# Evaluating existing circular business models – a systematic literature review

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## ABSTRACT

***Purpose*** *– Governments and society demand from businesses higher and higher sustainability efforts, but linear business models struggle to keep up. Because of this circular business models are becoming more popular. However the goals and methods of these circular business models are significantly different from linear business models, which makes the evaluation of circular business models difficult. So, this research paper analyzes the aims and methods of circular business models and draws a conclusion on how they should be evaluated based on them.*

***Design/methodology/approach*** *– A systematic literature review was conducted with a final dataset of 29 documents that underwent a full-text review. A literature table was maintained to extract valuable information for the synthesis and a survey was created for validation purposes.*

***Findings*** *– This research paper shows the importance for CBMs to create not only economic but also environmental value, which in the end leads to the conclusion that not only the value capture capabilities but also the value propositions and value creation & delivery methods of circular business models need to be inspected when evaluating circular business models. Furthermore, lifecycle profit, circularity metrics and life cycle assessment are showcased as appropriate valuation methods for circular business models.*

***Theoretical and practical implications*** *– This research paper contributes to the theory by bringing together knowledge about circular business models and concluding on an appropriate valuation approach. The practical implications of this are that owners, managers and investors of circular business models will receive information that is adjusted to the goals and methods of circular business models.*

***Research limitations/implications*** *– The major limitation of this systematic literature review is that due to time constraints strict inclusion & exclusion criteria had to be applied and more articles could not have been reviewed.*

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**Keywords**
Circular business models, CBMs, circular economy, CE, valuation, value, financial models

# 1. INTRODUCTION

Sustainability is becoming increasingly important in the world of business and there are several trends that make it evident. Firstly, according to Fleming (2025), Hall (2025) and Federal International Marketing (2025) stricter regulations will make companies engage in sustainability reporting more intensively and drive them to implement entire strategies and frameworks to prove their sustainability claims. Such rigorous sustainability reporting is already implemented by supranational organizations like the European Union (EU) in form of the "Europe sustainable development report 2025" (Lafortune & Fuller, 2025). Furthermore it is foreseen that companies will be stronger incentivized to uphold sustainability standards not only internally but also externally, which includes their entire supply chain (Federal International Marketing, 2025; Fleming, 2025; Hall et al., 2025). Another reason showing the importance of becoming more sustainable today is the forecast estimating that developing countries, excluding China, will need roughly $3.2 trillion per year to finance sustainability activities out of which "$1.3 trillion needs to come from external sources" (Hall et al., 2025). External sources refer in this case to all financing options excluding domestic origins (Hall et al., 2025). Customers also start to become more aware regarding sustainability when purchasing a product (Federal International Marketing, 2025), an example is that "4 to 7 percent of consumers are willing to pay a premium well above 10 percent" (Feber et al., 2023) for products that were packaged through environmentally friendly procedures.

A development that is becoming more popular for companies in order to adhere to the sustainability standards and expectations that are projected onto them by governments and society is to start transitioning towards circular business models (CBMs) (Capozza et al., 2025; Federal International Marketing, 2025). Newly founded businesses that incorporate a circular economy (CE), so CBM start-ups are also being founded more frequently (Elobeid et al., 2023), because including circularity is part of the product design which is implemented easiest at an early stage of a product's life cycle (Bocken et al., 2016). CE is a trend that changes the fundamentals of business, since this means moving from the conventional linear style of "production, distribution, use, and disposal" (Erkelens et al., 2025) to the CBM of reducing waste, extending the product life span and recycling (Erkelens et al., 2025). A consequence of this are more complex business operations, because such a model requires reverse logistics (Fernando et al., 2023), an addition of recovery processes (Ho et al., 2025) and other strategies that are discussed in further sections. Aside from that, income streams in CBMs are usually divers in form of subscription and buyback & resell models, which makes conventional financial models that focus on one-time transactions - the sale of a product - less effective in estimating the value of the business (Kandpal et al., 2024). The inaccurate evaluation of a business is an issue because the performance of a business is a key factor in an investor's decision-making process on whether a company is worth the investment or not. Without that knowledge, the investor and banks are lacking information on the subject they are usually interested in the most, which is generating profits.

The problem that becomes apparent is that with the innovation of CBMs conventional financial and especially valuation models start to become outdated. The objective of this research is to work on a solution to this problem by answering the following main research question (RQ):

"How can the value of CBMs be assessed?"

The main research question is solved by finding answers to the following sub research questions:

- SubRQ1: What criteria do financial models have to meet to assess the value of CBMs?
- SubRQ2: How can these criteria be applied to assess the value of CBMs?

Figure 1 depicts the three subject areas that are involved in the research objective, which include: "Circular economy", "business models" and "valuation". While numerous research papers already exist that focus specifically on one of these subject areas (Chesbrough, 2010; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Kirchherr et al., 2017; Morck et al., 1988; Ohlson, 1995; Teece, 2010; Yermack, 1996; Zott et al., 2011) or on the intersection of two of these subject areas (Bocken et al., 2016; Ferranti & Jaluzot, 2020; Geissdoerfer et al., 2018; Lee & Kwak, 2020; Lewandowski, 2016; Moro-Visconti et al., 2020; Nandi et al., 2023; Torreiro et al., 2020; Vijaya Pandi et al., 2022), only very little research has been conducted so far that concerns itself with the intersection of all of these three subject areas. Furthermore, the importance of sustainability has already been showcased and CBMs perform sustainable business activities more efficiently and effectively than linear business models (Petri et al., 2025). Therefore, this research paper contributes to the existing theory by collecting relevant information to the research objective and synthesizing an appropriate solution.

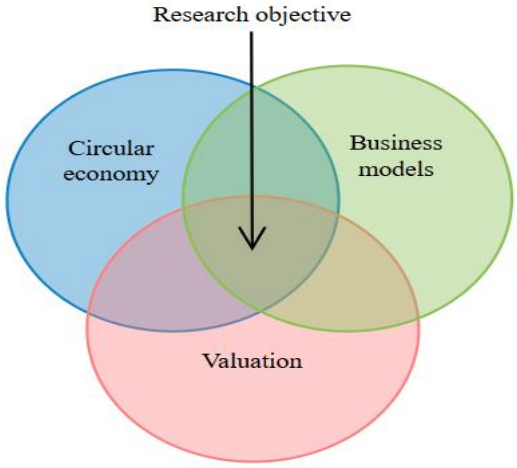


**Figure 1: Research objective in Venn diagram**

Looking at the practical relevance, applying conventional financial models to CBMs has multiple risks. Both managers and investors could be misled by the information output of conventional financial models due to its inaccuracy (Kandpal et al., 2024) and incentivized to take a wrong decision. Since conventional financial models tend to undervalue the performance of a CBMs, this would mean that potential investors would be more hesitant and less likely to invest into such a business. This research aims to reduce the likelihood of these risks occurring by providing guidelines for valuation approaches that assess the performance of CBMs more accurately.

# 2. METHODOLOGY

The methodology of this research paper consists of two parts. The first and main component of this study is a systematic literature review (SLR) (see Figure 2), which compiles relevant knowledge that is required to create a synthesis that answers the sub research questions to then answer the main research question. Additionally, the second part of the methodology in this research paper involves a survey, which supports the results of the SLR (see Appendix A).

## 2.1 Creating the initial database

As there is an insufficient number of approaches to accurately evaluate the success and profitability of CBMs (Brogi &

Menichini, 2024), I conducted a SLR, in order to determine the aspects of CBMs that need to be assessed to effectively estimate their value. Furthermore, methods to analyze these criteria are also suggested. The process of the SLR can also be seen in Figure 2. Okolie (2015) and Xiao & Watson (2019) developed eight-step models on how to carry out SLRs. While not all steps are identical three stages become apparent, which are preparing, performing and presenting results of the SLR (Xiao & Watson, 2019). The first stage is about following a clear goal and procedure (Okoli, 2015; Wijnhoven & Machado, 2024; Xiao & Watson, 2019). A goal has already been set through the establishment of the main and sub research questions (see section 1.2) and a strict procedure, which makes the SLR replicable, is described in more detail in the following steps.

Xiao & Watson (2019) recommend to select databases that serve as the source for the resulting documents, as part of the second stage of the SLR, which is the performing phase (Xiao & Watson, 2019), and to form keywords that stem from the main and sub research questions, to create search strings for the SLR (Bai et al., 2019; Linnenluecke et al., 2020; Xiao & Watson, 2019). The author selected Scopus[1] as the database for this SLR, because it already contains a wide range of articles, which is shown by the fact that the initial document search resulted in roughly 2,000 documents. This high number of results is also the reason for why the author did not scan further databases for this SLR. Regarding the keywords, "circular business model" and "value" are the focal points of the main and sub research questions. However, "circular business model" can also be split into "circular economy" AND "business model", so the author created two search strings and carried them out at the same time. The sub research questions also offer words such as "criteria" and "implementation" that can be combined with "circular business model" and "value" to express the desired document results more precisely. Furthermore, the author also added synonyms and alternative spelling ways of these keywords to the search strings (Xiao & Watson, 2019) to capture the most amount of relevant documents. Examples for the synonyms include: "Sustainable business model", "closed-loop economy" and "assessment". Additionally, the author utilized parenthesis to not circumvent documents with words that have been spelled slightly differently. The author combined all of these keywords with Boolean operators such as "AND" and "OR" to create the search strings (Xiao & Watson, 2019). Lastly, the author excluded other SLRs to avoid reporting a researcher's interpretation of another researcher's empirical study and results as much as possible. This leads to the final search strings of the initial dataset that collected 1,991 documents (see Figure 2) by searching within "Article title, Abstract, Keywords":

"Circular Business Model*" OR "Sustainable Business Model*" OR "Closed-loop Business Model*" OR "Green Business Model*" AND "Valu*" OR "Assess*" OR "Measur*" OR "Evaluati*" OR "Analysis*" OR "Return on investment" OR "ROI" OR "Financial assessment" OR "Financial metrics" OR "Financial model" AND "Criteria" OR "Standard*" OR "Indicat*" OR "Parameter*" OR "Guid*" OR "Requir*" OR "Condition*" OR "Factor*" OR "Specif*" OR "Metric*"

OR

"Circular Econom*" OR "CE" OR "Sustainable econom*" OR "Regenerative econom*" OR "Green econom*" OR "Closed-loop econom*" OR "Low-waste econom*" OR "Zero-waste econom*" AND "Business Model*" OR "Value creation strateg*" OR "Organization* model*" OR "Business framework*" OR "Enterpise model*" OR "Corporate model" AND "Valu*" OR "Assess*" OR "Measur*" OR "Evaluati*" OR "Analysis*" OR "Return on investment" OR "ROI" OR "Financial metrics" OR "Financial assessment*" OR "Financial model" AND "Criteria" OR "Standard*" OR "Indicat*" OR "Parameter*" OR "Guid*" OR "Requir*" OR "Condition*" OR "Factor*" OR "Specif*" OR "Metric*"

AND NOT

"Systematic literature review" OR "Literature review" OR "SLR"

## 2.2 Inclusion & exclusion criteria and process of the systematic literature review

Two methods to decrease the size of the dataset are limiting to one or several subject areas and to one or several document types (Linnenluecke et al., 2020). In this SLR the author limited the subject area to "Business, Management and Accounting" and the document type to "Article" OR "Conference paper" (see Table 1). Moreover, other inclusion & exclusion criteria that the author applied, were to only display documents that were published from 2020 onwards and in the English language (see Table 1). These inclusion & exclusion criteria reduced the dataset to 456 documents (see Figure 2). The author scanned the titles of the resulting documents and removed documents from the dataset if the title included less than two of the above-mentioned keywords or their synonyms (see Table 1), which led to a reduced dataset consisting of 128 documents (see Figure 2). As a last step, the author inspected the abstracts of the 128 documents to come to the final dataset of 29 documents (see Figure 2), which served as the main source for this SLR. Out of these 29 documents 28 are journals and one of the documents is a conference paper.

**Table 1: Inclusion & exclusion criteria**

| Criteria | Reason for inclusion or exclusion |
|---|---|
| Subject area: Business, management and accounting | Limiting to this subject area removes documents that have set a different focus for their study. |
| Document type: Article or conference paper | Applying this filter helps to further decrease the number of results. |
| Publication year: From 2020 onwards | This filter assumes that studies published after 2020 still contain correct information that was released prior to 2020. |
| Language: English | English is the official scientific language. |
| Title must include at least two keywords or their synonyms | This filter assumes that the more keywords and their synonyms a title includes, the more likely it is that the document sets a research objective that is helpful for this SLR. |

[1] See https://www.scopus.com/

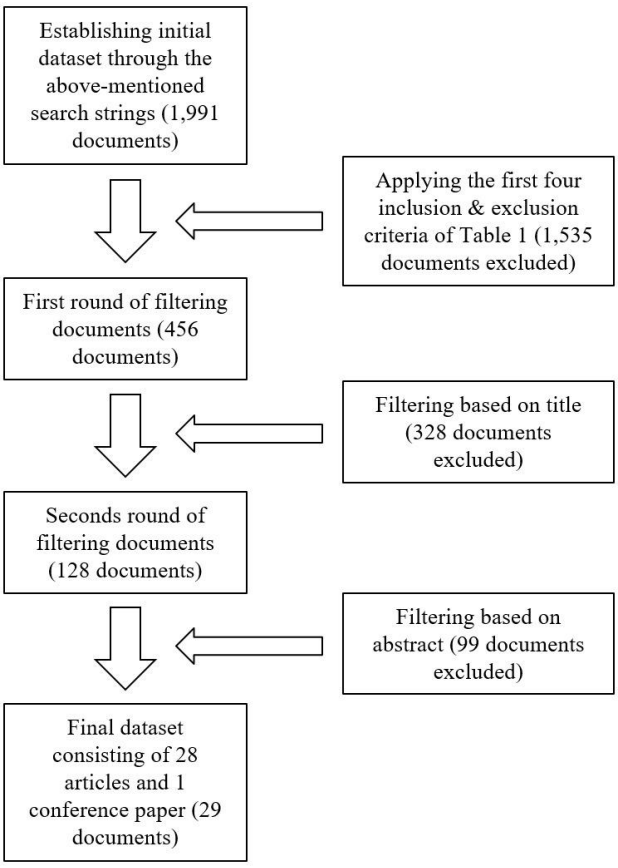


**Figure 2: Process of the SLR**

## 2.3 Data retrieval and analysis

To efficiently convert the information gathered from the final dataset into a synthesized literature review that answers the main and sub research questions, the author created a literature table (see Appendix B). The literature table contains relevant information in regard to the research objective (see Section 1) that was extracted from the documents that are part of the final dataset of the SLR (see Appendix B). The author then maintained the literature table while conducting a full text review of the final dataset. The literature table is structured in way, where each row represents one document and it supports answering the research questions through the following columns: "Features of value assessment criteria of circular business models", "implementation method of criteria", "applied or analyzed case", "limitation of findings" and "summary of most important findings" (see Appendix B). The first two columns focus specifically on the sub research questions, which in the end answer the main research question, and the other columns help by proving context to the information that is meant to answer the research questions.

## 2.4 Survey for validation

Surveys often follow the goal "to examine attitudes, opinions, perceptions and confidence" (Toy & Daly Guris, 2023) of the topic at hand. This also matches the aim of the survey in this research paper, since it serves a confirming purpose in regard to the evaluation of CBMs to identify whether the results of the past literature in this research paper align with the positioning of current researchers and professionals, who concern themselves with or work within CBMs. According to Toy & Daly Guris (2023) the questions in a survey should always present the entire context and define technical or specialized terms to avoid misinterpretation by the respondents. Additionally, the survey itself is ideally as concise as possible, because "longer surveys run the risk of generating rushed, incomplete or poorly considered responses" (Toy & Daly Guris, 2023). To account for this, the researcher always explained terms such as "life cycle profitability", "circularity" and "life cycle assessment" in a short sentence to avoid that respondents misunderstand the question. Furthermore, the author made a survey that contains only eleven topic specific questions, which required answers on a scale from one to five (see Appendix A), to minimize the likelihood that respondents answer questions without giving them some proper thought. The author published the survey on LinkedIn, after creating it, targeting the mentioned researchers and professionals who focus on CBMs. It is worth noting that the respondents had to answer whether they are a researcher or a professional, so that the answers and results could be categorized and potential differences in opinions of these two groups could be identified.

# 3. RESULTS

This section is split into four subsections, at first, the author discusses the goals of CBMs and their methods to achieve these goals. Followingly, the author shows why CBMs should be assessed through new metrics by explaining how conventional valuation methods are ineffective when applied to CBMs. After that, the author identifies criteria that need to be taken into account when measuring the total value of CBMs. Lastly, the author presents methods to assess the mentioned criteria to effectively and precisely evaluate CBMs.

## 3.1 Circular business models

As the name suggests CBMs utilize principles of the CE in their business activities that means implementing recovery processes and creating not only economic but also environmental and social value. Ariztia & Araneda (2022) coined the term "win-win formula" in relation to the CE. With this term they refer to the ability of businesses that utilize a CE to create profit but also impact the environment positively at the same time. They conducted a case study and 30 semi-structured interviews in Chile with entrepreneurs, who work within the CE and are managers or owners of their small businesses with less than 65 employees. Their main findings in regard to goals and methods of CBMs are that when CBMs keep the value of end-of-life products as long as possible in the system, CBMs can create a win-win situation by reducing waste in the environment and generate profits for themselves (Ariztia & Araneda, 2022; Tapaninaho & Heikkinen, 2022). However, creating a business that is capable to sustain itself in the first place has a higher priority than being environmentally sustainable (Ariztia & Araneda, 2022; Tran & Nguyen-Thi-Phuong, 2024). Nevertheless, positive environmental impact is also seen as a form of economic value (Ariztia & Araneda, 2022; Moggi & Dameri, 2021). Neesham et al. (2023) are aiming to define what is meant by value in sustainable business models through Aristotelian logic and came across the term "tri-profit", which was created by Upward & Jones (2016). Tri-profit includes not only economic and environmental value as previously discussed, but also social value (Neesham et al., 2023; Upward & Jones, 2016). The difference to "the triple bottom line" (Elkington, 1997) is that tri-profit looks to assess environmental and social impacts economically unlike the triple bottom line, which does not estimate environmental and social impacts from a financial perspective (Upward & Jones, 2016). In general, researchers agree that CBMs should indeed create economic, environmental and social value (Kuzma & Sehnem, 2021; Moggi & Dameri, 2021; Neesham et al., 2023; Schlüter et al., 2023). This view is also shared by the respondents of the survey, where 11 out of 11 respondents agree on a scale from 1-5 with a 4 or 5 that CBMs should achieve not only economic but also environmental and social value (see Appendix A). In comparison conventional linear business models follow the typical process of "make-use-

dispose" (Lundgren et al., 2024) or "take-make-use-dispose" (Tran & Nguyen-Thi-Phuong, 2024), which means that at the end of a lifecycle of a product a lot of value is being lost (Kuzma & Sehnem, 2021) and waste remains at the expense of the environment. So, a trade-off between profitability and environmental impact is accepted, unlike with CBMs, that aim to achieve both and social value on top of that. Furthermore, CBMs tackle issues of linear business models such as the limited availability of resources and environmental impacts (Okorie et al., 2021). This makes it apparent that CBMs try to create value that linear models cannot capture, but it also means that the operations and value creation methods of CBMs are significantly different from linear business models (Galvão et al., 2023).

These distinctions between operations of CBMs and linear business models are necessary to accommodate for typical business processes of the CE. Researches agree that one of the major goals of the CE is to utilize the concept of "3Rs" (Austin & Rahman, 2022; Okorie et al., 2021; Parte & Alberca, 2024; Villalba-Eguiluz et al., 2023). The 3Rs stand for "reduce, reuse and recycle" (Austin & Rahman, 2022) and refer to the idea that CBMs or businesses within the CE in general should reduce waste, reuse materials and recycle products, whereby reducing is preferred over reusing and reusing is preferred over recycling. These undertakings may seem like CBMs have to focus on three different responsibilities, but the 3Rs complement each other. This is because usually, when a business takes action to reuse certain materials instead of using virgin materials or recycles an entire product that has been bought back or brought back, the business also inherently reduces waste that could have ended up in the environment. Besides that the 3Rs simultaneously lead businesses that implement this principle towards the 12$^{th}$ Sustainable Development Goal (SDG) (Austin & Rahman, 2022; Galvão et al., 2023; Parte & Alberca, 2024) which targets "sustainable consumption and production patterns" (Parte & Alberca, 2024). There are also other variations of the 3Rs that describe the business activities more precisely of the businesses that implement this framework, such as the "9Rs" (Villalba-Eguiluz et al., 2023) or the "10Rs" (Reike et al., 2018), which was listed by Kuzma & Sehnem (2021), while proposing a measuring metric for CBMs. Additional and more detailed recovery options is what differentiates the 9Rs and 10Rs from the original 3Rs. The 9Rs contain: "Refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, recycle and recover" (Villalba-Eguiluz et al., 2023), while the 10Rs contain: "Refuse" (R1), "reduce" (R2), "resell/re-use" (R3), "repair" (R4), "refurbish" (R5), "remanufacture" (R6), "repurpose" (R7), "recycle materials" (R8), "recover (energy)" (R9) and "re-mine" (R10) (Reike et al., 2018). All of these variations have one thing in common, which is that they emphasis the desire of CBMs and businesses within the CE in general to operate within a closed-loop system. Reike et al. (2018) demonstrate that by categorizing their 10Rs into three groups: Short loops (R1-4), medium long loops (R5-7) and long loops (R8-10). Here, the distance to the customer is the deciding factor whether a recovery option is part of a short or long loop. However, they do mention that short loops are preferred over long loops (Reike et al., 2018). This has also to do with the distance to the customer, because in general longer loops or extensive processes provide more room for undesired waste creation and potential inefficiencies. At the same time "reduce" and "reuse", which are part of the short loops, are also part of the original 3Rs. Additionally, the literature recognizes the 3Rs more frequently than the 9Rs or 10Rs with 4 out of 29 articles mentioning the 3Rs while the 9Rs and 10Rs were only mentioned by one article each (see Appendix B).

Aside from creating value, as shown based on the 3Rs, CBMs also need to be able to offer their products and services to potential customers. This can be done in form of several different CBM types. Researchers generally agree that CBMs provide their value offering represented as a service, which means that even tangible products are made available without transferring ownership to the customer, such a model is referred to as a "Product-Service System" (Alpsahin Cullen, 2023; Azcarate-Aguerre et al., 2022; Brändström & Eriksson, 2022; Kohtamäki et al., 2024; Kuzma & Sehnem, 2021; Roci & Rashid, 2023; Toxopeus et al., 2021). While most CBMs utilize a Product-Service System, the implementation method can differ. CBMs can sell "customized integrated solutions", "outcome-based services" or "service agreements" (Kohtamäki et al., 2024). Typically, this requires much more interaction between provider and customer compared to linear business models (Alpsahin Cullen, 2023), but it also allows CBMs to connect deeper with their customers to create long-term relationships, hence constant income streams. Such service agreements can also be different in itself. Payment type and contract duration are typical characteristics for contracts between provider and customer that can vary (Roci & Rashid, 2023). For example a CBM could ask for a fixed fee that is paid per month by the customer regardless of how often the service was made use of or the CBM can utilize the mechanism where the customer pay per use of the service (Roci & Rashid, 2023). A third alternative would be a mix of the previous two models, in which case a CBM can offer both payment options to the customer, this is also referred to as a "hybrid model" (Roci & Rashid, 2023). In regard to the contract duration, this can deviate between short-term, mid-term and long-term contract duration (Roci & Rashid, 2023). Roci & Rashid conducted a case study on these different types of CBMs through a simulation model to asses how well they perform when offering domestic appliances, in this case washing machines. Their results showed that while long-term contracts with a fixed fee have the shortest time until the break-even-point, the pay-per-use contracts generally have less environmental impact, because customers are incentivized to use the product when needed instead of using it until the monthly payment fee feels worth it. Meanwhile, short-term contracts are the most costly type of contract for a CBM, because operational changes, such as transportation of goods is required more frequently than with the other types of contract durations. Their conclusion is that in order to balance out the economic benefit with the environmental impact a CBM should apply a hybrid payment model and stick to long-term contracts (Roci & Rashid, 2023). This conclusion also falls in line with the opinions of other researchers, as mentioned before, CBMs should prioritize sustaining the business itself (Ariztia & Araneda, 2022; Tran & Nguyen-Thi-Phuong, 2024) instead of overemphasizing the environmental impact and risking the survival of the CBM. A hybrid payment model allows CBMs to adjust to current circumstances, so that the CBM can offer more pay-per-use contracts in thriving business times and demand more fixed fee contracts during uncertain conditions. In the meantime, short-term contracts are more costly for the CBM and are worse for the environment, so they should be avoided most of the time.

Researchers agree that when addressing CBMs, their entire ecosystems should be taken into account (Aureli et al., 2023; Galvão et al., 2023; Moggi & Dameri, 2021; Neesham et al., 2023; Oskam et al., 2021). An ecosystem refers to the collaboration between the CBM and external stakeholders, "such as consumers, associations and other organizations" (Galvão et al., 2023). This means, on the one hand that CBMs need to not only take into account their shareholders in their decision making process but many of their stakeholders (Neesham et al., 2023). This has also been exemplified by showcasing the importance of CBMs to not only create economic but also environmental and social value. On the other hand, CBMs not only have to provide

value to their stakeholders, but they themselves can also benefit from the value creation of other entities in the environment in form of the "industrial symbiosis" (Galvão et al., 2023). Both terms, "ecosystems" and "industrial symbiosis" refer to the collaboration between stakeholders (Aureli et al., 2023; Galvão et al., 2023; Moggi & Dameri, 2021; Neesham et al., 2023; Oskam et al., 2021). But "industrial symbiosis" is usually more precise in its meaning by describing how for example one business can use the waste of another business as their resource and using waste as a resource is a typical characteristic of CBMs (Lundgren et al., 2024). Meanwhile, "ecosystem" is more of an umbrella term. However, such ecosystems simultaneously offer room for conflict as the study of Oskam et al. (2021) shows. According to them, disagreements concerning the ratio between economic, environmental and social value creation and the perception whether everyone within the ecosystem benefits from the collaboration equally are common (Oskam et al., 2021). This also further highlights the importance to accurately evaluate CBMs.

## 3.2 Challenges of applying conventional evaluation models to circular business models

Many researchers argue that conventional valuation models are not as precise in assessing the value of CBMs as when evaluating linear business models (Aureli et al., 2023; Brogi & Menichini, 2024; Galvão et al., 2023; Geetha et al., 2024; Heikkilä, 2023; Roci & Rashid, 2023; Toxopeus et al., 2021). The reasons for that are manifold. Firstly, conventional valuation methods have a disproportionally strong focus on assessing the capability of a business to capture its value to its value propositions and value creation & delivery methods (Geetha et al., 2024; Toxopeus et al., 2021). Secondly, conventional valuation models have difficulties in accurately measuring the environmental and social benefits of CBMs in a financial matter (Aureli et al., 2023; Roci & Rashid, 2023). Lastly, CBMs are structurally significantly distinct from linear business models, which also impacts the financing mechanisms of CBMs (Brogi & Menichini, 2024; Galvão et al., 2023).

Toxopeus et al. (2021) claim that approaches that only assess the value capture capability of CBMs do not suffice to measure their total value. This standpoint is also shared by the participants of the survey of this research paper, where 8 out of 11 respondents said that a purely financial approach does not suffice to evaluate CBMs (see Appendix A). Toxopeus et al. (2021) analyzed in their study how CBMs can obtain financial support from banks through qualitative research in the form of 36 interviews, out of which 32 were with company representatives and four were with bank representatives. The results showed that even though a misalignment exists, which is that the common valuation models of banks focus on the financial performance of companies, there are methods to reconfigure even purely financial models to be more applicable to CBMs. They talk about cash flow-, asset- and relationship-based metrics to assess whether a business is eligible to a credit. Lending based on cash flow is mostly about a company's financial statements, lending based on assets concerns itself with tangible assets such as inventory, real estate or production machines and lending based on the relationship between the bank and firm has to make a long-term cooperation seem enticing to the bank (Toxopeus et al., 2021). Out of these metrics, cash flow-based lending focusses on the financial performance of a firm the most. The misalignment becomes apparent especially for recently established CBMs that are missing a history of track records to justify their eligibility for credits, but CBMs in general also struggle with "delayed revenues" (Toxopeus et al., 2021), where revenue follows much later than costs (Galvão et al., 2023; Roci & Rashid, 2023). Furthermore, the cost structure of CBMs is also complex (Toxopeus et al., 2021), because the operations of CBMs need to incorporate recovery processes, but the amount of products that are recovered per period is uncertain. Moreover, such circularity procedures are generally neglected by conventional valuation models (Geetha et al., 2024). So, when circularity is assessed then its most often from an environmental perspective, but a circularity evaluation from an economic point of view is infrequent (Roci & Rashid, 2023). This and the simultaneously high importance of circularity for CBMs further signals why conventional valuation methods are ineffective when applied to CBMs. Another reason for this is the principle of "limited-profit" (Villalba-Eguiluz et al., 2023). Similar to how CBMs try to satisfy needs rather than wants (Neesham et al., 2023; Villalba-Eguiluz et al., 2023) of their customers, Villalba-Eguiluz et al. (2023) argue that a truly circular business should apply that way of thinking to their personal capital gains as well and to limit their profit to what is needed rather than wanted. If that is implemented, then it would allow for significantly more investments into the environment and society (Villalba-Eguiluz et al., 2023). But it would also make the conventional valuation methods such as the lending based on cash flows even less accurate. However, as mentioned before, ways to reconfigure even purely financial approaches to CBMs have been suggested, such as to make customer contracts in advance that ensure future income (Toxopeus et al., 2021).

Even though methods that only focus on the economic aspects are not adequate to evaluate CBMs, some researchers argue that there is strong link between economically well-performing CBMs and CBMs that provide lots of environmental value (Bashir et al., 2022; Galvão et al., 2023; Geetha et al., 2024). However, even then, the environmental and social value of CBMs is usually judged based on the economic performance of CBMs and not based on aspects that are inherent to environmental and social value in itself such as reducing waste and recycling a higher proportion of their products. For example, the conventional valuation models, such as "cash flow-based", "asset-based" and "relationship-based" (Toxopeus et al., 2021) put only very little effort into measuring CBMs in terms of their performance regarding the environment and society. Many researchers analyze the value proposition and value creation & delivery of CBMs as a way to estimate the environmental and social contribution of CBMs (Lundgren et al., 2024; Neesham et al., 2023; Okorie et al., 2021; Toxopeus et al., 2021). The tunnel vision of cash flow-based lending can be combated by the solution to acquire customer contracts in advance, which offers some knowledge about the value proposition of CBMs, but the value creation & delivery remains neglected (Toxopeus et al., 2021). In asset-based lending the amount of the loan depends on the tangible asset value of CBMs and the loan can increase if the assets are circular or modular, so asset-based lending offers more insight into the value creation & delivery of CBMs (Toxopeus et al., 2021). However, estimating circularity and modularity during the asset-based lending method overlooks the fact that this would stop the asset-based lending method from being a stand-alone approach. Instead, it would require further metrics (see Section 3.4) that actually assess the circularity and modularity of CBM operations to apply the asset-based lending method. Lastly, the relationship-based lending method allows to analyze all three mentioned value dimensions, which are value proposition, value creation & delivery and value capture (Toxopeus et al., 2021). But unlike the other metrics, this approach also includes subjective judgement from whoever the relationship is supposed to be with, which makes the overall valuation of CBMs through this method less objective. Ultimately, these are all reasons why conventional valuation models are ineffective in evaluating

CBMs and why new valuation metrics should be introduced and added to the valuation process of CBMs (Aureli et al., 2023).

There are more typical characteristics of CBMs that valuation models should take into account. Austin & Rahman (2022) identified the "triple helix of market failures" (Austin & Rahman, 2022) in their study, where they examined how CBMs finance their business operations even though hurdles exist. The triple helix of market failures refers to "environmental, knowledge and financial" (Austin & Rahman, 2022) risks. They, however, do not define and discuss each factor individually in detail. But they do mention problems, especially for young CBMs since their study is on the topic of financing, such as insufficient technologies, too little data and potentially low market demand. Furthermore, they note that cash flows in CBMs are different from cash flows in linear business models as CBMs require higher initial investments than linear business models and "legal issues surrounding collateral and its value" (Austin & Rahman, 2022). Their results say that because of these uncertainties, CBMs usually finance themselves, which has also been deemed the most successful approach to finance a CBM. Meanwhile, financing through bank loans is the seconds most frequent method (Austin & Rahman, 2022). This also aligns with the above explained issues to evaluate CBMs with current financial models, which is why CBMs finance themselves more often than they receive external finance. Other researchers also agree that CBMs generally have high initial investment costs (Azcarate-Aguerre et al., 2022; Brändström & Eriksson, 2022). Azcarate-Aguerre et al. (2022) conducted research on the total value of ownership within the building industry, where the upfront costs are crucial to determine the result. Moreover, Brändström & Eriksson (2022) also dealt with the high initial investment costs of CBMs during their efforts in creating an appropriate valuation metric. When combining this with the different types of CBMs, which are fixed fee, pay-per-use and hybrid models, it becomes apparent that CBMs are slower than linear business models, when it comes to retrieving the provided value from the customers. This is because CBMs usually utilize subscription models, unlike linear business models where the customer has to pay the full price in exchange for the ownership over the product. The fitting term "delayed revenues" (Toxopeus et al., 2021) to describe this has already been named previously and other researchers also agree that this is a reoccurring phenomenon in CBMs (Galvão et al., 2023; Roci & Rashid, 2023).

## 3.3 Considerations to properly assess the value of circular business models

As determined in Section 3.2, evaluating CBMs purely based on their value capture capabilities does not suffice. Therefore, many researchers propose taking the value proposition and value creation & delivery of CBMs additionally to their value capture capabilities into account when estimating the value of CBMs (Lundgren et al., 2024; Neesham et al., 2023; Okorie et al., 2021; Toxopeus et al., 2021). Lundgren et al. (2024) defined these terms in their study to assess the lifecycle impact of CBMs as follows: The value proposition describes what the CBM or businesses in general have to offer to the market and how their product or service satisfies the needs or solves issues of potential customers. Value creation & delivery refer to the entire business operation process, as in where the supplies come from, how the supplies are transformed into the final product or service, how the product or service is brought to the customer and who is responsible for all of these activities, so essentially the whole value chain. Lastly, value capture identifies what CBMs or businesses in general gain from all of this effort for themselves, usually in form of income, expenses and profit (Lundgren et al., 2024). Similar to the opinion that CBMs should not only focus on economic, but also environmental and social value, 11 out of 11 survey respondents of this research paper also agreed with a 4 or 5 on a scale of 1-5 that the value proposal and value creation & delivery additionally to the value capture capabilities should also be examined when evaluating CBMs (see Appendix A). Toxopeus et al. (2021) share a comparable view in regard to these three value dimensions, but they concretize and split the value creation & delivery dimension into four categories: "Strategy, resources, network (partners), and target customers" (Toxopeus et al., 2021). This also aligns with the definition of Lundgren et al. (2024), since strategy describes the contribution of CBMs to the market and the production process, resources describe supplies and equipment that is needed for the production process, network describes supply chain partners and customers are the receivers of the CBM's or businesses' market offering. Furthermore, Toxopeus et al. (2021) recognize that CBMs have three phases unlike linear business models, which are not differentiated in different stages. The three phases of CBMs are: "pre-use, use and post-use" (Toxopeus et al., 2021). These phases are similar to the 3Rs or 10Rs, because the different phases concern themselves with some of the Rs. The pre-use phase includes production steps prior to a product or service being sold, this means that the product design and the product production process are part of this phase (Toxopeus et al., 2021). The use phase is about the lifetime of a product (Toxopeus et al., 2021), which ideally has been made possible through the robust product design of the pre-use phase. Finally, the post-use phase concerns itself with steps following after a lifecycle of a product, so efforts in getting used products back and remanufacturing them belongs to this category (Toxopeus et al., 2021). If these phases were to be applied to the 3Rs, then reduce would represent the pre-use phase due to its goal to create less waste in the first place. Reuse fits to the use phase because of its encouragement to try and use products for as long as possible, this was also mentioned by Toxopeus et al. (2024) themselves. Lastly recycle is an equivalent to the post-use phase as its about using raw materials from products at their end of life as input for the production of new products. Toxopeus et al. (2024) used the three value dimensions and the three CBM phases to create a matrix that shows how CBMs contribute value to which aspect of value dimensions and CBM phases. In their study they created a table that is generalized to all CBMs, but entrepreneurs and owners of CBMs could use such a table as a tool to identify what and how they offer value to the environment, society and the economy.

Another scale that has been taken into account a couple of times when evaluating the circularity of CBMs are the micro, meso and macro levels of circularity (Brändström & Eriksson, 2022; Tapaninaho & Heikkinen, 2022). However, Brändström & Eriksson (2022) and Tapaninaho & Heikkinen (2022) did not define these three levels in an identical way. All of these researchers agree that the micro level concerns itself with the internal structure and operations of an individual company. But, according to Brändström & Eriksson the macro level includes both the regional and global conditions and the meso level focuses on industrial symbioses, which are the previously discussed alliances between CBMs and businesses in general to turn waste into a resource. Meanwhile, according to Tapaninaho & Heikkinen (2022) the macro level is about "the economy's structure" (Tapaninaho & Heikkinen, 2022), which presumably are the global conditions that Brändström & Eriksson referred to, and the meso level describes the "regional level" (Tapaninaho & Heikkinen, 2022), so they leave out the aspect of industrial symbioses in their definitions of these three scales. For the rest of this research paper the definitions of Brändström & Eriksson (2022) are used. Brändström & Eriksson (2022) also discussed typical assessment metrics for these three levels. The macro level is usually being measured by the amount of material that is recycled compared to the total amount of material that is used.

Standard metrics for the meso level include rates on how often a product can be refurbished until its not reusable anymore and how well the lifetime of a product or service is extended. Lastly, the micro level can be measured by examining how slow and narrow the recycling loops are (Brändström & Eriksson, 2022).

In Section 3.1 it has been shown that stakeholders have a big impact on CBMs due to the creation of ecosystems and industrial symbioses. Therefore, many researchers agree that the effectiveness degree of the collaboration between CBMs and their stakeholders should also be taken into account when evaluating CBMs (Akinwale, 2024; Alpsahin Cullen, 2023; Chavez et al., 2023; Geetha et al., 2024; Lundgren et al., 2024; Neesham et al., 2023; Zhuang et al., 2023). This standpoint is also inferred from the answers of the survey, since 10 out of 11 respondents confirm with a 4 or 5 on a scale from 1-5 that stakeholder collaboration improves the cost performance of CBMs (see Appendix A) and should therefore be also assessed when estimating the value of CBMs. Akinwale (2024) identified in his study, where he surveyed owners and managers of micro-, small- and medium- enterprises in Saudi Arabia, seven significant ways in which stakeholders are relevant to CBMs, namely: "training, availability of financial resources, top management commitment, digital technology, product/service upgrade, material generated/cheaper to use and pressure from people" (Akinwale, 2024). If CBMs and the corresponding stakeholders work effectively together on these aspects, then CBMs are expected to benefit in form of positively influenced financial performance (Akinwale, 2024). Additionally, CBMs should see their stakeholders as the recipient of the previously discussed value proposition that shows that the CBM is able to create environmental, social and economic value (Alpsahin Cullen, 2023). Especially to the investors and customers, since the investor provides the financial capital necessary to run the CBM and the customer proves the effectiveness of the product or service through market demand, which is the so-called "market validation" (Ariztia & Araneda, 2022). Besides that, Chavez et al. (2023) showcased in their study, where they surveyed Australian CBMs to test their robustness under the special regional and climatic factors, confirmed the positive effect of the information exchange between CBMs and their suppliers in regard to an environmentally friendly product design on the cost-efficient performance of CBMs. Similarly to the opinion of the survey respondents that shareholder collaborations are an important consideration when evaluating CBMs, they also further confirm this view of Chavez et al. (2023) with over 10 out of 11 respondents agreeing with a 4 or 5 on a scale from 1-5 (see Appendix A). Furthermore, Chavez et al. (2023) also proved the amplifying effect of when CBMs are digitally orientated on the just mentioned positive effect of the information exchange with suppliers relating to an environmentally friendly product design on cost-efficient performance of the CBMs. Digital orientation refers in this case to the voluntary readiness of CBMs to utilize new technologies to create new products (Chavez et al., 2023). Once again, the respondents of the survey further confirm this standpoint, because over 9 out of 11 respondents agree with a 4 or 5 on a scale from 1-5 (see Appendix A). Then, there are researchers such as Geetha et al. (2024) who quantified how to assess stakeholder collaboration for CBMs and created the so-called "stakeholder collaboration intensity" (Geetha et al., 2024), which essentially is a ratio of the amount of stakeholder collaboration that a CBM is engaging with to the total possible amount of stakeholder relationships presumably in the close environment of the CBM (Geetha et al., 2024). Geetha et al. (2024) do not further elaborate on how to precisely define the total number of potential stakeholder collaborations, so only limited use of this metric is possible as it is not entirely clear how to utilize it. The amount of studies that concerned themselves with stakeholder collaboration shows that even though the research scope of Akinwale (2024) was rather narrow, since he only surveyed relevant companies from Saudi Arabia; the importance of stakeholder collaboration, however, can be generalized across other industries and regions of the world.

Another aspect that has been discussed in the literature only focused on a specific industry is the role of reverse logistics in CBMs (see Appendix B). Fernando et al. (2023) conducted a survey-based study in the automotive sector of the Malaysian value chain with 113 relevant companies responding. Their findings are that reverse logistics within the CE contribute to a better financial performance of CBMs and amplify the relationship between a company's commitment to sustainability and their financial performance in general. The reason for that is that reverse logistics reduce costs through waste reduction by purposefully gathering back products that have reached their end of the lifecycle or making it comfortable for customers to bring back their used products. The positive effect of reverse logistics on the financial performance also scales up with the amount of effort that CBMs are willing to put into it, because a well-managed product return procedure prevents inaccurate reverse transportation and therefore save further costs (Fernando et al., 2023). The survey respondents show a higher inclination to agree with the positive effect of reverse logistics on financial performance can be generalized across other industries with over 5 out of 11 respondents agreeing so with 4 or 5 on a scale from 1-5, while almost 1 out of 11 respondents showed their strong disagreement with this with a 1 out of 5. Meanwhile, 5 out of 11 respondents are indecisive and gave the question a 3 out of 5 (see Appendix A).

## 3.4 Implementing evaluation approaches to circular business models

Circularity, which refers to a company's ability to recycle resources (Geetha et al., 2024), is an aspect that is frequently measured (Aureli et al., 2023; Brändström & Eriksson, 2022; Brogi & Menichini, 2024; Galvão et al., 2023; Geetha et al., 2024; Zhuang et al., 2023) when evaluating CBMs as it incorporates all of the previously discussed elements including different value dimensions, different circularity scales, stakeholder collaboration and reverse logistics, hence if a CBM scores a good circularity score then it also should indicate that the other elements of the CBM are going well. Most of the survey respondents agree that circularity is an important metric when estimating the value of CBMs, since 8 out of 11 respondents agree to this with a 4 or 5 on a scale from 1-5 (see Appendix A). Aureli et al. (2023) mentioned the example of Ellen MacArthur Foundation's Circulytics tool to measure a CBM's circularity rate, but at the moment this service is no longer offered by this foundation (Ellen MacArthur Foundation, 2021). Brändström & Eriksson (2022) utilized in their study the product circularity indicator as a method to assess circularity, which was originally developed by Bracquené et al. (2020). The product circularity indicator estimates the circularity level of a product by creating a ratio between the linear index flow and the utility factor (Bracquené et al., 2020). The linear index flow indicates how much of the product is produced in a linear matter within the CBM compared to if the production line was completely linear and the utility factor demonstrates the durability and usage of the product (Bracquené et al., 2020). Geetha et al. (2024) also suggests a ratio between the total inputs for production and the total amount that is recycled to create a measurement system for circularity. They refer to this metric as the "resource circulation efficiency" (Geetha et al., 2024) and explain that if the outcome of the ratio is high, then it means that a CBM or company in general manages to reuse a high amount of their products (Geetha et al., 2024). Besides that, a general guideline that suggests a

strong circularity within CBMs is the presence of "competitive criteria" and its effect on "technical cycles" (Galvão et al., 2023). Technical cycles refer to standard recycling procedures such as closing production loops and remanufacturing (Galvão et al., 2023) or the 3Rs. Galvão et al. (2023) conducted a survey-based research with 233 participating organizations from 50 different countries and 16 distinct industries followed up by "the partial least squares structural equation modelling technique" (Galvão et al., 2023). They identified four competitive criteria that have a significant effect on technical cycles, namely: Cost reduction, flexibility, quality and delivery, where cost reduction has the biggest impact on the technical cycles (Galvão et al., 2023). Furthermore, Zhuang et al. (2023) discussed the importance of the following four criteria for a modular product design to increase circularity: "Joint design", "material selection", "product reuse" and "topologically interlocked modular components" (Zhuang et al., 2023). However, their study is focused on the construction industry (Zhuang et al., 2023), so it is not evident that these criteria apply across other industries.

Aside from assessing circularity on a product level, it can also be examined in more detail by analyzing the material circularity of CBMs or companies in general (Aureli et al., 2023; Brändström & Eriksson, 2022). Aureli et al. (2023) utilized the "material flow accounting" (Aureli et al., 2023) approach in their study, while assessing the limitations of conventional management accounting in the CE. On the macro circularity level material flow accounting indicates the resource streams of entire cities and regions and on the meso level material flow accounting describes the material exchange between different companies and industries (Aureli et al., 2023). For the micro level, which assess the material flow within individual CBMs or companies in general, the World Business Council for Sustainable Development's Circular Transition Indicators (CTI) convert the material circularity data into performance benchmarks (Aureli et al., 2023). The material circularity indicator, which was created by the Ellen MacArthur Foundation, is a comparable metric to the previously discussed product circularity indicator (Brändström & Eriksson, 2022), in the sense that both measurements estimate the circularity of the production process, but the material circularity indicator also estimates the sustainability of the production process by incorporating a time component into the ratio (Brändström & Eriksson, 2022). Furthermore, the material circularity indicator differentiates itself further from the product circularity indicator, because the material circularity indicator provides one result for multiple production processes, while the product circularity indicator calculates results for individual production processes (Brändström & Eriksson, 2022).

Brändström & Eriksson (2022) used the product circularity indicator and material circularity indicator as a foundation to construct their own circularity measurement, the so-called: "Material efficiency metric" (Brändström & Eriksson, 2022). At the start they establish that the material efficiency metric is built on the idea that circularity "assess[es] both material input[s] and material output[s]" (Brändström & Eriksson, 2022). The material efficiency metric itself is essentially a ratio between the raw material input and outputs in terms of weight in a linear production model compared to virgin material input and outputs in terms of weight in a circular production loop (Brändström & Eriksson, 2022). In their study they exemplified their metric on three CBMs, one of which is Varubolaget AB[2], which collects used furniture, refurbishes it and sells it to other companies and organizations. Varubolaget AB manages to reuse over one third of the components of refurbished desks for two lifecycles, incorporates roughly 20% recycled materials and therefore requires less than 50% of virgin materials for their production, which leads to over 50% less waste compared to the linear model. This means that the material efficiency metric measures a 50% more efficient material usage in the CBM than in the linear business model (Brändström & Eriksson, 2022).

While it has been established that a purely financial approach to evaluate CBMs is not sufficient (see section 3.2) it is nonetheless beneficial to assess CBMs from a financial perspective on top of using non-financial measurements. Since economic value is generally seen as the gathered gain per output (Neesham et al., 2023) and CBMs try to provide products with multiple life cycles through the 3Rs, hence retaining already created value in the value chain (Galvão et al., 2023), it is sensible to utilize a metric that calculates the total profit of a product over multiple lifecycles, the so-called "lifecycle profit" (Lundgren et al., 2024). 7 out of 11 survey respondents agree with a 4 on a scale from 1-5 that lifecycle profit is an effective tool to estimate the value capture capabilities of CBMs (see Appendix A). Just like for regular profit, the equation for lifecycle profit consists of revenues and expenses, therefore in this context they are referred to as lifecycle costs and lifecycle income (Lundgren et al., 2024). This means that lifecycle income contains the total revenue that is accumulated throughout several sales and lifecycle costs include, additionally to the initial production process, the expenses for recycling and refurbishment procedures. This approach indicates whether a CBM is financially sustainable long-term on paper, but it does not overcome the potential liquidity issues of CBMs because of the delayed revenues (see Section 3.2), regardless of the higher profit expectancy of Product-Service-System (Toxopeus et al., 2021) CBMs. Roci & Rashid (2023) came up with four strategies to circumvent these early liquidity issues of CBMs. These strategies include implementing deposit fees at the start of a contract that are paid back at the end of a contract, extra fees for customers who terminate contracts before the agreed due date, additional fees for short-term contracts such as for collecting the provided product and obtaining loans in general for the high initial investments (Roci & Rashid, 2023). While bank loans have been shown not to be the most effective source of finance for CBMs (see Section 3.2), two of the other three options extract more value from the customers in case they turn out to be challenging or have especially distinct requirements, in form of the additional fees. Moreover, the deposit fees are a subtle way to temporarily alleviate the pressure of the high initial investments until the revenues start to be realized.

A non-financial measurement tool that has been used by many researchers to evaluate CBMs is the so-called life cycle assessment (Aureli et al., 2023; Awasthi et al., 2022; Brändström & Eriksson, 2022; Lundgren et al., 2024; Manninen et al., 2018; Schlüter et al., 2023). Since life cycle assessment is a non-financial performance metric it aims to estimate the environmental implications that CBMs or businesses in general have (Aureli et al., 2023; Awasthi et al., 2022; Lundgren et al., 2024). Therefore, life cycle assessment has a special focus on the value proposition and value creation value dimensions and disregards the profitability of CBMs. 10 out 11 survey respondents also agree with a 4 or 5 on a scale from 1-5 that life cycle assessment is an appropriate metric to evaluate CBMs (see Appendix A). The typical life cycle assessment process goes as follows: CBMs measure their carbon emissions or another environmental benchmark as part of the life cycle assessment and are then incentivized to increase their stakeholder communication efforts across the supply chain (Aureli et al.,

[2] See https://rp.se/

2023) to create more sustainable business operations through stakeholder collaboration. This leads to "a more participatory form of decision-making" (Aureli et al., 2023) that decreases the CBM's environmental impact (Aureli et al., 2023). Manninen et al. (2018) propose a general framework for evaluating the environmental impact that can be applied to CBMs, because in the literature there has been debate about whether life cycle assessment is better suitable for CBMs in their early or late stages (Bocken et al., 2012; Schlüter et al., 2023). The general framework consists of five steps, where at first the value proposition for the environment is defined (Manninen et al., 2018). Secondly, the main stakeholders are determined and thirdly, set evaluation metrics are agreed on (Manninen et al., 2018). As a fourth step the metrics are applied and it is checked whether the value propositions are upheld or not and as the last step, depending on the result of the fourth step, improvement recommendations have to be made (Manninen et al., 2018). A different approach that assesses all three value dimensions is to transform the Business Model Canvas into "the Circular and Sustainable Business Model Canvas" (Okorie et al., 2021). Next to the regular nine entry boxed of the Business Model Canvas the Circular and Sustainable Business Model Canvas contains information in regard to what makes the activities of a particular CBM circular and "factors of influence" (Okorie et al., 2021) on the three value dimensions (Okorie et al., 2021). CBMs can complete this canvas and identify how they are creating value and what separates them from the competition.

# 4. DISCUSSION

This section is split into two subsections. Section 4.1 combines the information from Section 3 to answer the sub research questions and gives practical implications. Section 4.2 discusses the limitations of this SLR and potential research directions for the future.

## 4.1 Theoretical and practical implications

SubRQ1 deals with the necessary criteria that financial models need to consider in order to evaluate whether a particular CBM is performing financially and operationally well, hence is forecasted to be a successful business long-term. The mutual agreement within the literature that CBMs should create not only economic but also environmental and social value (Kuzma & Sehnem, 2021; Moggi & Dameri, 2021; Neesham et al., 2023; Schlüter et al., 2023) cements the impression that either CBMs should not only be evaluated through financial models or the financial models need to be able to assess the environmental and social performance of CBMs additionally to the economic value capture ability. Either way, the fundamental methods of CBMs will not change (Ariztia & Araneda, 2022; Moggi & Dameri, 2021). This means, regardless of the valuation method CBMs will continue to follow principles such as the 3Rs, 9Rs or 10Rs (Austin & Rahman, 2022; Kuzma & Sehnem, 2021; Okorie et al., 2021; Parte & Alberca, 2024; Reike et al., 2018; Villalba-Eguiluz et al., 2023), collaborate with stakeholders in ecosystems and engage in industrial symbioses (Aureli et al., 2023; Galvão et al., 2023; Moggi & Dameri, 2021; Neesham et al., 2023; Oskam et al., 2021). Meanwhile, conventional financial models such as cash flow- and asset- based lending (Toxopeus et al., 2021) have to be redesigned so that they account for typical CBM barriers such as high initial investment costs (Azcarate-Aguerre et al., 2022; Brändström & Eriksson, 2022) and delayed revenues (Galvão et al., 2023; Roci & Rashid, 2023; Toxopeus et al., 2021). To answer SubRQ1, financial models need to be able to assess the value propositions and value creation & delivery methods additionally to the profitability of CBMs to account for their purpose of not only creating economic but also environmental and social value. Moreover, financial models have to estimate the effectiveness of stakeholder collaborations, because recovery processes usually rely on cooperative procedures. Lastly, by modifying financial models to factor in these two aspects the overemphasis on the value capture capabilities of financial models will be balanced out and overstressing the financial short-term limitations of CBMs will be avoided.

SubRQ2 then focusses on analyzing how value- proposition, creation & delivery and capture, the stakeholder collaboration and the financial short-term limitations of CBMs can be assessed in order to evaluate CBMs. Circularity is a concept that measures the value creation & delivery and stakeholder collaboration effectiveness of CBMs (Aureli et al., 2023; Brändström & Eriksson, 2022; Brogi & Menichini, 2024; Galvão et al., 2023; Geetha et al., 2024; Zhuang et al., 2023). It can be analyzed on multiple levels, such as the micro, meso and macro level (Brändström & Eriksson, 2022) and it examines the recovery processes of CBMs through different metrics (see Section 3.4) by offering insight into how many resources are retained and kept within the value chain for multiple life cycles. This information can then be translated into how much costs are saved due to the recovery processes and be utilized in a financial model. Similarly, the output of life cycle assessment (Aureli et al., 2023; Awasthi et al., 2022; Brändström & Eriksson, 2022; Lundgren et al., 2024; Manninen et al., 2018; Schlüter et al., 2023) can also be converted into financial information by for example assessing how much waste was avoided by the CBM and how much money that saved in potential waste disposal costs. Combining these two options with the lifecycle profit approach (Lundgren et al., 2024), which incorporates revenues and expenses of multiple lifecycles of products, results in extensive financial information that can be utilized to evaluate CBMs. Thus, to answer SubRQ2, by transforming the output of circularity metrics and life cycle assessment into financial data the value creation & delivery and stakeholder collaboration of CBMs can also be evaluated through financial models. Additionally, life cycle assessment also offers a narrative for CBMs to frame their value proposition in terms of how a product not only fulfills the need of the customer but also supports the environment. Lastly, an approach such as lifecycle profit estimates the capability of CBMs to capture their value and besides this methods such as deposit-, cancellation- and collection fees (Roci & Rashid, 2023) can also be integrated into a financial model to make it more lenient towards the financial short-term limitations of CBMs.

In regard to the practical implications, the survey conducted in the course of this research plays a supporting role. Throughout this research paper the survey respondents consistently endorsed the standpoints of the literature. Starting with the idea of the value perception of CBMs, the majority of the survey respondents agrees that CBMs should create not only economic but also environmental and social value (see Appendix A). Furthermore, the majority of the survey respondents agrees that conventional financial models are not adequate, while circularity, life cycle assessment and lifecycle profit are appropriate metrics to evaluate CBMs (see Appendix A). Out of 11 survey respondents, 9 are researchers and 2 are professionals from within the industry of CBMs (see Appendix A). Both groups provided similar answers (see Appendix A). This indicates that the proposition of this research paper to integrate measurement tools that assess value proposition and value creation & delivery aside from only value capture in financial models has relevance for the real practice setting. For the future this means that financial models should account for the financial short-term limitations of CBMs and incorporate cost efficiency components and different types of fees for an all-rounded evaluation of CBMs. Furthermore, this solution provides managers and owners of CBMs with an outline of financial models, which deliver

output and information that is adjusted to CBMs and allow them to take the correct managerial or investment decision.

## 4.2 Limitations and future research

The SLR of this research paper faces multiple limitations, most of which are a consequence of the inclusion & exclusion criteria (see Table 1). While the inclusion & exclusion criteria narrow down the scope of the SLR and remove irrelevant documents from the database, they do not prevent the unintentional exclusion of relevant documents. This applies to limiting articles based on subject area, document type, publication year and language. It is possible that documents, which could have helped answering the main and sub research questions, could appear in other subject areas, document types, publication years and languages and are therefore excluded. Using only Scopus as a database for the SLR creates a similar issue. Other databases might contain documents, which are not shown on Scopus, that could have been relevant for this research paper, but did not appear as a result for the SLR. However, Scopus is a broad database. The survey for validation also faces a limitation, because of the publication method. The author shared the survey on LinkedIn, while addressing researchers and professionals who work within the CE. But this makes it also possible for people, who are not part of the target group, to respond to the survey, which could skew the results of the responses of the actual target group.

Future research should pick up on the results of this research paper by conducting studies in two directions. Firstly, further research with secondary data could be performed to discover other aspects that help evaluate CBMs. Lifecycle profit, circularity metrics and life cycle assessment were discussed in this research paper, but future research could look for more aspects that help assess the value proposition, value creation & delivery and value capture capabilities of CBMs, which could also be added to financial models. This would also tackle the limitations of this SLR by widening the scope of the research and literature. Secondly, future research could propose precise financial models that show exactly how the outputs of circularity metrics or life cycle assessments can be transformed into monetary data and how it can be added to financial assessment tools. This research can also be combined with empirical research by either a longitudinal study for validation through survey-based research or interviews or a case study could be conducted. In the case study researchers could take their proposed financial model and apply it either to data of CBMs of five years ago and see whether the financial model forecasts the actual current state of the CBMs or apply the financial model to the current state of CBMs and wait and see if the results of the financial model turn out to be correct after a year or more.

# 5. CONCLUSION

The goal of this research paper was to find an answer to the research question: “How can the value of CBMs be assessed while accounting for their aims and methods?” During this process two sub research questions were answered through a SLR that provided the necessary information. This study answers the research question by identifying the importance within the literature for CBMs to create not only economic but also environmental and social value, which translates to estimating not only the value capture capabilities of CBMs but also their value propositions and value creation & delivery methods. This SLR also presents approaches to evaluate these three dimensions, which include lifecycle profit as an alternative model to regular profit, since it accounts for the multiple lifecycles of products of CBMs, and circularity metrics and life cycle assessment as tools to focus on the value propositions and value creation & delivery methods of CBMs.

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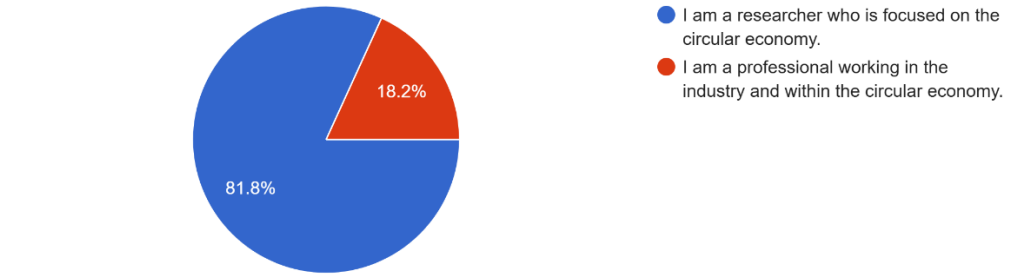
# Appendix A

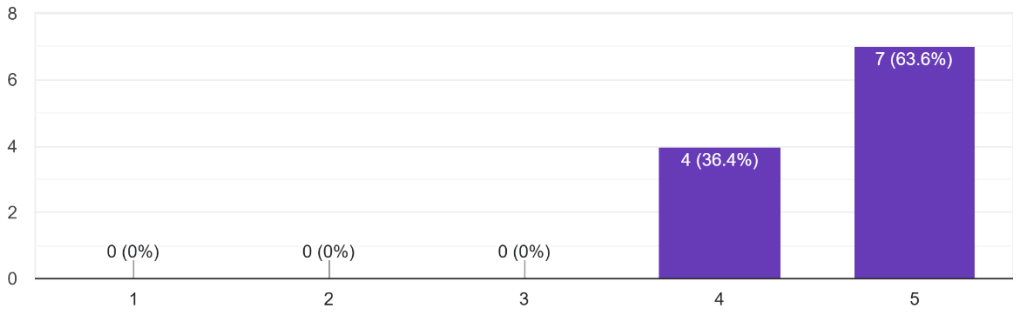
Are you a researcher or a professional?

11 responses



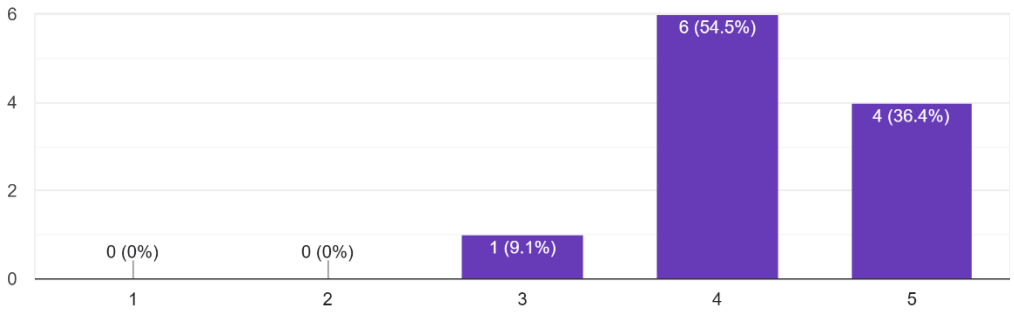

Circular business models aim to achieve not only economic but also environmental and societal value. Therefore not only the value capture of a bu...delivery when evaluating a circular business model.

11 responses



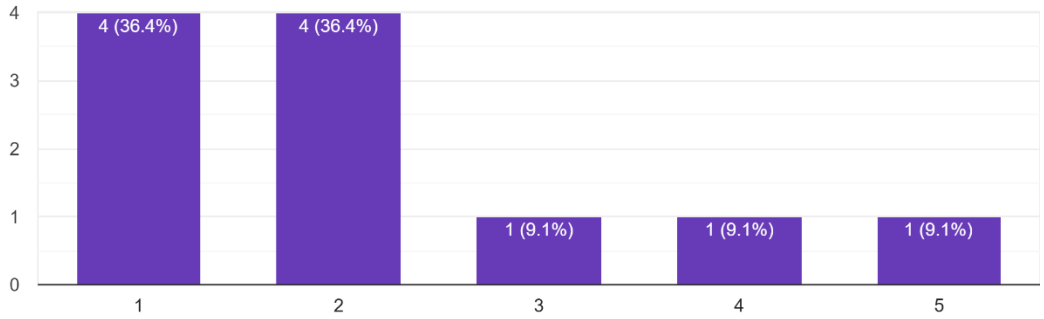

Circular business models try to minimize the environmental impact of their business activities, but sustaining the business itself has a higher priority.

11 responses



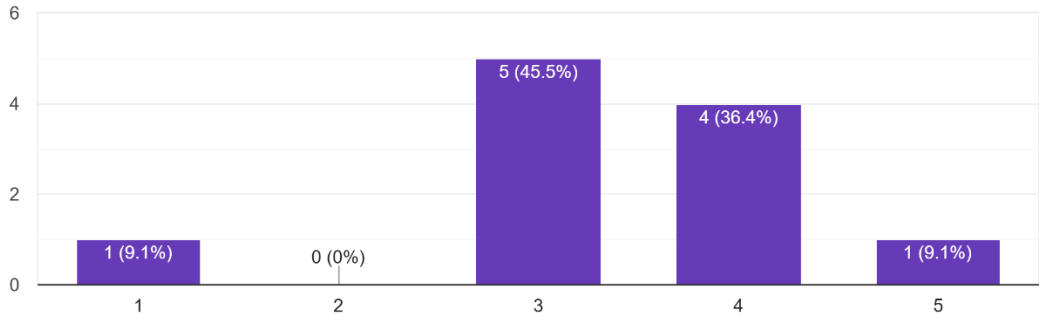
Does a purely financial approach suffice to assess the total value of a circular business model?

11 responses



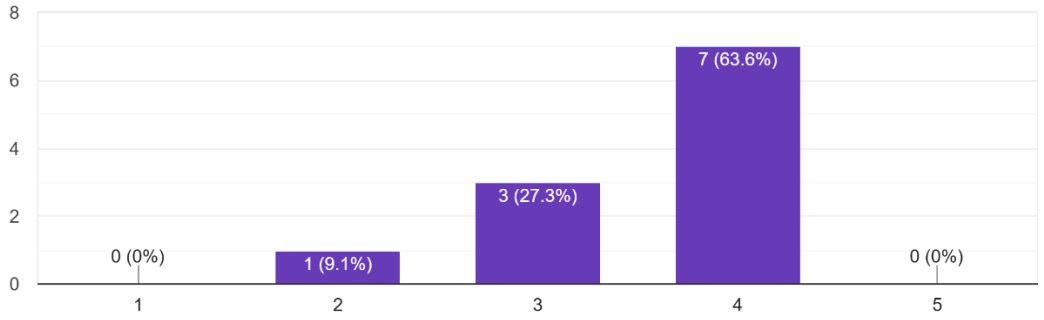

Are circular business models generally more cost efficient than linear business models due to better resource efficiency and waste management?

11 responses



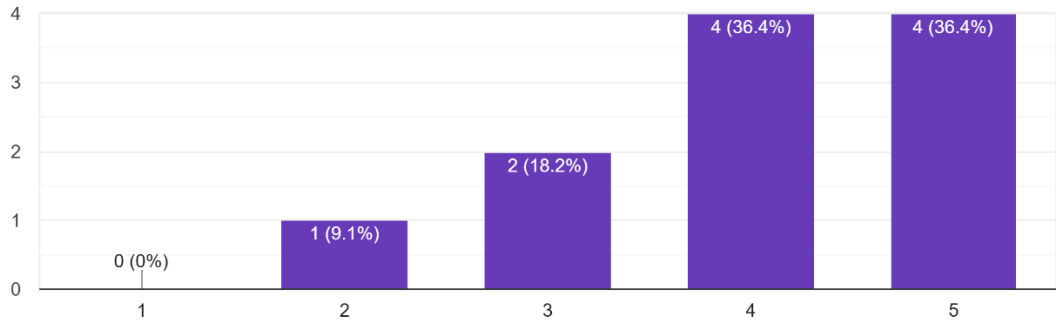

Since circular business models try to retain already created value in the value chain, is “life cycle profit”, referring to the total profit that is accumul...ity of a circular business model to capture its value?

11 responses



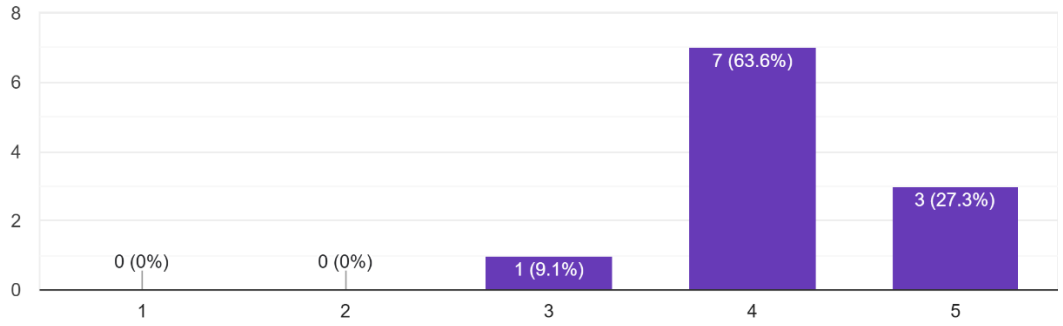
Is circularity, referring to a company's ability to utilize as little as possible virgin materials in the production process, an important valuation metric for circular business models?

11 responses



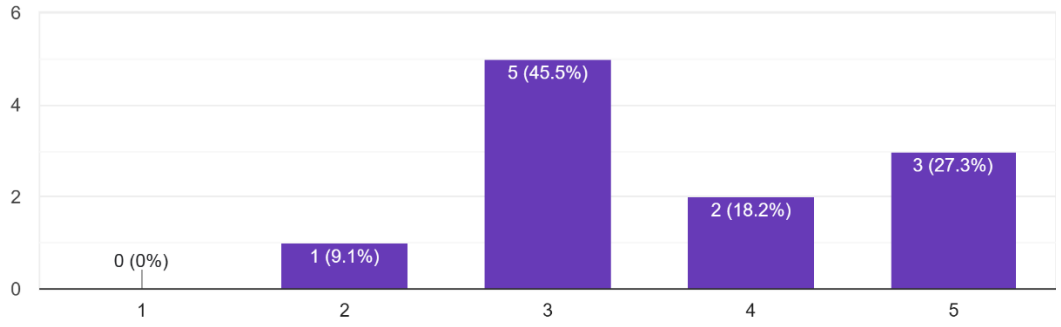

Is life cycle assessment, which analyzes the environmental impact of all life cycle stages of a product, an important valuation metric for circular business models?

11 responses



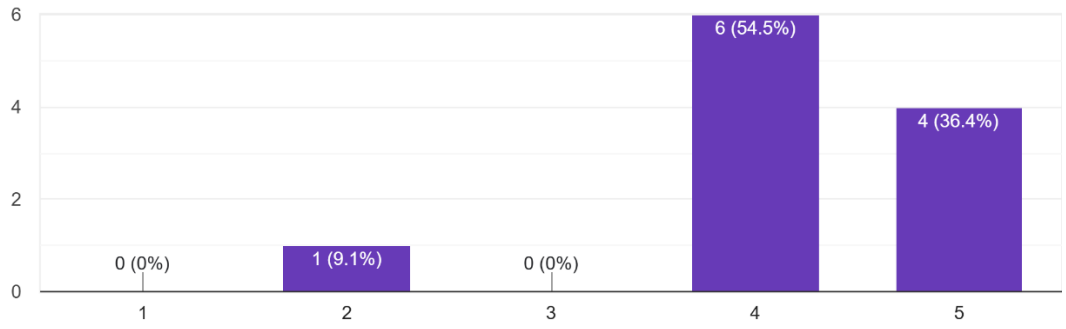

Does switching from selling product ownership to selling product-as-service improve financial performance?

11 responses



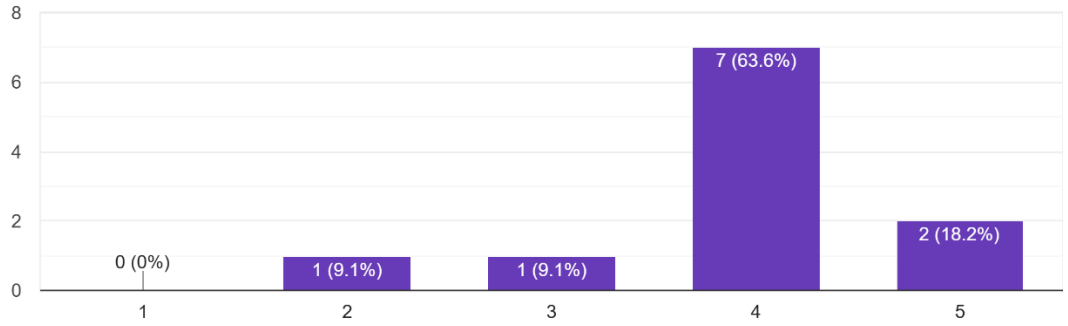
Does collaboration with stakeholders such as communication with suppliers focusing on an environmental product design improve cost performance of a circular business model?

11 responses



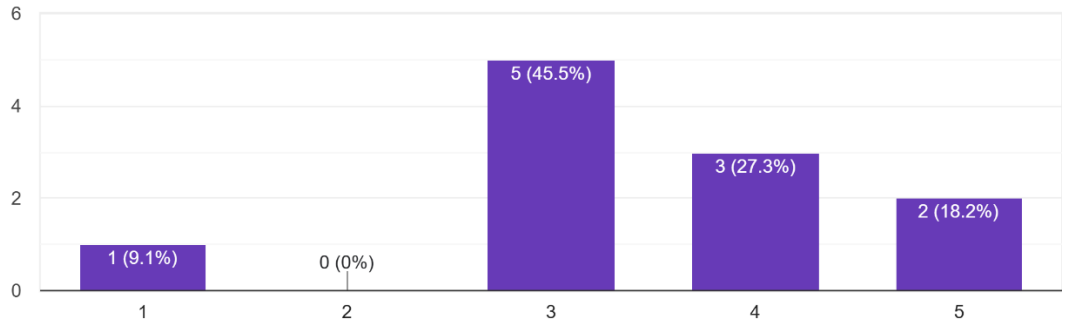

Does the digital orientation, referring to the openness of an organization to utilize new technologies for new product development, improve overall performance of a circular business model?

11 responses




Reverse logistics have shown to improve the financial performance of companies in the automotive industry. Do you think the statement “reverse logisti...ls” can be generalized for other industries as well?

11 responses



## Appendix B

| Article author, publication year | Features of value assessment criteria of CBMs | Implementation method of criteria | Applied or analyzed case | Limitations of Findings | Summary of most important findings |
|---|---|---|---|---|---|
| Akinwale, Y. (2024) | -literature review section, names a lot of studies that show improvement of financial performance in many different countries<br><br>-factors that show positive significant influence on financial performance within circular economy: financial resources, digital technology, cheaper to use, top management commitment, pressure from people, product/service upgrade, training of employees | -actions > plans, implementation of circular economy shows improvement of financial performance unlike a simple future plan/intention<br><br>-since the named criteria involve many different stakeholders, its suggested to put a lot of effort into collaboration<br><br>-promoting a company culture that engages in sustainable development and circular economy practices | -much more literature exists suggesting that a circular economy is profitable for already large firms, but smaller firms have not been analyzed a lot, so this study focuses on MSMEs (micro-, small-, medium- enterprises)<br><br>-more precisely SMEs from Saudi Arabia<br><br>-owners/managers of companies were surveyed | -this is a study that collected data only at one point of time<br><br>-small spectrum of companies were surveyed in form of only MSMEs from the eastern province of Saudi Arabia | -seven different factors have a positive significant influence on financial performance of circular business models<br><br>-implementation is achieved by collaboration and promoting company culture<br><br>-it is the actions that provide the benefits not the plans for future actions |
| Alpsahin Cullen, U. (2023) | -offering services rather than transfer of products ownership, requiring much more interaction between company and customer and institutions are "prerequisites" for CBMs that create incentives and reduce costs of collaboration according to institutional theory<br><br>-three principles to increasing customer life value: preserve and enhance natural capital, optimize resource yields and foster system effectiveness<br><br>-CBMs need to communicate value proposition to all stakeholders to show economic value while "regenerating natural, social, and economic capital" | -institutional logic perspective explains how the roles, activities and interactions of actors are shaped throughout the value cocreation processes within a circular business context<br><br>-stakeholder value analysis: who within the business environment benefits from the business activities and how? Wasted Apple as example | -semi-structured interviews with founder of Wasted Apple over 18 months<br><br>-informal talks with stakeholders of Wasted Apple | -single case study<br><br>-Wasted Apple has quite "distinct characteristics"<br><br>-Wasted Apple was only 5 years old during data collection | -three principles to increasing customer life value<br><br>-institutional logic perspective<br><br>-stakeholder value analysis |
| Ariztia, T., Araneda, F. (2022) | -"win-win formula" of CE: generating profits and a positive environmental impact<br><br>-adding value to waste from linear economy leads to double win: less waste and more revenue<br><br>-client and investor as key personas that validate the economic value of a CBM, investors want to see a vision and something unique about the product/company, while customers validate by buying the product and showing market demand, the result of that is "market validation" | -start-ups are often mostly judged on the capability to become profitable, displaying the positive environmental impacts as economic value and showing examples will more likely show the actual value of a CBM<br><br>-"economic survival" as another method to proof an economic importance of CBMs | -30 interviews with entrepreneurs within the circular economy<br><br>-case study in Chile<br><br>-interviewees are owners and managers of small businesses with less than 65 employees | -case study within a single country | -CBMs need to apply the "win-win formula" when justifying their value to investors in order to sustain themselves long-term, while customers will validate the CBM through demand |

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| | -positive environmental impact is a form of economic value in itself<br><br>-even a CBM should prioritize the sustainability of the business over being environmentally sustainable to maintain economic value | | | | |
| Aureli, S., Foschi, E., Paletta, A. (2023) | -CBMs involve closed cycled of material usage<br><br>-"CE is no longer limited to resource efficiency, but now models an economy based on redesign, reuse, shared ownership, repair, refurbishment and remanufacturing, with the aim to retain value along value chains"<br><br>-"CE models have the potential to create value, reduce costs, generate revenue, support legitimacy for companies"<br><br>-"current accounting systems are vain in CE for their limitations in providing comprehensive information and connecting different stakeholders and value chains"<br><br>-"self-generated accounting, such as vernacular accounting" "have been investigated to strengthen information-sharing systems"<br><br>-non-financial accounting e.g.: waste streams and resource accounting might suit better for CE<br><br>-new valuation metrics are needed for products-as-service businesses<br><br>-CBMs base on networks and collaboration<br><br>-environmental management tools are seen as more important than "financial and profit maximization oriented" | -managers use self-developed informal accounting methods<br><br>-life cycle assessment (LCA) as non-financial accounting tool<br><br>-LCA leads to "a more participatory form of decision-making", where stakeholders and supply chain actors can discuss needs<br><br>-short term ROI is "ambiguous" in CBMs, therefore call for more "inclusive" accounting systems that also support social and environmental progress<br><br>-critical and environmental management accounting for CE, which say today's accounting is not suitable for CBMs and that incremental changes towards that direction should be made<br><br>-material flow accounting (MFA)<br><br>-MIND methods determining economic and environmental advantages<br><br>-assessing circularity rate<br><br>-eco-cost value ratio and synthetic economic environmental indicator<br><br>-sometimes relying on "gut-feeling" is the way, since they though accountants can only provide financial information which in this case was impossible to forecast<br><br>-informal accounting | -case study method<br><br>-packaging sector due to high plastic usage within the food industry<br><br>-case study on six companies that are considered to be part of a value network in Italy<br><br>-Epsilon was chosen<br><br>-interviews with managers often from sales, which contained open ended questions and lasted 70min on average | -"We find three key limitations for the use of mainstream accounting in CE-related decisionmaking. First, it solely focuses on financial value, while CE embraces the concept of multiple value creation and maximisation of both company efficiency and ecosystem health. Second, it assumes that the main goal of firms is to create value for shareholders and only residually for all other stakeholders, while CE incorporates system thinking and stakeholder engagement to preserve the value of materials in entire ecosystems. Relevant stakeholders have an important role to play in terms of defining new expectations or institutional demands" "which may take the form of new regulations, customer demands or public pressure – factors that often conflict with existing organizational perspectives or institutional logics" "Finally, mainstream accounting restricts its reporting to the organizational boundaries, while CE requires a reconnection between the industrial metabolism and the earth's regeneration capacity"<br><br>-LCA encourage life cycle thinking but does not | -general CBM information<br><br>-current financial accounting does not suit CBMs, therefore it should develop in that direction<br><br>-nonfinancial accounting, informal accounting and other types as examples |

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| | | | | necessary support CBM transition<br><br>-single case study, tough to generalize<br><br>-no interviews with stakeholder outside of the businessm | |
| Austin, A., Rahman, I.U. (2022) | -three Rs: Reduce, reuse and recycle<br><br>-triple helix of market failures: environmental, knowledge and financial<br><br>-CBM is "a regenerative and restorative closed-loop industrial system that is designed and managed to improve resource efficiency"<br><br>-CBMs have "early-stage barriers such as the absence of industry standards, lack of human and technical resources, limited information, and low market demand (…) financial solutions must adjust to the 'changing nature of the cash flow', 'increased capital needs to pre-finance CE clients', and 'legal issues surrounding collateral and its value'" | -self financing is most common in CE, bank loans come second<br><br>-"Micro and small businesses benefit from CERRR adoption because of their shared management and ownership responsibilities"<br><br>-banks may have to accept that in CE "one size does not fit all", so they could "provide multiple forms of capital, cash flow optimization, and supply chain financing" | -data from the survey "European SMEs and the Circular Economy" is used which includes 10,498 SMEs from 28 EU member countries | -static data | -general information for CBMs<br><br>-barriers and solutions<br><br>-financing methods |
| Awasthi, S. K., Kumar, M., Sarsaiya, S., Ahluwalia, V., Chen, H., Kaur, G., Sirohi, R., Sindhu, R., Binod, P., Pandey, A., Rathour, R., Kumar, S., Singh, L., Zhang, Z., Taherzadeh, M. J., Awasthi, M. K. (2022) | -CBMs try to reduce ecological and environmental impact as much as possible | -life cycle assessment (LCA): determining potential environmental ffects (Ramirez-Islas et al., 2020); impact quantification tool (Prapaspongsa et al., 2010); production cycle framework (Hijazi et al., 2020); determining performance of product system Havukainen et al ., 2020)<br><br>-different LCA methods: CML, IPCC, ReCiPe<br><br>-GaBi 6.0 tool as standard procedure<br><br>-other softwares: SIMAPRO pHD, OpenLCA | -applies LCA for the life stock manure management industry to transition into a circular economy | | -unfortunately this article is hyper focused on the life stock manure management industry, so that it never explain how LCA generally works, instead the article immediately applies LCA to this industry<br><br>-this article still offers some general information about CBMs and mentions tools that can be used for LCA |
| Azcarate-Aguerre, J.F., Conci, M., Zils, M., Hopkinson, P., Klein, T. (2022) | -CBMs have high initial costs<br><br>-product-service-systems (PSS) selling intangible rather than tangible products<br><br>-PSS overperforms business as usual in the sense that PPS is less likely to result in a negative net present value over a | -carbon accounting<br><br>-cost-benefit analysis in regards to ESGs<br><br>-PPS consists of three steps "externalized capital investment", "performance-based procurement" and "incentivized product & material recovery" | -financial conditions such as weighted average cost of capital (WACC) are based on the Netherlands<br><br>-analysis has been computed for the next | | -PPS safer option compared to business as usual<br><br>-different accounting methods |

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| | long period of time, however "business as usual" reaches higher profits in a best case scenario<br><br>-for CBMs "(1) develop standardised contracting and financing models to lower setup and management costs and (2) develop a track record of implemented PSS models. This will support their bankability and insurability, i.e. lower interest rates and financial premiums to cover risk and uncertainty" | -Total value of ownership (TVO) | 30 years based on the climate neutrality goal by 2050<br><br>-study focuses on house building industry | | |
| Bashir, M., Alfalih, A., Pradhan, S. (2022) | -again mentioning three parts: value creation, delivery and capture<br><br>-CBMs positively affect business performance<br><br>-higher social and environmental focus of CBMs should increase their profitability | -scale was development, which contains components that should be scored in order to evaluate the CBM | -five step scale development process: "(1) item generation; (2) content validity; (3) exploratory factor validation; (4) psychometric property assessment; and (5) nomological validity"<br><br>-20 interviews, 12 with SME owners and 8 with faculty members, which lasted 40-60min<br><br>-results were applied to 200 SMEs in Saudi Arabia for validation | -results based on samples from Saudi Arabia | -assessment scale that contains three categories: "sustainable value proportion innovation", "sustainable value creation and delivery innovation" and "sustainable value capture innovation" |
| Brändström, J., Eriksson, O., (2022) | -again mentioned: "micro (product), meso (industrial symbiosis), and macro (regional) level circularity"<br><br>-again mentioned: PSS common as CBM type<br><br>-"A successful adoption of circular design principles and business models should close (increase circulation), slow (increase lifetime) and narrow (reduce product consumption and increase production efficiency) material loops"<br><br>-CBMs require high investment costs<br><br>- Circularity should assess both material in- and out-put (MIO) to evaluate how closed the loop is<br><br>-"quantitative information included product lifetime, product mass, amounts of production waste and use rate" | -material efficiency metric (MEM)<br><br>-material circularity indicator (MCI), measures both circularity and longevity<br><br>-product circularity indictor (PCI) assesses circularity on product level based on MIO<br><br>-flow index (LFI) "measures the fraction of material flowing in a linear fashion compared to a fully linear system"<br><br>-PCI can measure multiple processes individually while MCI summarizes the results<br><br>-material flow analysis (MFA), life cycle assessment (LCA) and material input per service | -feasibility of metric was tested in case studies<br><br>-case studies were performed on three companies with different CBM type<br><br>-results were collected through online interviews with company representatives | -the inclusion of a functional unit means that its partially affected by user choice, to mitigate this a third party could be hired to approve the "values" within the formula<br><br>-lack of distinction between different types of materials | -material efficiency metric as a tool to evaluate circularity of businesses<br><br>-mentions other valuation methods by referring to other articles |

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| | | -MEM requires little time compared to LCA<br><br>-MEM also encourages collaboration between actors within a value chain | | | |
| Brogi, S., Menichini, T. (2024) | -"From a strategic decision-making point of view, measuring CE implementation and its effectiveness involves evaluation against new business models, product and process innovations, and collaborations with industrial actors (Elia et al., 2017)"<br><br>-CBMs save costs and reduce environmental impact<br><br>-"a wide-ranging assessment approach that embraces products, technologies, business models and supply chains is necessary to assist decision-makers in circularity assessments"<br><br>-lack of assessment methods for CBMs<br><br>-multiple studies apply a MCDM approach to measure circularity<br><br>-business model > capabilities > technologies for circular advantage | -multi-criteria decision making method (MCDM) to evaluate circular advantage, which is a combination of fuzzy analytic hierarchy process (F-AHP) and interval-valued triangular fuzzy numbers additive ratio assessment (IVTFN-ARAS)<br><br>-"The F-AHP method allows capturing the multidimensional nature of the circular advantage and its constituent parts, hence establishing their relative importance to shape innovative conditions that better favor CE transition in the context under analysis"<br><br>-"The IVTFN-ARAS ensures to easy and accurate ranking of alternatives according to their ability to contribute to the assessment goal (Jaukovic Jocic et al., 2020), hence ensuring that Eco-Innovative solutions are ranked according to their ability to trigger drivers of circular advantage" | -sample of eco-innovative projects have been analysed | | -shows what criteria impact a CBM most effectively |
| Chavez, R., Malik, M., Ghaderi, H., Yu, W. (2023) | -environmental information exchange with suppliers can increase cost performance, if the information exchange focuses on an environmental product design<br><br>-a digital orientation can amplify that effect<br><br>-cost performance refers to resource efficiency and waste reduction<br><br>-environmental information exchange with suppliers refers to improving sustainability of supply chains through communication and cooperation<br><br>-environmental product design refers to drawing benefits from every product life stage, but most importantly in the early stage to integrate materials that are more circular | -increasing ability to create a sustainable product design by aligning "environmental and operational objectives"<br><br>-developing "SSCM refers to the management of internal and external sustainable practices for improved environmental performance across the supply chain" that promote information exchange between organization and suppliers<br><br>-promoting a culture within the company that willingly engages in technological development and its application | -Australian countries were surveyed due to increased initiatives for sustainable supply chains and inconsistent climate to test how a circular economy would put up with such harsh conditions | -inherent limitations of cross-sectional research such as results based on data that has been collected at only one point of time<br><br>-small Australian sample, hence not very robust and might lead to totally different results in other countries or industries<br><br>-study does not consider social consequences/performance | -within Australian companies it became evident that environmental information exchange with suppliers can boost cost performance of a company, which is further improved with a emphasis on digital orientation<br><br>-methods to achieve this include promoting a innovative company culture, aligning "environmental and operational objectives" and setting up systems that drive information exchange |

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| | -digital orientation mean to use new technologies to create new products | | | | between company and suppliers |
| Fernando, Y., Shaharudin, M.S., Abideen, A.Z. (2023) | -polution prevention: reducing costs by reducing waste<br><br>-products stewardship: financial advantage by reducing life-cycle costs<br><br>-Reverse logistics (RL)<br><br>-RL improves financial performance of companies when combined with CE by reducing waste<br><br>-controlled return cycle can increase companies profits by preventing inaccurate reverse transportation<br><br>-the greater the commitment the greater the results<br><br>-sustainable resource commitment has positive and significant effect on CERL product return and recovery<br><br>-CERL product return and recovery has a significant and positive effect on financial performance and positively mediates the relationship between sustainable resource commitment and financial performance | -resource based view (RBV) was criticized for not being sustainable enough, hence natural resource based view (NRBV) was developed to proactively consider the environment | -automotive industry<br><br>-cross sectional and survey method<br><br>-target population were companies involved in the Malaysian automotive supply chain<br><br>-113 companies replied | | -RL benefit financial performance within the CE |
| Galvão, G. D. A., Ferrer, P. S. S., Evans, S., Carvalho, M. M. (2023) | -increasing circularity through technical cycles (TC), which suggests value capture methods through a hierarchical process<br><br>-CBMs try capture value that has not been in linear models, there change in operation and value creation is required<br><br>-more circularity -> more revenue results<br><br>-benefits of TC: cost reduction, quality improvement, corporate image enhancement and inventive capability<br><br>-CBMs have immediate upfront costs/investments but income is rather long-term<br><br>-again talks about retaining already created value in the value chain | -investing in consumer education, increasing product lifecycle, investing in social development & environmental protection, reducing costs through resource & energy efficiency, investing sales of refurbished remanufactured products, maximising results by reducing environmental impact and investing in technologies and process capable of circular activity, all of which are strategies of CBMs to capture its value | -survey based research<br><br>-233 organizations participated | -data subjective due to answers of people | -talks about more criteria and tests the significance of those related to value capture (maybe add to section 3.3) |

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| | -CBMs are especially well aligned with SDG 12: sustainable consumption and production<br><br>-competitive criteria (CC) support TC, hence amount of captured value and shared value<br><br>-industrial symbiosis leads to shared value by exchanging waste, materials and energy<br><br>-CC: cost, flexibility, quality, delivery, innovation, cost reduction being most important | | | | |
| Geetha, B.t:, Gnanaprasuna, E., Bani Ahmad, A.Y.A., Kumar Rai, S., Rana, P., Kapila, N. (2024) | -conventional valuation models ignore circularity and focus much more on linear models<br><br>-circularity refers to a companies ability to recycle resources<br><br>-strong connection between circularity and profitability exists | -measuring resource efficiency and stakeholder collaboration<br><br>-"The total amount recycled (RCR) is the product of the total input resources (TIR) and the total amount recycled (RCE) multiplied by 100%"<br><br>-"Organizational Resource Circulation Efficiency (RCE) measures how rapidly resources are utilized or recycled"<br><br>-"Stakeholder Collaboration Level Value is equivalent to SCI's share of collaborative interactions. "All possible joint ventures" multiplied by 100"<br><br>-"A knowledge spillover index (KSI) is a measure of how often information is shared across different entities. The total number of innovations made, multiplied by one hundred percent" | -case study on CBMs that become successful due to open innovation<br><br>-financial-, collaboration- and innovation result - reports were collected<br><br>-regression analysis were performed on the data | | -this article shortly talks about the beginning of CE and CBMs<br><br>-presents three valuation/measurement metrics |
| Kohtamäki, M., Bhandari, K.R., Rabetino, R., Ranta, M. (2024) | -servitization as driver for profitability | -selling functionality, efficient resource utilization and dematerialization<br><br>-measuring servitization through ratio: service sales to total sales | -study uses data collected between 1993-2019 by the U.S Securities and Exchange Commission | -analysis based on keywords | |
| Kuzma, E., Sehnem, S. (2021) | -CBMs retain value by increasing amount of recycled inputs<br><br>-CBMs closed production loops, use resources and energy efficiently and upscale recycled products<br><br>-in contrast to linear models where a lot of value is lost after a single use/sale | | -questionnaire method | | -gives general information to CBMs<br><br>-discusses 10 Rs |

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| | -CBMs provide rather access to use instead of ownership over product<br><br>-10 Rs: refusal, reduction, reuse/resale, repair, renovation/reconditioning, remanufacture, reuse, recycling, energy recovery and re-extraction of resources, these criteria are in order of prioritization<br><br>-again mentions that CBMs try to capture economic, environmental and social value | | | | |
| Lundgren, R., Kyrö, R., Olander, S. (2024) | -CBMs try to retain value that is already created unlike linear models that make-use-dispose<br><br>-again mentions the three categories: value proposition, value creation and delivery and value capture<br><br>-CMS focus not only on economic goals but also environmental and societal<br><br>-typically CBMs create value from waste and offer functionality rather than ownership<br><br>-adaptive reuse is usually more cost-efficient<br><br>-sharing as circular principle, since it reduces resource needs<br><br>-indicators such as: "resource productivity, circular activities, waste generation and energy and greenhouse gas (GHG) emissions"<br><br>-more criteria: extending life cycle, encouraging circular activities and "climate conscious profit", where the goal is to find alternatives at similar cost that are better for the environment | -life cycle assessment (LCA)<br><br>-life cycle costing (LCC) to assess total cost of a product<br><br>-life cycle profit (LCP) fitting for assessing value capture<br><br>-"Manninen et al. (2018) propose a framework for the evaluation of CE business models which includes five steps, namely, (1) definition of environmental value proposition, (2) identification of stakeholders and their role, (3) definition of reference system and assessment of environmental impacts, (4) verifying the environmental value propositions and (5) identification of improvement proposals"<br><br>-above mentioned framework was extended to also assess economic and societal value<br><br>-net present value (NPV) as basis for LCP (sector specific) | -built environment<br><br>-case study approach<br><br>-interviews, site visits and some emails | -underlying uncertainties in assessment methods such as LCA and NPV | -information about CBMs in general<br><br>-names a couple valuation criteria/indicators<br><br>-further develops the mentioned model to also evaluate economical and societal aspects |
| Moggi, S., Dameri, R.P., 2021) | -stakeholders need to work together in order to achieve a self-sustaining "circular ecosystem"<br><br>-again says that environmental results can be seen as economic value -> less waste in the environment means governments and companies have to spend less money on waste management<br><br>-CBMs should create economic value while providing environmental and social benefits | -information sharing within the ecosystem, also a report was created<br><br>-"The mechanisms and processes described above, namely, participative governance, frequent engagement, CBM co-design, accountability and advocacy, laid the foundation for the ecosystem's financial self-sufficiency" | -case study on RiCibo, food waste industry<br><br>-2 year research<br><br>-researcher took part in stakeholder meetings<br><br>-12 semi-structured interviews | -framework needs to be tested in other contexts and cases | |

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| | -check figure for factors and drivers | -stakeholders try to satisfy their own interests at first, but can still work towards a common goal, which is incentivized by for example tax exemptions | | | |
| Neesham, C., Dembek, K., Benkert, J. (2023) | -CBMs create not only economical but also environmental and social value -> tri-profit<br><br>-CBMs focus not only on shareholders but consider most if not all stakeholders<br><br>-because of that valuation methods that focus only on economical aspects are insufficient<br><br>-again mentioned the three categories: value proposition, value creation and delivery and value capture<br><br>-economical value: profit per output<br><br>-tangle and intangible value exists<br><br>-satisfying needs rather than wants, communicating and educating consumers<br><br>-six categories: economic gains, impact, performance, better skills, relationships and risk<br><br>-four different types of benefit: goods, organizational justice, affiliation and opportunity costs reduction<br><br>-how many people benefit? If someone buys your product, can it positively affect developing countries, less fortunate regions and people? (maybe add to section 3.1)<br><br>-“A comprehensive (full) definition of value specifies a GP (what kind of thing is value), DS (how value is distinguished from other concepts), a S (who), a PR (is valuing), a DO (what), an IO (for whom), and CO (under particular conditions of time, place, and mode)” | | -used “Aristotelian logic” to create definition of value | | -this article does not help with the seconds sub research question<br><br>-offers method on how to define value |
| Okorie, O., Charnley, F., Russell, J., Tiwari, A., Moreno, M. (2021) | -CBMs tackle linear model issue such as limited resources and environmental impact<br><br>-again mentions three value dimensions: value proposition, value creation and delivery and value capture<br><br>-3 Rs: recycle, reduce and reuse | -circular and sustainable business model canvas (CSBMC)<br><br>-offers table for transitioning and evaluating practices | -case study and interviews<br><br>-5 companies of different sizes and industries | | -read discussion and conclusion section again |

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| Oskam, I., Bossink, B., de Man, A.P. (2021) | -tension between value creation and value capture and tension between mutual value and individual value | -provides table on solutions for conflicts for different CBMs | -case study consisting of four cases<br><br>-waste recycling industry | -no statistical validation | -check out table again when talking about ecosystems |
| Parte, L., Alberca, P. (2024) | -3 R's, 12th SDG<br><br>-optimal capital structure leads to higher efficiency, law of scale economy applies to efficiency as well | | -DEA multistage | | -check out results section again when talking about efficiency and profitability |
| Roci, M., Rashid, A. (2023) | -PSS considered most usual CBM<br><br>-PSS encourages longevity rather than repeated sales of a product<br><br>-assessing circularity, at the moment still difficult and companies struggle to understand their value<br><br>-deposit schemes, cancellation and collection fees may improve financial performance<br><br>-CBMs reduce overall costs through resource efficiency, create new revenue streams and improve competitive advantage from an environmental perspective (also brand image)<br><br>-"On the other hand, this shift leads to an initial revenue gap due to a timing mismatch between costs incurred and revenues generated, thus requiring a longer time for the manufacturers to reach the break-even point. As this initial revenue gap can hinder the adoption of an access-based model"<br><br>-"access-based business models leads to continuous revenue flows over the product lifetime"<br><br>-"It is to be noted that even though a fixed fee model leads to worse environmental performance compared to a pay-per-use and hybrid model, it is still preferable to a linear model as the washing machines deployed in this business model configuration are long-lasting and designed for multiple lifecycles. In fact, circular business models perform significantly better than traditional ownership models in terms of material use benefits mainly due to the longer lifespan of products" | -"the more service-oriented the business model, the more costly the business operations due to increased service and transport during the product use phase"<br><br>-"different strategies are considered to improve the initial liquidity performance of access-based business models: (1) apply a deposit fee to be returned at the end of the subscription period; (2) apply a cancellation fee in event of premature contract termination; (3) apply a collection fee in event of short-term subscription periods; and (4) take out a loan to finance the initial cost needed to deploy washing machines as-a-service in the market"<br><br>-number of usecycles, lifecycle costs, lifecycle revenues, break-even point, monthly customer expenditure, life cycle environmental impact<br><br>-short-term contracts are most costly regardless of CBM type<br><br>-fixed fee models generate more revenue than the other two types, however they also have the highest environmental impact (at least in the washing machine business)<br><br>-use stage always has the highest environmental impact<br><br>-fixed fee and long term-term contracts have the lowest time until break even | -white goods-as-a-service as a case study, more specifically washing machines<br><br>-three CBMs are considered: fixed fee model, pay-per-use model and hybrid model | -assumption of the study | -literature section on CBMs<br><br>-different CBM and contract types affect profitability<br><br>-fees can help surpass the initial investment hurdle |

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| | | point, a pay-per-use model with a short term contract need on average three times as long<br><br>-this also means customers pay most per month in a fixed fee model<br><br>-to achieve best balance between highest economical and lowest environmental impact a hybrid CBM with long-term contract should be chosen<br><br>-for fixed fee, long-term CBMs a deposit fee suffices to overcome initial investment bridge while the other types need additional support from the other mentioned above fees | | | |
| Schlüter, L., Kørnøv, L., Mortensen, L., Løkke, S., Storrs, K., Lyhne, I., Nors, B. (2023) | -CBMs seen as method to create economical value while reducing environmental impacts and increasing societal benefits | -system thinking as a way to assess sustainability<br><br>-talks about a type of LCA created by Bocken et al. (2012)<br><br>-developed guidelines on how to integrate system thinking in sustainability assessment | -exemplified cases | | -developed guidelines to use system thinking to assess sustainability, can be used to help answer second sub research question |
| Tapaninaho, R., Heikkinen, A. (2022) | -mentions macro-, meso- and micro level again<br><br>-six different value types: sustainability, economic, political, ecological, social and safety and quality value<br><br>-win-win opportunities where society and economy can benefit at the same time | -develop CBM around the recycle material/good | -case study approach about a Finnish energy company<br><br>-qualitative research in form of 20 interviews | | -this article talks about what kinds of value can and should be achieved but not about how it can be assessed |
| Toxopeus, H., Achterberg, E., Polzin, F. (2021) | -aside from “value capture” “value proposition” and “value delivery” should also be used for valuation<br><br>-rating only “value capture” “will not do the job”<br><br>-CBMs containing three phases: pre-use, use and post-use<br><br>-PSS has higher profit expectancy but requires more time to realize<br><br>-cost structure depends a lot on refurbishment processes since usually new materials do not have to be purchased | -focus on client contracts for cash flow based lending and therefore proving future cash flows<br><br>-set high expectation in value proposal, use extended lifespan to show higher value in the future<br><br>-use existing partnership to indicate a sustainable future business<br><br>-lower repair costs because of smart/modular design further increase attractiveness | -qualitative research<br><br>-“a case study-based theory-refining approach”<br><br>-not sector specific<br><br>-interviews with both banks and companies, 32 with company representatives and 4 with bank representatives, all of | | -again saying that assessing CBMs purely on a financial matter is inaccurate<br><br>-proposes three strategies to show the value of a CBM more accurately both (non) financially |

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| | | -"just-in-time asset holding lowers financing costs"<br><br>-"Strategy 3: Designing long-lasting, standardised circular assets as collateral for banks" | which were roughly 1-2 hours<br><br>-study was carried out in the Dutch context | | |
| Tran, T., Nguyen-Thi-Phuong, A. (2024) | -linear is about "take-make-dispose", and CBMs try to closed the loop<br><br>-financial factors have higher effect on CBM transition than non-financial factors<br><br>-economic > non-economic benefits for CBMs | -"During the decision-making process, businesses evaluate financial and business data in order to better understand the short-term and long-term economic benefits that a business plan will generate. This can be done by following four steps: (1) defining clear goals for CBMs, (2) collecting financial and non-financial information related to the implementation of CBMs, (3) conducting differential analyses to compare the effectiveness of CBMs and existing models, and (4) evaluating and reappraising the results in light of the input of financial and environmental economists" | -survey research approach in Vietnam<br><br>-291 surveys were completed | -survey answers are subjective and are only at one point of time | -check out table again to see which factors are significant and which are not |
| Villalba-Eguiluz, U., Sahakian, M., González-Jamett, C., Etxezarreta, E. (2023) | -3Rs: reduce, reuse and recycle<br><br>-satisfying needs rather than wants, extending life cycle<br><br>-social and solidarity economy (SSE)<br><br>-SSE sets other economic parameter based on "justice, cooperation, reciprocity and mutual aid", service and community above profit<br><br>-SEE willingly limit their profit and share it with all stakeholders, unlike non-profit organizations who are legally not allowed to share profits between shareholders | -this limited profit principle may further indicate that solely financial accounting is not a proper way to evaluate CBMs<br><br>-significant investments into society and environment instead of huge profits, which is referred to as "reasonable profitability"<br><br>-once again collaboration and cooperation is vital | -qualitative research with 26 "in-depth" interviews with people who represent SSE initiatives in Switzerland<br><br>-food and agriculture sectors | -focusing on environmental and social performance can be slowed down due to "high costs of implementation"<br><br>-tensions between economy, environment and society in general, one thing might benefit one but hurt the other | -this article does not help much with the research question in regards to how to evaluate CBMs, but it offers a unique perspective to how CBMs in general could be implemented<br><br>-this article also offers general knowledge regarding CBMs and CE within their literature review |
| Zhuang, G.L., Shih, S.G., Wagiri, F. (2023) | -discusses criteria for reusable modular components in the building industry<br><br>-most important criteria: joint design, material selection, product reuse, topologically interlocked modular components | -mentions that stakeholder collaboration is needed for CBMs | -multi criteria decision making method<br><br>-first AHP then TOPSIS | -really focused on building industry, tough to generalize | -maybe revisit when talking about circularity |