P63: 60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P64: 61.	0	1	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	4	0	0	3	1	
P65: 62.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	4	1	1	3	2	
P66: 63.	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P67: 64.	2	0	0	0	0	0	6	0	0	0	0	0	1	1	2	1	4	2	1	1	0	0	0	2	0	2	4	2	2	1	
P68: 65.	1	1	1	0	0	3	0	0	0	0	1	0	0	3	1	0	0	2	2	2	0	1	0	0	0	0	1	0	0	0	
P69: 66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P70: 67.	0	0	0	0	0	1	2	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	0	1	0	0	1	0	1	1	
P71: 68.	0	0	0	1	0	4	2	0	0	0	1	0	0	0	1	0	2	2	1	1	0	0	0	0	1	2	1	0	0	1	
P72: 69.	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	2	0	0	0	0	
P73: 7. C	0	2	0	2	0	4	1	0	0	0	0	0	0	0	0	0	5	2	2	0	0	0	1	0	0	7	0	0	0	0	
P74: 70.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	1	0	0	1	1	
P75: 71.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	
P76: 72.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P77: 73.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P78: 74.	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P79: 75.	0	2	0	1	1	5	3	0	0	0	2	3	0	0	0	0	7	3	3	1	0	1	0	0	0	6	0	1	5	0	
P80: 76.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P81: 77.	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	1	0	1	0	0	0	0	0	2	1	0	0	0	
P82: 78.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P83: 79.	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P84: 8. E	0	0	1	1	0	2	3	0	0	0	1	0	0	3	0	0	2	1	3	0	0	0	0	0	1	4	3	0	1	0	
P85: 80.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P86: 81.	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	7	1	0	0	0	3	4	0	0	0	
P87: 82.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P88: 83.	0	0	0	0	0	3	2	0	4	1	0	0	2	0	3	0	4	0	0	0	0	0	0	0	0	3	0	0	0	0	
P89: 84.	0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	2	0	
P90: 85.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P91: 86.	0	1	0	1	0	2	2	0	0	0	0	1	0	0	0	0	7	2	1	1	0	0	0	0	0	2	0	0	0	1	
P92: 87.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
P93: 88.	0	0	0	0	0	2	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	
P94: 89.	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P95: 9. C	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
P96: 90.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
P97: 91.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P98: 92.	0	0	1	1	0	3	1	0	0	0	1	1	0	0	0	0	3	1	0	0	0	1	0	0	0	0	1	1	1	0	
P99: 93.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
P100: 94.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P101: 95.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P102: 96.	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P103: 97.	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	2	1	3	1	0	0	0	0	3	3	0	4	1	
P104: 98.	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	2	1	2	0	0	0	0	0	0	1	0	0	1	0	
P105: 99.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
P106: 10.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	
P107: 10.	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	2	0	0	3	0	0	0	0	1	2	0	0	0	
P108: 10.	0	1	0	0	0	1	6	0	2	0	0	0	1	0	7	0	1	2	0	2	2	0	0	4	0	3	0	5	1	0	
P109: 10.	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
P110: 11.	1	0																													

## APPENDIX 11. QUOTATIONS FROM DOCUMENT ANALYSIS PER BMCE TYPOLOGY

BMCE	Building Block	Keywords	Quotations indicating configuration of building blocks for each BMCE archetype
C/SRNP	Pure inputs	Renewable, recyclable, non-toxic, bio-based, nature-based, biodegradable inputs.	<p><i>"Avantium is a leading technology firm that, among other things, develops PEF. PolyEthylene Furanoate (PEF) is a new ground-breaking polymer, made with Avantium's YXY technology. It can be used in multiple applications, like bottles, fibers and film. PEF is 100% plant based and 100% renewable".</i></p> <p><i>"In 2009, we introduced the use of PlantBottle™, which uses PlantPET derived from renewable sources of sugar cane and molasses."</i></p>
	Waste as input	Waste as resource input, waste as energy input, compost.	<p><i>"Van Scherpenzeel is a knowledge-based business that controls a wide range of raw material supply chains. The company extracts new materials from waste via destroying and recycling all types of waste, such as paper, plastic, glass or textile."</i></p> <p><i>"Right now, materials left over from producing NIKE shoes are being reborn as tennis courts, athletic tracks and new shoes."</i></p> <p><i>"Veolia transforms organic material into compost to be returned to the soil, otherwise known as composting or organic recovery."</i></p>
	Waste management	Waste management, waste handling, sorting, separating.	<p><i>"Veolia handles waste in all forms and at all stages of the waste cycle. Veolia manages waste from collection to recovery, on behalf of both industrial and service sector customers, as well as local communities."</i></p> <p><i>"To achieve this, we are completely redesigning and optimizing our Refinity® plant to provide superior methods for separating post-consumer carpet tiles."</i></p>
	Renewable input sources	Renewable energy sources, renewable power, solar, wind, water.	<p><i>"In 2016, we added rooftop solar panels to 157 new sites, ending the year with 350 totals, for a capacity of 166.3 megawatts. On average, a Target store with onsite solar uses 30 percent less energy from the local electric grid than those without."</i></p> <p><i>"CCE's first water turbine has been approved and will be built in 2016 in the river next to the Chaudfontaine plant. It will eventually supply some 3 percent of the site's electricity or up to 330 megawatt hours (MWh)."</i></p>
	Efficient design	Durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use	<p><i>"Philips Lighting have recognized the need to increase the 'value' of their lighting components to encourage reuse, i.e. redesigning them to be accessible, fully repairable or upgradable to potential new functions (future-proofing and extending the economic lifetime of the product)."</i></p>

		design, prolonging life.	<i>"BMA Ergonomics makes high quality office chairs since 1997. Since its start it has designed its chairs for easy disassembly and remanufacturing as the seats can be taken off the frame within seconds."</i>
	Hybrid manufacturing	3D printing, additive manufacturing.	<i>"One remarkable renewal is to adopt a 3D printing project which has been just recently started for the creation of molds."</i>
	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<i>"Schiphol Group has joined forces with home carrier KLM, biofuel supplier SkyNRG and several other partners to promote the large-scale use of biofuels in aviation."</i>  <i>"Anglian Water are also taking the by-product of their core business process and turning it into an input material for another sector."</i>  <i>"That is why we invest in our production apparatus so that we not only produce steel, but that we also create valuable by-products which may be used as raw materials for other industries or for other useful applications instead of natural resources."</i>
	Maintenance	Maintenance, repair, replacement, component replacement, refurbishing.	<i>"One way to ensure the longevity of our products is through our Customer Support Business Group (CSBG), which provides system upgrades, refurbished systems, spare parts, and services."</i> <i>"Philips installs, maintains and upgrades the systems."</i>
	Reuse	Recovery and reuse, reuse, second-hand.	<i>"For instance, we use pallets to store and ship our products, and we ask customers, when feasible, to return the pallets and the tier sheets used in stacking for reuse."</i> <i>"Baxter works to repair and reuse electronic medical products when possible, and collaborates to recycle medical waste and recapture materials when reuse is not an option."</i>

<b>RR/CVW</b>	Waste as input	Waste as resource input, waste as energy input, compost.	<i>"NC Miljø transforms 120.000 tons of food waste to green energy each year. NC Miljø has since 2005 collected used cooking oil from restaurants and commercial kitchens to use and sell it as biomass for Biogas plants."</i> <i>"Acciona's Energy Division runs biomass plants in Spain that incinerate agricultural cereal straw and forest waste to generate renewable electricity – a process that results in ash and slag byproducts."</i>
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	Waste management	Waste management, waste handling, sorting, separating.	<i>"The sorting process separates certain paper grades for paper manufacturing, corrugated paper and board grades for board manufacturing, and non-pulpable materials like plastics and other wastes that can partly be utilized in our mills' power plants to generate energy."</i> <i>"We work with the transportation, sorting, processing, recycling/detoxification and sales of more than 800 different materials."</i>
	Renewable input sources	Renewable energy sources, renewable power, solar, wind, water.	<i>"For many years, we've utilized renewable energy generation at some of our largest distribution facilities, including solar panels and wind turbines at our European Logistics Campus in Laakdal, Belgium, and solar panels at our logistics center in Taicang, China."</i> <i>"For the supply of green energy, solar panels have been installed at the DHL Express Hub."</i>
	Efficient design	Durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use design, prolonging life.	<i>"BlackBerry devices are designed to last with software that can be upgraded over-the-air and hardware that facilitates repair."</i>  <i>"Designs that enable multiple lifecycles with minimal loss of value, quality and energy impact and that can also be mined for materials and components that can be reused."</i>
	Hybrid manufacturing	3D printing, additive manufacturing.	<i>"The 3D files are then sent to the ISO13485-certified manufacturers, where the guides are 3D-printed and the implant is produced through turning and milling."</i>
	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<i>"Stora Enso utilize 98 per cent of their by-products and process residuals, circling them widely through different sectors and so reusing materials that would otherwise end up as waste."</i> <i>"In order to minimize the environmental impact, we are also co-operating with partners and suppliers to find new ways of recycling fibers, as saving raw material is an important issue for the fashion industry."</i>
	Take-back	Return chains, two-way supply chain, drop-off points, take-back, trade-in, buy-back, return points, return and collect, return-services.	<i>"The company built up a temporary but innovative recycling station, where local residents could drop off any items they no longer needed. As a part of the project, an electric vehicle was used to drive around the local area, picking up any items that people had not brought to the station for recycling themselves."</i>  <i>"Bell recovers mobile phones through two complementary programs: The Bell Trade-in program and the Bell Blue Box program."</i>

			<i>"Delivered to your office, this safe is where you put end-of-life equipment. After ten days, it is collected and transported to Atea Logistics in Växjö."</i>
Rewards	Incentives, credits, paid in return.		<i>"T-Mobile USA incentivizes its customers to trade in their used devices and accessories for great deals on the latest technology"</i> <i>"The event allowed guests to exchange a used car seat for a discount off a new car seat, booster or travel system."</i>
High quality products	Product quality, testing, inspecting, quality assurance, monitoring.		<i>"...for example, enhancing fiber quality so that clothing, textiles and materials can be recycled and reprocessed into new fashionable garments."</i> <i>"Through its Refurbished Systems business unit, Philips offers a choice of pre-owned systems that have been thoroughly refurbished, upgraded and quality tested."</i>
Information sharing	Knowledge sharing, open-source initiatives, crowdsourcing.		<i>"In December 2013, the Sustainable Apparel Coalition released the new Higg Index 2.0 tools. It distils the knowledge and expertise from a number of organizations, gathered over many years in the industry. The result is a web-based assessment platform combining the best environmental and social knowledge from across the apparel and footwear sectors that is both accessible and shareable."</i> <i>"The TEED platform was officially launched on World Environment Day in 2015. This educational online portal is transforming environmental educational knowledge into a cloud-based dialogue."</i>
Digital technologies	Online platforms, HUB's, apps, track and trace, Internet, digital communication.		<i>"Companies can use the online portal to properly and safely dispose of their used cell phones and smartphones free of charge and receive a certificate as confirmation."</i> <i>"...Tracking of service parts and their condition during use phase for return and replacement planning."</i>
Recycling	Recycling, advanced recycling.		<i>"At Heljestorp in Vänersborg municipality, we have a Granulate factory who produce rubber granulate for use as infill in football fields and other uses. We produce about 15.000 mt a year from an input of 25.000 mt tires. The rest of the tire is metal (about 5.000 mt) and textile (about 5 mt). The metal is recycled and the textile is used as fuel in a cement factory."</i>

	Upcycling	Upcycling, performance improvement, remanufacturing, remarketing.	<i>"KLM renewed 11,000 uniforms of its stewardesses in 2010. This corresponds with 90,000 kilograms of textile which previously was burned. Nowadays it is pulverized and upcycled to nylon. The nylon is upcycled further as it is used for lining in the business class seats. KLM renewed 11,000 uniforms of its stewardesses in 2010. This corresponds with 90,000 kilograms of textile which previously was burned. Nowadays it is pulverized and upcycled to nylon. The nylon is upcycled further as it is used for lining in the business class seats."</i>
	Shared ownership	Share, sharing, co-use, multiple users, shared ownership, full utilization.	<i>"...car-sharing for employees for travel to and from the workplace."</i>
	Eco-efficiency	Less energy use, reduce emissions, minimize environmental footprint, reduce consumption, less waste generation.	<i>"We acknowledge the environmental impacts of our business operations and strive to prevent the adverse effects of operations on the environment by reducing emissions, increasing the efficiency of energy and water consumption and carrying out waste sorting and recycling." "Over the past 20 years, we have reduced our energy consumption by 30% by investing in a modern production apparatus and by recovering the energy present in flue gases to produce steam."</i>

<b>PLE/CLLM</b>	Efficient design	Durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use design, prolonging life.	<i>"Moreover, Philips has also started to adjust design practices so products can be increasingly modular. This results in better ease of repair, longer lifetimes and, ultimately, improved environmental footprints." "Design for disassembly and easy maintenance. If products can be taken apart easily in modules they can be easily maintained and product life is increased."</i>
	Take-back	Return chains, two-way supply chain, drop-off points, take-back, trade-in, buy-back, return points, return and collect, return-services.	<i>"Cisco currently receives about 12,000-13,000 ton/year of used Cisco product that is used for life extension through our service contracts, for development in our labs, or to support our demonstration loan program, or that is remanufactured to like-new condition for resale or recycled." "At Dustin, we endeavor to extend product lifetimes by encouraging our customers to return them to us when they no longer need them."</i>
	High quality products	Product quality, testing, inspecting, quality assurance, monitoring.	<i>"Before each refurbished product enters the market again, Atea ensures the extended lifecycle of the product."</i>

	Information sharing	Knowledge sharing, open-source initiatives, crowdsourcing.	<i>"Philips Lighting strives to further increase collection and recycling and to set up new systems in other parts of the world, educate countries on how to manage collection and recycling, and to lobby with local governments for enabling legislation."</i>
	Digital technologies	Online platforms, HUB's, apps, track and trace, Internet, digital communication.	<i>"Using Big Data Advanced Technology – SDF-Safety Data Framework: Use cloud-based information communication technology to instantly track material status and obtain material safety management information as well as emergency processing reporting assistance to enhance disaster response efficiency by significantly reducing occurrences of occupational safety accidents and reducing the impacts of environmental disasters."</i>
	Recycling	Recycling, advanced recycling.	<i>"Conceived by Atea and originally designed for PCs, this recycling management system ensures complete or partial reuse of hardware, thus preventing a lot of materials from heading to landfill sites." "...that can be either recycling or refurbishing and returning to the market as a second-hand product".</i>
	Upcycling	Upcycling, performance improvement, remanufacturing, remarketing.	<i>"As these modules are designed to be durable, a significant amount of them are still in good working condition when returned and are therefore suitable for multiple product life cycles. After a thorough re-qualification process, these modules are restored to an as-new condition and can be reused, offering the same level of performance as new modules."</i>
	Maintenance	Maintenance, repair, replacement, component replacement, refurbishing.	<i>"We strive to design products that will last for several years of outdoor use, and extend the product lifetime by providing an extensive repair service even after the warranty period." "As appropriate, the company repairs those products for reuse, which lengthens product life, decreases the environmental impacts of product disposal and new product manufacture, and keeps valuable materials in use."</i>
	Insurance	Guarantee, warranty, after-sales support, extended warranty, insurance, extended insurance.	<i>"Through its Refurbished Systems business unit, Philips offers a choice of pre-owned systems that have been thoroughly refurbished, upgraded and quality tested. For example, the Philips Diamond Select program makes first-rate equipment available at lower cost, offering high quality refurbished systems with full Philips warranty."</i>
	Reuse	Recovery and reuse, reuse, second-hand.	<i>"Some of the electronic medical devices Baxter sells, such as renal automated peritoneal dialysis cyclers, are designed to support the circular economy through serviceability, repair and reuse." "Philips has an active policy to retain used products and sell them in the second-hand market after remanufacturing and refurbishment."</i>

SP/AM	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<i>"To improve water efficiency on cotton farms, we're working in partnership with C&amp;A Foundation and CottonConnect to pilot finance schemes giving farmers greater access to drip irrigation technology."</i>
	Rewards	Incentives, credits, paid in return.	<i>No quotation.</i>
	High quality products	Product quality, testing, inspecting, quality assurance, monitoring.	<i>No quotation.</i>
	Information sharing	Knowledge sharing, open-source initiatives, crowdsourcing.	<i>"I-invoicing (Intelligent invoicing) was developed by Ricoh as a Document Process Outsourcing (DPO) service. This service gives our Business Partners the opportunity to switch from traditional paper based invoicing to a more modern, digitized system."</i>
	Digital technologies	Online platforms, HUB's, apps, track and trace, Internet, digital communication.	<i>"The app is a social network allowing employees to share their private car or taxi with other employees." "BlackBerry provides eligible employees the use of a free online carpool ride matching service to support the formation and success of carpooling groups."</i>
	Maintenance	Maintenance, repair, replacement, component replacement, refurbishing.	<i>"Service business models will shift ownership to access. Maintenance and repair of the equipment are included in the agreement as well as the latest technology upgrades and software releases."</i>
	Reuse	Recovery and reuse, reuse, second-hand.	<i>No quotation.</i>
	Shared ownership	Share, sharing, co-use, multiple users, shared ownership, full utilization.	<i>"...car-sharing for employees for travel to and from the workplace."</i>

	Servitization	Service providing, access, function, intermediary service, organization retains ownership, solution provider, product as a service, through-life and end-life responsibility.	<i>"End-users pay for the performance only, so that manufacturers retain access to the raw materials."</i>
	Alternative revenue model	Leasing, renting, swapping, lending, payment fee, commission, no promotions, pay-per-use.	<i>No quotation.</i>

<b>PAAS/FO/PM</b>	Efficient design	Durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use design, prolonging life.	<i>"A contract for 'lighting performance' is a nearly circular business model: their products are designed to be repaired, upgraded and collected again – the customer only pays for the light and performance, and the company takes care of the end of life of the product."</i> <i>"Retaining ownership of our products through their life cycle allows Cisco to extend their useful life, optimize utilization, and recover more value at the end of each use phase."</i>
	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<i>No quotation.</i>
	Take-back	Return chains, two-way supply chain, drop-off points, take-back, trade-in, buy-back, return points, return and collect, return-services.	<i>No quotation.</i>
	Rewards	Incentives, credits, paid in return.	<i>No quotation.</i>

	High quality products	Product quality, testing, inspecting, quality assurance, monitoring.	<i>No quotation.</i>
	Information sharing	Knowledge sharing, open-source initiatives, crowdsourcing.	<i>No quotation.</i>
	Digital technologies	Online platforms, HUB's, apps, mobile, track and trace, Internet, digital communication.	<i>"Konecranes has invested in the Industrial Internet of Things (IIoT) and Big data technologies, converting collected data into information, and using it for predictive maintenance."</i>
	Upcycling	Upcycling, performance improvement, remanufacturing, remarketing.	<i>"Service business models will shift ownership to access. Maintenance and repair of the equipment are included in the agreement as well as the latest technology upgrades and software releases." "By shifting from 'one-time sale' to 'Light as a Service' Philips maintains ownership of materials. Similarly, managed services extend the lifetime and performance of products."</i>
	Maintenance	Maintenance, repair, replacement, component replacement, refurbishing.	<i>"Philips installs, maintains and upgrades the systems." "...leasing services that include repair and recovery services to ensure that products can be safely reused or recycled."</i>
	Insurance	Guarantee, warranty, after-sales support, extended warranty, insurance, extended insurance.	<i>No quotation.</i>
	Reuse	Recovery and reuse, reuse, second-hand.	<i>No quotation.</i>
	Servitization	Service providing, access, function, intermediary service, organization retains ownership, solution provider, product as a service, through-life and end-life responsibility.	<i>"We also offer development platforms (platform as a service – paas) like AppAgile. Along with a technical development environment for iT developers, we also make industry-specific business applications available from the cloud."  "Selling light as a service instead of bulbs." TurnToo is a circular concept for the build environment that applies the design for disassembly and access over ownership concepts on buildings."</i>



			<p><i>"That is why we promote the "don't buy, rent" approach. introducing a twelve-month minimum contract term for routers and media receivers helps to extend the average usage time and reduces returns during the minimum lease period."</i></p> <p><i>"In 2014 Desso and DLL, a global financial solutions partner, launched a new offer for Desso's customers: the ability to lease rather than own the carpet they need."</i></p>
	Alternative revenue model	Leasing, renting, swapping, lending, payment fee, commission, no promotions, pay-per-use.	<p><i>In 2014 Desso and DLL, a global financial solutions partner, launched a new offer for Desso's customers: the ability to lease rather than own the carpet they need.</i></p> <p><i>"That is why we promote the "don't buy, rent" approach. introducing a twelve-month minimum contract term for routers and media receivers helps to extend the average usage time and reduces returns during the minimum lease period."</i></p>
	Eco-efficiency	Less energy use, reduce emissions, minimize environmental footprint, reduce consumption, less waste generation.	<i>No quotation.</i>

<b>MMEE/EE</b>	Efficient design	Durability, longevity, redesign, (dis)assembly, modular design, upgradability, optimal use design, prolonging life.	<p><i>"The company is also simplifying its designs and reducing the amount of different materials in any one product to enable higher quality reuse and recycling."</i></p> <p><i>"We design machines that can produce smaller and smaller ICs, allowing our customers to produce higher density chips. This higher density means fewer natural resources being used and less energy consumption per transistor over a chip's lifespan compared to older generation chips."</i></p> <p><i>"Moreover, Philips has also started to adjust design practices so products can be increasingly modular. This results in better ease of repair, longer lifetimes and, ultimately, improved environmental footprints."</i></p>
	Hybrid manufacturing	3D printing, additive manufacturing.	<i>No quotation.</i>
	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<p><i>"In order to minimize the environmental impact, we are also co-operating with partners and suppliers to find new ways of recycling fibers, as saving raw material is an important issue for the fashion industry."</i></p> <p><i>"We listen to our customers and stakeholders and are a part of the public conversation, often through round table dialogues, and then work to see how we can improve our production further."</i></p>



			<i>"To improve water efficiency on cotton farms, we're working in partnership with C&amp;A Foundation and CottonConnect to pilot finance schemes giving farmers greater access to drip irrigation technology."</i>
	Rewards	Incentives, credits, paid in return.	<i>"Implementing incentives for consumers to return products (including ease of access and transparency on drop points)." "The CEO and Board's remuneration package is 70% salary and 30% performance-related bonus against business targets. 5% of bonus is related to CR performance across a number of variables."</i>
	Digital technologies	Online platforms, HUB's, apps, mobile, track and trace, Internet, digital communication.	<i>"In the long term, we hold to a fundamental objective to continue developing business solutions, such as cloud services, e-billing, and virtualization, that reduce carbon footprint, both for our customers and for ourselves." Veolia is moving forward in the realm of smart metering, and now offers remote meter reading to a million French households. With this technology, consumers can be immediately alerted about a leak and they can track their consumption on the Internet or other media (e.g., mobile phone).</i>
	Alternative revenue model	No promotions, pay-per-use.	<i>No quotation.</i>
	Eco-efficiency	Less energy use, reduce emissions, minimize environmental footprint, zero-emissions, reduce consumption, lean manufacturing.	<i>"Our facilities minimize waste through sustainable operations, lean manufacturing techniques and environmental management programs."  "Key metrics illustrate progress on avoiding materials of concern, minimizing customer waste and reducing product carbon footprint."</i>
	Consumer education	Transparency on environmental and social impact, eliminating unhealthy products, providing information, advising consumers, discourage overselling, discourage obsolescence.	<i>"Advancing transparency about social and environmental performance in the supply chain is crucial to helping us address some of our most significant sustainability issues—supply chain labor standards, lifecycle environmental impacts, and ethical sourcing of raw materials—and is a fundamental foundation to building trust and effective stakeholder engagement."</i>

SR/R	Pure inputs	Renewable, recyclable, non-toxic, bio-based, nature-based, biodegradable inputs.	<p><i>"Ensuring that the materials we use are made of positively defined chemical ingredients in accordance with C2C principles which makes it safe for human health and the environment during the use-phase and when being recycled."</i></p> <p><i>"For both human health and the environment, we work to decrease the use and discharge of toxic chemicals in our supply chain by replacing them with better alternatives."</i></p>
	Stakeholder engagement	Collaboration, collective efforts, industrial symbiosis, partnerships, exchanging by-product, community building, relationships.	<p><i>"Interface also incorporates local communities in their ambition to be restorative to nature."</i></p> <p><i>"On a smaller scale, but with more of a personal impact, O-I also helps fund local programs that encourage community members to collect glass and return it to glass recovery centers."</i></p> <p><i>"By setting up networks with other industrial operators, we obtain new ideas and information, and can also share our expertise by offering lectures and training, holding events and issuing publications."</i></p>
	Consumer education	Transparency on environmental and social impact, eliminating unhealthy products, discourage obsolescence.	<p><i>"This is why we are working together with The Coca-Cola Company to reduce the sugar and calories consumed from our beverages – specifically by reducing our packaging portion sizes, introducing new low- and no-calorie products, and reformulating some products."</i></p> <p><i>"Imposing anti-dumping measures (import levies) to companies that sell their steel on the European market at prices lower than the actual production cost price."</i></p>
SUS	Information sharing	Knowledge sharing, open-source initiatives, crowdsourcing.	<p><i>"In December 2013, the Sustainable Apparel Coalition released the new Higg Index 2.0 tools. It distils the knowledge and expertise from a number of organizations, gathered over many years in the industry. The result is a web-based assessment platform combining the best environmental and social knowledge from across the apparel and footwear sectors that is both accessible and shareable."</i></p> <p><i>"We have shared our restricted substance list to help create an industry-wide manufacturing restricted substance list (MRSL) and shared a water-based solvent formula to enable the industry to eliminate the use of toxic chemicals in a key footwear process."</i></p>
	Digital technologies	Online platforms, HUB's, apps, mobile, track and trace, Internet, digital communication.	<p><i>"ASE has established a Technology Board that aims to connect employees from related professional fields through the integration of technology and knowledge sharing and the creation of a platform for in-depth analysis and discussions."</i></p> <p><i>"Deutsche Telekom and other key players together created the qiViCon platform on which any company, regardless of their industry or size, can offer their own solutions."</i></p>

	Scale-up initiatives	Franchising, licensing, mergers, acquisitions.	<i>No quotation.</i>
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<b>GEM</b>	Waste management	Waste management, waste handling, sorting, separating.	<i>"Veolia handles waste in all forms and at all stages of the waste cycle. Veolia manages waste from collection to recovery, on behalf of both industrial and service sector customers, as well as local communities." "Our food waste collection service feeds our Anaerobic Digestion plant which recovers energy and provides valuable nutrients which can be cycled back to the agricultural sector."</i>
	Take-back	Return chains, two-way supply chain, drop-off points, take-back, trade-in, buy-back, return points, return and collect, return-services.	<i>"We collect, treat and recycle waste and residual products from businesses, organizations and households."  "Consolidating return products for a cost-effective collection from large geographical areas. Establishing collaboration programs to increase return volumes".</i>
	Rewards	Incentives, credits, paid in return.	<i>No quotation.</i>
	Recycling	Recycling, advanced recycling.	<i>"Where waste production cannot be avoided Biffa can provide recycling services for a variety of materials."</i>
	Upcycling	Upcycling, performance improvement, remanufacturing, remarketing.	<i>No quotation.</i>
	Maintenance	Maintenance, repair, replacement, component replacement, refurbishing.	<i>No quotation.</i>

	Servitization	Service providing, access, function, intermediary service, organization retains ownership, solution provider, product as a service, through-life and end-life responsibility.	<i>"Where waste production cannot be avoided Biffa can provide recycling services for a variety of materials."</i>
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## APPENDIX 12. ADJUSTED BUILDING BLOCKS PER BMCE TYPOLOGY

BMCE	Building Block	Appearance	BMCE	Building Block	Appearance
CSC/SRNP	Pure inputs	✓	PAAS/FO/P	Efficient design	✓
	Waste as input	✓		Digital technologies	✓
	Waste management	✓		Upcycling	✓
	Renewable input sources	✓		Maintenance	✓
	Efficient design	✓		Servitization	✓
	Hybrid manufacturing	✓		Alternative revenue model	✓
	Stakeholder engagement	✓	MMEE/EE	Efficient design	✓
	Maintenance	✓		Stakeholder engagement	✓
	Reuse	✓		Rewards	✓
RR/CVW	Waste as input	✓		Digital technologies	✓
	Waste management	✓		Eco-efficiency	✓
	Renewable input sources	✓		Consumer education	✓
	Efficient design	✓	SR/R	Pure inputs	✓
	Hybrid manufacturing	✓		Stakeholder engagement	✓
	Stakeholder engagement	✓		Consumer education	✓
	Take-back	✓	SUS	Information sharing	✓
	Rewards	✓		Digital technologies	✓
	High quality products	✓	GEM	Waste management	✓
	Information sharing	✓		Take-back	✓
	Digital technologies	✓		Recycling	✓
	Recycling	✓		Servitization	✓
	Upcycling	✓			
	Shared ownership	✓			
	Eco-efficiency	✓			
PLE/CLLM	Efficient design	✓			
	Take-back	✓			
	High quality products	✓			
	Information sharing	✓			
	Digital technologies	✓			
	Recycling	✓			
	Upcycling	✓			
	Maintenance	✓			
	Insurance	✓			
	Reuse	✓			
SP/AM	Stakeholder engagement	✓			
	Information sharing	✓			
	Digital technologies	✓			
	Maintenance	✓			
	Shared ownership	✓			
	Servitization	✓			