Financial performance measurement supporting the transition towards circular business models

Amal Kanzari
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Abstract

Financial performance measurement plays an important role in leading decision-makers through strategic innovation, such as business model innovation. To convey relevant information, it is important that the practices used to measure financial performance are appropriate to what is being measured. This thesis focuses on the financial performance measurement supporting the transition towards circular business models (CBMs), which has been under-researched. More specifically, this thesis aims to identify the key practices that enable the financial performance measurement of CBMs and support the transition from linear business models to CBMs. Additionally, it seeks to contribute with insights about the financial outcomes of CBMs in the context of sustainable-oriented technologies.

This thesis consists of a compilation of three papers, a systematic literature review and two empirical studies. The outset of this thesis lies in the systematic literature review, which examines the financial aspects addressed in CBM literature and in relation to the transition towards CBMs. The empirical studies examine the financial performance measurement practices that support the transition towards two different types of CBMs, namely result-oriented CBMs and sufficiency-driven CBMs. Both studies are based on an action case study, which involved collaborative development of financial performance measurement tools with practitioners from the manufacturing industry.

The results of this thesis emphasize the customer-centric aspect of financial performance measurement of CBM. The key practices identified by this thesis suggest considering costs involved in customer-value creation when measuring performance. The findings also highlight the importance of taking the offering perspective for defining the cost structure and engaging with customers early in the transition to reduce uncertainty about future cash flows and hidden costs. Life Cycle Costing (LCC) is proposed as a measurement technique. However, the results suggest adapting the LCC perspective, by addressing providers’ or users’ cost, to satisfy the different needs of decision makers. To cover the long-term returns of the CBM offering, multiple use cycles of the offering and of its underlying assets should be considered in the LCC. In terms of cost management, the findings of this thesis suggest an outside-in approach to reduce costs while enhancing customer value creation and re-creation. Finally, this thesis underscores the necessity of employing the recommended practices from various evaluation perspectives to bolster the iterative transition process toward CBMs.

Regarding the financial outcomes of CBMs, this thesis shows that the transition towards CBMs in the context of sustainability-oriented technologies holds promising financial advantages for both providers and customers. Technological innovation and retained product ownership contribute to improving the financial performance of CBMs.

**Keywords:** Financial performance measurement, circular business models, management accounting practices, circular strategy, result-oriented business models, sufficiency solutions.
Sammanfattning

Finansiell prestationsmätning spelar en viktig roll när det kommer till att vägleda beslutsfattare genom strategiska innovationer. Avhandlingen syftar till att identifiera de viktigaste praktikerna som möjliggör finansiell prestationsmätning av cirkulära affärsmodeller och som stödjer övergången från linjära affärsmodeller till cirkulära affärsmodeller. Dessutom strävar avhandlingen efter att bidra med insikter om lönsamhet för företag som introducerar cirkulära affärsmodeller i samband med införandet av hållbara teknologier.


Avhandlingens resultat framhäver ett kundcentrerat perspektiv vid finansiell prestationsmätning av cirkulära affärsmodeller. En av de viktigaste praktikerna för prestationsmätning som identifierats betonar vikten av att hänsyn tas till kostnader som är involverade i att skapa kundvärde. Resultaten understyrker också vikten av att överväga hela erbjudandet som perspektiv när kostnadsstrukturen definieras. Beräkning av livscykelkostnaden (LCC) föreslås som mätmetod. Resultaten visar dock på vikten av att LCC anpassas genom att ta hänsyn både till leverantörers och användares kostnadsstrukturer för att tillgodose beslutsfattares olika behov. För att möjliggöra en långsiktig lönsamhet i en cirkulär affärsmodell bör flera användningscykler för den ingående tillgången ingå i erbjudandet till kund redan vid affärsmodellens designstadium.

Cirkulära erbjudanden kan medföra både ökade och reducerade kostnader samt kassaflödesförändringar på systemnivå. Dessa förändringar föreslås att inkluderas i mätningen av cirkulära affärsmodellers finansiella prestation. Vidare framhåller resultaten behovet av att använda föreslagna praktiker utifrån olika utvärderingsperspektiv för att stödja en övergångsprocess mot cirkulära affärsmodeller.

Slutligen, när det gäller lönsamheten för cirkulära affärsmodeller indikerar avhandlingens resultat att övergången från linjära till cirkulära affärsmodeller medför potentiella ekonomiska fördelar för både leverantörer och kunder. Teknologisk innovation samt behållande av produkttågande i en cirkulär affärsmodell kan bidra till att förbättra en industriell tillverkares ekonomiska prestation.

Nyckelord: Finansiell prestationsmätning, cirkulära affärsmodeller, styrningspraktiker, strategier, resultatdrivna affärsmodeller
Acknowledgement

There are several people and organizations whose support was instrumental in the completion of this licentiate thesis, and I would like to express my gratitude.

First, I am grateful to my supervisors whose trust, dedication, and encouragement have guided me throughout this journey. Henrik Nehler and Josefine Rasmussen, thank you for your permanent support and valuable feedbacks. Your thought-provoking "why" questions pushed me to delve deeper into my ideas. Thank you for the trust and freedom you gave me in shaping my research perspectives. Lars Witell, thank you for your comments and valuable feedbacks, which have helped me further develop this thesis.

I wish to acknowledge the financial support provided by MISTRA REES, VINNOVA, and the Division of Business Administration at Linköping University, which made it possible for me to pursue my doctoral studies.

To the participants from the case companies, thank you for the time and effort you invested in participating in my studies. Your cooperation made this study not only possible but also enjoyable.

I want to express my gratitude to my colleagues at FEK who took the time to read and provide feedback on earlier draft of this thesis, which was presented at the PhD day. Thank you also, Aku Valtakoski Besma Glaa, and Mikael Ottosson for your thorough reading and valuable inputs.

I would like to thank my colleagues. Besma, you have been a constant source of inspiration and positivity, providing me with the resilience to overcome the most demanding moments. Thank you for all your support! Joanna, thank you for not only being a great colleague but also a friend, always there to offer support and extend a helping hand when I have needed it. Thank you Alex and Subhomoy for the good discussions. To everyone else in FEK, thank your being part of this journey.

Last but not least. I am grateful for my family for their care and support. To my parents and my sister, despite the distance you have always been by my side. Thank you for your unlimited love, for caring the most about my wellbeing and for always believing in me. To my soulmate Kais, words fall short in describing the pivotal role you have played in this journey. You are my unavering pillar of strength, and I am deeply grateful for everything you do for me. To Sarra and Malek, thank you for all the joy you bring to my life every single day. Your love means the world to me. I love you!

Linköping, September 2023

Amal Kanzari
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Part I:
Synthesis
Chapter 1
Introduction

Financial performance measurement has garnered substantial recognition in the management accounting field as an important instrument that steers strategic transformations (Feurer & Chaharbaghi, 1995; Chenhall, 2005). Its significance lies in its capacity to provide decision makers with relevant information, thus effectively guiding them through the formulation, implementation, and review of organizational strategies (Micheli & Mari, 2014). For providing relevant information to decision makers, financial performance measurement practices need to be adjusted to different levels of analysis, spanning from the overall company's performance to the performance of individual business units, business models, and products (Ahrens & Chapman, 2004; Brignall, 2007; Jørgensen & Messner, 2010; Montemari et al., 2020). Furthermore, these practices need to align with strategic changes such as business model innovation that may arise as a response to environmental pressures and new business trends (Bititci et al., 2012; Bourne et al., 2014; Melnyk et al., 2014). One recent type of business model innovation involves the transition towards circular business models (CBMs), implying a fundamental shift in the underpinnings of business model performance. This shift in turn warrants adaptations in financial performance measurement practices, which will be the subject of this thesis.

Over the past decade, there has been an increasing global commitment to enhancing the sustainability of production and consumption (Ellen MacArthur Foundation, 2013; United Nations, 2015, 2019), placing significant emphasis on the responsibilities of manufacturing companies in driving the transition towards more sustainable and circular economies (Bjørnøet al., 2021; Parida et al., 2019; United Nations, 2018). Manufacturing companies have therefore been urged to transition from linear business models to CBMs in order to leverage sustainable solutions (Ellen MacArthur Foundation, 2015; Liakos et al., 2019; Pieroni et al., 2021). Contrasting with linear business models that prioritize generating profits through
increased product sales and resource consumption, CBMs suggest generating profit while slowing and closing the resource loop (Bocken et al., 2016). As part of the transition towards CBMs, manufacturing companies should actively engage in circular activities aimed at extending and enhancing the use of products and materials. These activities include for instance maintenance, refurbishment, and repair, all of which contribute to prolong the lifespan of products (Whalen, 2019). Moreover, companies should establish efficient reverse logistics systems to facilitate the return of products from customers to providers, enabling the closure of the material loop (Cong et al., 2019).

Extending the use of products and materials presents an opportunity for manufacturing companies to generate additional long-term revenues. However, the generation of these revenues relies on the company's capability to effectively take back products and extend their lifespan through circular activities. While these activities contribute to the value extension of products and materials, they also entail additional costs, such as labor costs (Kambanou & Sakao, 2020). To enhance the value of products and materials, CBMs can propose performance and product outcomes as services, rather than merely offering the ownership of physical products (Bocken et al., 2016; Geissdoerfer et al., 2020). Through this approach, manufacturers can establish a take-back system and effectively manage circular activities, which has the potential to improve performance and reduce uncertainties (Werning & Spinler, 2020). However, this shift may imply additional efforts for manufacturers, who are used to only manufacturing and selling physical products, in terms of full responsibility of product operation and end-of-life management (Sousa-Zomer et al., 2018). This suggests significant changes in companies’ organizational practices, financial structure, and risk exposure (Linder & Williander, 2017; Ünal et al., 2019a, 2019b).

Accordingly, the transition from linear business models to CBMs has substantial implications for business activities and financial structures, leading to a fundamental shift in the underpinnings of business model performance. It becomes hence essential to adjust financial performance measurement practices to effectively evaluate the financial outcomes of CBMs. Guldmann and Huulgaard (2020,p. 7) assert the following in this context:

“Circular business models operate at different timelines and have different financial structures and risks than linear business models (Linder and Williander, 2017) […] circular business models thus need to be evaluated on different terms, and according to parameters that are yet to be developed.”
As stated in the quote above, the financial performance measurement of CBMs differs from the financial performance measurement of linear business models due to their different financial structures and timelines. Nevertheless, there is currently limited knowledge regarding the financial performance measurement practices that provide decision makers with relevant information about CBMs’ financial outcomes, and that can guide them in achieving a viable transition towards CBMs. This knowledge gap impedes companies’ ability to navigate a successful transition towards CBMs (Liakos et al., 2019; Guldmann & Huulgaard, 2020; Hofmann & Jaeger-Erben, 2020).

Performance measurement can aim to assess the financial outcomes or the non-financial outcomes of actions (Otley, 2016). While both are important for understanding financial performance, this thesis specifically addresses the financial outcomes of actions involved in the transition towards CBMs. Therefore, in this thesis, the term financial performance measurement denotes the performance measurement process that aims at measuring the financial outcomes of actions, using financial (e.g., unitary cost) and non-financial (e.g., repair time) information. The focus on financial performance measurement is driven by the theoretical gaps relating to the financial performance measurement of CBMs (Guldmann & Huulgaard, 2020).

Prior studies have proposed financial measures(s) for evaluating the financial outcomes of CBMs (e.g., cost reduction, payback period, IRR), but without defining the measurement practices that should be involved in calculating these measures in the context of CBMs (Averina et al., 2021; Fornasiero & Sorlini, 2010; Low & Ng, 2018). Other studies used financial evaluation models, including Life Cycle Costing (LCC), to support decision-making in the realm of product or material management (Albuquerque et al., 2019; Bradley et al., 2018; Kaddoura et al., 2019). Nonetheless, the current body of research lacks studies investigating specifically financial performance measurement at the business model level (Nielsen & Roslender, 2015; Nielsen et al., 2018; Sort & Roslender, 202), and specifically at the CBM level (Guldmann and Huulgaard, 2020; van Loon & van Wassenhove, 2020). This hinders decision makers from understanding the financial implications of CBMs and represents a barrier to the transition towards CBMs (Guldmann & Huulgaard, 2020; Hofmann & Jaeger-Erben, 2020; Tura et al., 2019; Vermunt et al., 2019). Therefore, scholars have suggested investigating practices that support decision makers’ understanding of the financial implications of CBMs, while guiding them throughout the transition towards more circular solutions (Bocken et al., 2019; Kambanou & Sakao, 2020).
These research gaps underscore the need for dedicated studies that investigate the financial performance measurement practices that embrace the CBM level and provide guidance for decision makers and that clarify the financial implications of CBMs. By addressing these gaps, this thesis also intends to analyze how financial performance measurement can support the transition from linear business models to CBMs.

1.1. Circular business models: Emergence and strategies

Industrialization, coupled with globalization and technological development, has promoted a linear economic model characterized by high resource consumption with related high emissions and waste volume (Stahel, 2016). In linear economies, resources are extracted, used for manufacturing products, and consumed, with residual value then discarded into the environment (Ellen MacArthur Foundation, 2013). The linear models can raise environmental challenges, i.e., pollution, climate change and biodiversity loss, when they do not suggest solutions for regenerating resources and reducing the environmental footprints of production and consumption. Likewise, linear business models that follow the linear economic model can expose many companies to additional risks related to resource scarcity when their growth recurrently relies on new resources (Ellen MacArthur Foundation, 2015). Therefore, in recent decades, global organizations have set goals and implemented actions for sustainable development including the transition from linear economy to a circular economy (CE) (United Nations, 2015; European Commission, 2020), an economy that offers a way to potentially decouple environmental impacts from economic growth (Kjaer et al., 2018).

After an analysis of 114 definitions, Kirchherr et al. (2017, p. 224) define the CE as “an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes.” They add that “a CE understanding lacking business models is one with no driver at the steering wheel” (Kirchherr et al., 2017, p. 228). CBMs are thus seen as being at the core of the CE and as one important pillar of sustainable development (Geissdoerfer et al., 2018). Therefore, the transition towards CE needs to be facilitated by a transition towards CBMs that encompass the CE principles into the design or re-design of the business model activities (Zucchella & Previtali, 2019).

The design and re-design of a business model’s activities are determined by a contingent strategy that represents higher-order choices made by management (Casadesus-Masanell & Ricart, 2010). Activities within CBMs can be strategically designed, based on two fundamental
approaches that aim to either slow down or close the material loop (Bocken et al., 2016). Slowing the resource loop strategies seek to extend the assets’ use—hence, instead of being wasted after a single use, products are re-used, and their residual value is transformed from waste into benefits. Following a slowing-the-resource-loop strategy, products are designed for durability, reliability, and for lifetime-extension. Closing-the-resource-loop strategies are based on the cradle-to-cradle design philosophy, thus aiming to eliminate waste through the recycling and reuse of components and materials at the product end-of-life.

Both circular strategies aim to reduce waste and make efficient use of resources, which can lead to potential environmental benefits. However, the financial benefits from adopting these strategies and implementing circular activities are less clear. Based on a survey of 821 manufacturing companies, Gusmerotti et al. (2019) concluded that companies engage in environmental initiatives only when they can understand their financial outcomes. This hints at the importance of understanding the financial implications of the transition to CBMs and measuring their outcomes.

The transition towards CBMs suggests significant changes in the way companies create and deliver, propose, and capture value, which raise significant challenges in measuring their financial outcomes.

1.2. Transitioning to CBMs: A shift in value dimensions

Compared to linear business models, the transition towards CBMs proposes changes in all value dimensions, including the way companies create and deliver value, propose value to their customers, and capture value (Linder & Williander, 2017; Nußholz, 2017).

For value creation and delivery, new resources are continuously needed in linear business models for manufacturing and selling more products. This value is then delivered to customers in exchange at the point of sale and is determined by the sale price (Peronard and Ballantyne 2019). However, CBMs suggest creating and delivering value-in-use—hence, while using the circular offering that usually include durable and high-quality products and services. Value in CBMs is hence co-created with customers that continue to interact with providers for creating value. CBMs also suggest recreating value by exploiting the residual value retained in product after use for creating new offerings (Linder & Williander, 2017).

¹ “Value co-creation is defined as joint activities by parties involved in direct interactions, aiming at contributing to the value that emerges for one or both parties” (Grönroos et al., 2012, p. 1521).
For their value propositions, linear business models center around offering value through the linear sale of products, often designed for single use and subsequent replacement. Although after-sales services, such as repair and maintenance, may be available, they are often managed by distinct organizational units that are not primarily concerned with product sales (i.e., product and service sale are not integrated). In contrast, CBMs propose an extended value proposition to customers through offering durable products designed for circularity and enriched with high-level services, often integrated with the product offering (Bocken et al., 2016). CBMs can also propose the outcome-performance from integrated products and services as a service, instead of offering product ownership. The integration of products and services hence not only extends the value offered to customers but also streamlines the process of product take-back for value re-creation (Guldmann and Huulgaard, 2020).

For value capture, value in linear business models is captured by providers through immediate revenues stemming from product sales and potential services sales. Hence, the more products and services are sold, the higher profit and benefits are captured by the provider. However, in CBMs, value is captured and recaptured over the long term due to the circular activities that allow product and material circulation and recreate value. While these circular activities involve additional cash flows out, they also generate additional cash flow in. Value in CBMs can be captured in the form of premium prices for durable, high-quality products and services, or in the form of long-term fees received for performance-as-a-service (Bocken et al., 2016).

Table 1 summarizes the value dimensions in linear business models and CBMs.
Table 1: Value dimensions in linear business models and circular business models

<table>
<thead>
<tr>
<th></th>
<th>Linear business models</th>
<th>Circular business models</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value creation and delivery</strong></td>
<td>New resources for manufacturing new products</td>
<td>Exploiting the residual value of products and materials for making new offering</td>
</tr>
<tr>
<td></td>
<td>Product designed for enhancing sales</td>
<td>Products designed for circularity, sufficiency, and lifetime extension</td>
</tr>
<tr>
<td></td>
<td>Linear sale of products</td>
<td>Services for extending product performance</td>
</tr>
<tr>
<td><strong>Value proposition</strong></td>
<td>Product ownership</td>
<td>Durable product sales and services for extending product value</td>
</tr>
<tr>
<td></td>
<td>After-sale services</td>
<td>The outcome of a bundle of products and services</td>
</tr>
<tr>
<td><strong>Value capture</strong></td>
<td>Cost structure:</td>
<td>Cost structure:</td>
</tr>
<tr>
<td></td>
<td>- Manufacturing and sales costs</td>
<td>- Manufacturing and sales costs</td>
</tr>
<tr>
<td></td>
<td>Revenue stream:</td>
<td>- Cost of circular activities. Cost of product take-back, cost of activities for</td>
</tr>
<tr>
<td></td>
<td>- One sale of product</td>
<td>product lifetime extension (e.g., maintenance, repair, upgrade, refurbishment,</td>
</tr>
<tr>
<td></td>
<td>- After-sale services</td>
<td>remanufacturing), cost of activities for closing the material loop (e.g., recycling)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revenue stream:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Premium price from the sale of durable products and high-level services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fees from the sale of integrated product and service</td>
</tr>
</tbody>
</table>

It is basically by creating, delivering, and offering value to customers that companies can generate profit (Teece, 2010). Therefore, any alteration in value dimensions signifies a shift in the foundational aspects of financial performance and the principles of profit generation, which in turn suggests a need for adjustments in practices enabling the financial performance measurement (Neely et al., 1995). As the transition towards CBMs implies changes in value creation, proposition, and capture (see Table 1), it necessitates alignments in financial performance measurement practices.

According to Granlund and Lukka (1998), financial performance measurement deals directly with practices and has significant implications for practices. Adapting financial performance measurement to align with the CBMs’ context necessitates concurrent adjustments in measurement practices. In the management accounting literature, the term "practice" has been employed to describe two distinct aspects of behavior (Jørgensen and Messner, 2010). First,
practice refers to the actual actions and behaviors carried out by management accountants and other actors in the practical execution of management accounting activities (Ahrens & Chapman, 2007; Englund & Gerdin, 2015). Micro-level practices can, for instance, be manifested in the way in which social actors understand and mobilize accounting information in their daily work (Ahrens & Chapman, 2007). Second, practice pertains to the collective set of activities within management accounting that are interconnected by various elements, knowledge, or rules (e.g., Messner, 2016). Granlund and Lukka (1998) refer to the former as micro-level practices and the latter as macro-level practices. In the context of this thesis, the concept of practices aligns with the latter definition. Hence, practices is used to refer to the set of activities performed for measuring the financial performance of CBMs. This is motivated by the challenges highlighted in the literature in measuring the financial performance of CBMs, which can impede the transition (Linder & Willander, 2017; Oghazi & Mostaghel, 2018; Sousa-Zomer et al., 2018; Svensson & Funck, 2019).

1.3. Challenges related to the financial performance measurement of CBMs

CBMs involve the creation and recreation of value through circular activities and innovative product designs (Bovea & Pérez-Belis, 2018). The design of circular products often requires the development of new technologies and capabilities, incurring substantial upfront costs (Ghisetti & Montresor, 2020). Value recreation within CBMs also relies on circular activities, which may necessitate manufacturers to acquire additional capabilities. This entails not only new upfront costs but also presents challenges in predicting both the amount and timing of future cash flows (van Loon & van Wassenhove, 2020). Furthermore, the uncertainty surrounding these future cash flows is compounded by their dependence on product take-back and the potential residual value of products, both of which are difficult to forecast. This inherent uncertainty poses a significant challenge in understanding the financial outcomes of CBMs.

Value in CBMs is typically offered through circular products, designed for durability and value extension, often bundled with high-level services (Tukker, 2015: Bocken et al., 2016). Circular products are usually proposed at a premium price, intended to cover the high upfront costs and compensate for the cash outflows (which are currently uncertain) (Bocken et al., 2016). However, this premium pricing can be a hurdle for customer acceptance, particularly when customers lack information about the long-term financial benefits of circular offerings. Therefore, it is crucial not only to predict the costs associated with value recreation but also to quantify the cost savings stemming from the circular offerings (Bocken & Short, 2016). This
would not only promote the acceptance of circular solutions, but also support providers designing attractive offerings. Understanding the long-term advantages of CBMs is particularly important when they offer value not only through the sale of durable products but also through reduced end-user consumption. This has been addressed in the literature as a sufficiency solution. However, understanding the long-term benefits of sufficiency solutions requires an assessment of the users' long-term benefits, which are difficult to predict by providers. This raises additional challenges for the financial performance measurement of CBMs. One of the empirical studies (Paper III) underlying this thesis therefore investigates the financial performance measurement in the context of sufficiency-driven CBMs.

CBMs can also propose value by offering only the access to products or by selling their performance as a service. This can be an alternative for reducing uncertainties related to value recreation and to the assessment of the long-term benefits of CBMs. However, this type of CBMs also entails considerable financial challenges, as providers retain ownership of products and propose terms of access and performance (Linder & Willander, 2017). In this case, operational costs are supported by providers who remain responsible for the product operation and for all supporting services (supporting the products operation and customers). While CBMs that suggest retained ownership promise additional revenues by extending and managing the offering, revenues are typically spread over the longer-term horizon. This creates a time gap between cash flow in and cash flow out, posing challenges for companies in managing their cash flows and in predicting the financial outcomes of CBMs (Linder & Willander, 2017; van Loon et al., 2020; Vermunt et al., 2019). Scholars argue that CBMs which propose offering outcomes/results as services provide more opportunities for extending product and material value and can enhance resource efficiency (Tukker, 2015). However, they raise more financial challenges than other types of CBMs (Vermunt et al., 2019). Therefore, future research has been suggested to develop adapted measurement that facilitates managing and reducing the risk related to CBMs’ long-term return (Guldmann & Huulgaard, 2020; Linder & Willander, 2017). Therefore, Paper II (appended to this thesis) suggests developing financial performance measurement and discussing the financial outcomes of a result-oriented CBM.

Accordingly, CBMs introduce innovative approaches to create and offer value, which, in turn, pose challenges in comprehending the financial benefits that providers and customers can capture. These changes challenge conventional financial performance measurement, requiring adjustments in measurement practices to better align with the value dimensions of CBMs and fully grasp their financial outcomes. Aligning financial performance measurement and its
underlying practices with the new value dimensions of CBMs is needed not only to facilitate the measurement of CBMs’ financial performance but also to provide support to decision makers during the transition towards CBMs (Kravchenko et al., 2019). As outlined by Bocken et al. (2019), this transition can unfold in three phases: ideate and design, implement and test, and finally evaluate and improve. Decision makers face particular challenges and possess varying requirements for each of these phases. Hence, they cannot navigate the transition process without assessing the financial outcomes of their CBMs in the different phases of its development—it is imperative to adapt financial performance measurement practices to meet decision makers’ evolving needs. This adaptation allows providing pertinent information to decision makers, supporting them in achieving a viable and successful transition.

1.4. Transitioning towards CBMs within the realm of technological innovation

The past decade has witnessed a growing focus on low-carbon transition and energy efficiency (United Nations, 2015; IEA, 2022b). This has triggered technological innovations and the rise of sustainability-oriented technologies aimed at minimizing emissions and curbing energy consumption, such as electric vehicles and energy-efficient products (Kumar & Alok, 2020; Waris & Hameed, 2020; IEA, 2022a). To fully leverage the potential of these technologies, several Original Equipment Manufacturers (OEMs) have embraced CBMs as a means to align their business models with sustainability objectives. Likewise, a range of literature has suggested the implementation of CBMs for supporting the commercialization and viability of sustainability-oriented technologies (Kley et al., 2011; Jiao & Evans, 2016; Wainstein & Bumpus, 2016; Albertsen et al., 2021). The European Commission has also concluded an innovation deal for enhancing the circulation of sustainability-oriented technologies, specifically for the reuse, repurposing, and recycling of electric batteries (European Commission, 2018).

In addition to leveraging sustainability-oriented technological innovations, CBMs can also optimize resource utilization and minimize waste generation and emission, thereby promoting a more sustainable and circular economy (Baars et al., 2021; Sigüenza et al., 2021). The implementation of circular activities for supporting sustainability-oriented technologies has garnered increasing attention in the literature (Albertsen et al., 2021; Fernando et al., 2020; Jerome et al., 2023). However, despite the growing interest that CBMs and sustainability-oriented technologies are receiving in literature and practice (Baden-Fuller & Haefliger, 2013; Wainstein & Bumpus, 2016), the financial benefits of CBMs in the context of sustainability-
oriented technologies remain understudied (Ensslen et al., 2020). Existing research has emphasized the critical role of technology in the success of business models (Chesbrough & Rosenbloom, 2002; Teece, 1986, 2006, 2010, 2018). Nevertheless, little is known about the financial implications of CBMs implemented in the context of sustainability-oriented technologies. Such knowledge can provide valuable insights into the potential financial benefits of these innovative approaches, as well as into the challenges and opportunities associated with them.

Therefore, this thesis investigates the financial implications of CBMs in the realm of sustainability-oriented technological innovation. Thereby, the thesis elucidates how measurement practices can support decision makers in understanding the financial implications of CBMs, particularly in the context of sustainability-oriented technologies. By shedding light on the financial implications, this research seeks to contribute to a better understanding of the financial outcomes associated with CBMs and sustainability-oriented technologies, ultimately promoting their wider adoption and contributing to a more sustainable future.

1.5. Research aim and questions

The overall aim of this thesis is to examine the financial performance measurement of CBMs. More specifically, this thesis aims primarily to identify the key practices that enable the financial performance measurement of CBMs and that support the transition from linear business models to CBMs. Then, by using these practices in developing financial performance measurement tools in empirical studies, this thesis seeks to contribute with insights about the financial outcomes of CBMs, specifically in the context of sustainable-oriented technologies. This thesis addresses the following research questions:

RQ1. What are the key practices that enable the financial performance measurement of CBMs?

RQ2. How does financial performance measurement support organizations in transitioning from linear business models to CBMs?

RQ3. What are the financial implications of implementing CBMs in the context of sustainability-oriented technologies?

Three papers have been developed for answering these research questions. Table 2 provides details about the papers and their contributions to the thesis aim and to answering the research questions.
Table 2: Papers’ contribution to the thesis

<table>
<thead>
<tr>
<th>Papers</th>
<th>Title</th>
<th>Research aim</th>
<th>Contribution to the thesis research questions</th>
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<tbody>
<tr>
<td>Paper I</td>
<td>How financial performance is addressed in light of the transition to circular business models: A systematic literature review</td>
<td>Investigating the extent, context, and content of the financial performance discussions concerning the transition towards CBMs and suggesting future research paths for reducing uncertainty about CBMs' financial performance, which can facilitate the transition process.</td>
<td>Overall aim, RQ1, RQ2</td>
</tr>
<tr>
<td>Paper II</td>
<td>Financial performance measurement of result-oriented circular business models: The case of electrification and assets-as-a-service</td>
<td>Suggesting management accounting practices that allow grasping the financial value captured by providers from a result-oriented CBM. Illustrating how these practices could be applied in the context of electrification for assessing the financial implications of assets-as-a-service and supporting the development of the CBM.</td>
<td>Overall aim, RQ1, RQ2, RQ3</td>
</tr>
<tr>
<td>Paper III</td>
<td>Unlocking financial benefits through sufficiency-driven circular business models: The case of high-efficiency motors and maintenance strategies</td>
<td>Investigating the financial benefits of sufficiency-driven CBMs and demonstrating how TCO can be used as a financial performance tool for supporting both providers’ and users’ decision-making</td>
<td>Overall aim, RQ2, RQ3</td>
</tr>
</tbody>
</table>

Answering the research questions proposed for this study would make theoretical and practical contributions. From a theoretical perspective, this research takes a management accounting perspective to examining financial performance measurement in the context of CBMs. Specifically, the research advances knowledge on how financial performance measurement practices can be adapted to enable the evaluation and transition towards CBMs. Additionally, the research provides valuable insights into the financial outcomes of CBMs implemented in the context of sustainability-oriented technologies, focusing on electrification and high-efficiency technologies. This addresses a critical gap in the literature concerning the financial evaluation and outcomes of CBMs (Guldmann & Huulgaard, 2020; Hofmann & Jaeger-Erben, 2020; Ormazabal et al., 2018; Tura et al., 2019).

From a practical standpoint, this thesis provides managers with knowledge about financial performance measurement practices for CBMs. This knowledge can be utilized to develop evaluation guidelines and provide practical guidance for managers seeking to make a viable
transition towards CBMs and, ultimately, towards a circular economy. Moreover, this research offers empirical case study evidence on the financial performance outcomes in the emerging context of CBMs for sustainability-oriented technologies. The results from the case studies contribute to informed decision-making and enhances understanding of the financial implications associated with adopting CBMs. By bridging the gap between theory and practice, this research supports the practical implementation of CBMs and sustainability-oriented technologies, paving the way to a more sustainable future.

1.6. Thesis outline

This thesis consists of two parts. The first part is a synthesis of the three papers appended to this thesis and includes six chapters, and the second part includes the three papers. The thesis outline is presented below.

Chapter 2 presents the theoretical background of this thesis. This chapter presents the concepts of financial performance measurement, CBMs and the transition towards CBMs, and also discusses how financial performance measurement methods can be applied to the CBMs. This chapter motivates the research aim and presents the theoretical foundations of this thesis.

Chapter 3 presents and motivates the methodology used for answering the research questions of this thesis. This chapter presents the philosophies underpinning this research and the research strategy and approach. It then describes how the three studies of this thesis were conducted and concludes with discussing the trustworthiness of this thesis.

Chapter 4 presents an overview of the three papers that are the basis of this thesis.

Chapter 5 discusses the results of the three studies in light of the research questions and synthesizes the main findings.

Chapter 6 concludes this thesis and presents its limitations and suggestions for future research.
Chapter 2
Theoretical background

This chapter provides the theoretical foundation for the thesis, beginning with an exploration of key concepts such as financial performance measurement, CBMs, and the transition towards CBMs. Subsequently, the chapter suggests a framework linking the main concepts discussed there and elucidating the theoretical perspective of this thesis.

2.1. Financial performance measurement

Before discussing financial performance measurement, it is important to understand what is meant by performance. Meyer (2002) argues that there is no absolute definition of performance, since it is related to a decision-making context defining what we want to measure and why. In management research, performance is often perceived as constituting the unitary goal of organizations (March & Sutton, 1997). Companies aim for performance, seek to measure and improve their performance, and compensate their employees for performance (Meyer, 2002). Performance is thus the outcome of managerial and employee actions and is therefore a dynamic concept that changes over time (Lebas, 1995; Lebas & Euske, 2007). March and Sutton (1997) describe organizational performance as a dependent variable that needs to be predicted, understood, and shaped. To be understood and managed, performance needs to be measured.

Melnyk et al. (2014) provide a comprehensive description of performance measurement as a multifaceted process that encompasses several stages (Figure 1). The process starts with setting goals according to which performance will be assessed (e.g., profitability levels). Then, relevant data is collected, which should accurately capture the outcomes of managerial and employee actions. Subsequently, the collected data is subjected to analysis and interpretation, enabling the extraction of meaningful information regarding the performance of these actions.
This information serves as a basis for comparing actual results with predetermined goals, facilitating the identification of gaps and areas for improvement. By leveraging this knowledge, organizations can make informed adjustments to their actions and strategies, ultimately enhancing their performance. Thus, performance measurement not only enables the monitoring and evaluation of performance, but also serves as a vital tool for managing and optimizing organizational outcomes (Amaratunga and Baldry, 2002).

**Figure 1:** The process of performance measurement and management

(own illustration based on Melnyk et al., 2014)

In essence, performance measurement was defined by Neely et al. (1995) as the process whereby the efficiency and effectiveness of actions is quantified, where measurement is the process of quantification and efficient and effective action correlates with better performance. The efficiency and effectiveness of actions can be evaluated in term of financial outcomes, such as profitability, or in term of non-financial outcomes, such as product innovation or customers’ perceptions (Brignall & Ballantine, 1996). According to Otley (2016), assessing both financial and non-financial performance is crucial for obtaining accurate information about organizational performance. Nevertheless, he notices that financial performance is the most commonly used outcome variable in literature. This tendency was explained by the widespread utilization of financial performance measures within organizations and their integral role in compensation systems (Otley, 2016). Particularly in the case of CBMs, existing literature has highlighted the importance of assessing the financial performance of CBMs for making the transition (Gusmerotti et al., 2019; Ghisetti & Montresor, 2020). However, literature has identified gaps related to the understanding and measurement of the financial outcomes of CBMs (Guldmann & Hulgaard, 2020). Therefore, this thesis focuses specifically on measuring the financial outcomes of CBMs. Based on the definition by Neely et al. (1995), in this thesis, the term "financial performance measurement" here refers to the process of quantifying the effectiveness and efficiency of actions and measuring their outcomes in terms
of financial performance. Based on Neely et al. (1995), effectiveness relates to the extent to which customer requirements are met, while efficiency is a measure of how economically a company’s resources are used when providing a given level of customer satisfaction.

Traditional financial performance measurement practices have primarily centered around cost and financial accounting-based approaches (Otley, 2005; Brignall, 2007). However, accounting-based performance measurement has been criticized for its limitations in effectively aligning with and supporting the strategic orientations of businesses (Johnson & Kaplan, 1987). These limitations arise from their short-term perspective, their emphasis on historical data and reporting requirements, and their inability to adapt to the dynamic and evolving business environment (Johnson & Kaplan, 1987). To overcome these limitations, scholars advocated a return to basics and to measuring what truly matters and holds significance for organizations (Johnson & Kaplan, 1987; Neely & Bourne, 2000). Additionally, these scholars have emphasized the need to consider the non-financial drivers of performance for a more comprehensive view of long-term performance. Non-financial drivers, such as service innovation or R&D performance, have indeed been considered as leading factors often predicting subsequent lagging financial performance (Meyer, 2002).

Aligned with these recommendations, therefore, while this thesis examines financial performance measurement practices, it also takes into account non-financial factors that influence financial performance for CBMs. The design of financial performance measurement requires defining performance and its underpinnings, selecting measures for quantifying the underpinnings of performance and linking measures for evaluating performance in terms of financial outcomes (Bourne et al., 2000; Neely et al., 1995). Scholars emphasize the dynamic aspect of financial performance measurement design, emphasizing the need for continuously updating and adapting performance goals, as well as underpinning measures to business environment and changing goals (Bititci et al., 2000; Bourne et al., 2000).

For instance, Melnyk et al. (2014) emphasize the need to fit performance measurement to the environment in which measurement operates, in order to support the implementation of emergent business trends such as new business models and environmental sustainability in activities. Likewise, Bititci et al. (2012) stress the need for adapting measurement practices to emergent contexts such as servitization and the increasing focus on business sustainability. For adapting what is measured to internal and external dynamics, scholars suggested flexibility in
measurement to address the contingent aspect of financial performance measurement (Bititci et al., 2000; Otley, 2005, 2016).

The process of financial performance measurement deals with and has implications for management accounting practices (Granlund & Lukka, 1998). This thesis focuses on the macro-level practices that refer to the set of activities involved in financial performance measurement. According to Granlund and Lukka (1998), macro-level management accounting can be examined from various perspectives. These perspectives include understanding the concepts that need to be considered in the measurement process, exploring the ideas generated by the accounting system, investigating the purposes behind the usage of specific management accounting information, and analyzing the techniques (e.g., steps in measurement) employed in measurement and system design (e.g., the software used in the measurement implementation). This research considers the different dimensions of macro-level management accounting practices when investigating the financial performance measurement of CBMs. However, the system design dimension is excluded, since it pertains to the software implicated in technically implementing financial performance measurement, which falls outside the scope of this thesis.

By employing appropriate practices, financial performance measurement can provide relevant information that supports decision makers in the formulation, implementation, and review of organizational strategies (Micheli & Manzoni, 2010). Measurement also provides information that can be communicated to shareholders and showcase the achievements of the organization (Atkinson et al., 1997). Furthermore, it can be used to motivate employees and create a performance improvement culture (Micheli & Manzoni, 2010). Financial performance measurement can also be used as a tool that supports the operational level, where it becomes instrumental in facilitating daily decision-making processes (Englund & Gerdin, 2015).

Previous studies argue that different levels of analysis necessitate different types of information (Jørgensen & Messner, 2010; Micheli & Manzoni, 2010). Therefore, financial performance measurement needs to be designed to support decision makers at different organizational levels, and to enable their decision-making process rather than to control their work (Adler & Borys, 1996). This approach fosters increased managerial commitment and motivation, leading to improved performance (van der Hauwaert et al., 2022). For the development of enabling financial performance measurement, Wouters & Wilderom (2008) and Wouters & Roijmans (2011) suggest an experience-based development that builds on existing knowledge, local
practices and know-how, and that adapts to changes that emerge over time. Additionally, they identify the need for experimentation for refining the design of performance measurement, thereby enhancing the enabling nature of measurement. By relying on experience and fostering experimentation and continuous improvement, performance measurement can cultivate knowledge and improve work processes (Wouters & Wilderom, 2008).

2.2. Financial performance measurement at a business model level

The relationship between strategy and financial performance measurement has been widely discussed in the literature under the umbrella of strategic performance measurement (Micheli & Manzoni, 2010). Scholars investigating this topic have mainly discussed the alignment between what is measured and the strategic goals of organizations (Atkinson et al., 1997; Chenhall, 2005; Chenhall & Langfield-Smith, 1998). Additionally, previous studies have emphasized the dynamic aspect of performance measurements and their role in driving strategic changes (Brignall, 1992; Fearer & Chaharbaghi, 1995). Strategies are operationalized through business models that link business activities to a defined strategy and define how companies compete in the marketplace (Casadesus-Masanell & Ricart, 2010). A business model is centered around the concept of value and describes how companies create, deliver, and capture value while following a certain strategy (Teece, 2010). It addresses the operational level of strategies, thus necessitates distinct management accounting practices for measuring and managing their performance (Nielsen et al., 2018). Despite acknowledging the importance of business models, the specific relationship between financial performance measurement and business models has remained largely unexplored in the management accounting field (Montemari et al., 2020; Nielsen et al., 2018; Sort & Roslender, 2021).

Previous studies have presented diverse definitions of the business model concept. Table 3 provides an overview of these definitions. On one hand, the business model has been characterized as a static representation of the operational level of a business unit. From this perspective, it has been defined as an architecture that encompasses the arrangement of products, services, and information flows (Timmers, 1998). Additionally, it has been viewed as a conceptual tool that connects variables and concepts to business objectives (Osterwalder et al., 2005) and as a representation of decision variables (Morris et al., 2005). On the other hand, business models have also been perceived as dynamic structures. In this context, they have been defined as systems of interdependent activities that extend beyond organizational boundaries (Zott & Amit, 2010) and define how a company delivers value to customers, attracts
customer payments, and converts those payments into profit (Teece, 2010). In this thesis, the business model is viewed from the latter perspective, emphasizing its dynamic nature and its role in value creation and capture. Hence, the business model is perceived as a dynamic activity system where the content, structure, and governance need to be continuously adjusted for efficiently creating value, proposing an attractive value to customers, and capturing value.

Table 3: Selected business model definitions

<table>
<thead>
<tr>
<th>Author(s), year</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Timmers (1998)</td>
<td>The business model is an architecture of the product, service, and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues. (p. 4)</td>
</tr>
<tr>
<td>Amit &amp; Zott (2001)</td>
<td>The business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities. (p. 511)</td>
</tr>
<tr>
<td>Morris et al. (2005)</td>
<td>A business model is a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets. (p. 727)</td>
</tr>
<tr>
<td>Osterwalder et al. (2005)</td>
<td>A business model is a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm. Therefore, we must consider which concepts and relationships allow a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences.</td>
</tr>
<tr>
<td>Richardson (2008)</td>
<td>A business model is a conceptual framework that helps to link the firm's strategy, or theory of how to compete, to its activities, or execution of the strategy. The business model framework can help to think strategically about the details of the way the firm does business. (p. 135) […] The three major components of the framework; the value proposition, the value creation and delivery system, and value captured reflect the logic of strategic thinking about value. The essence of strategy is to create superior value for customers and capture a greater amount of that value than competitors“ (p. 138)</td>
</tr>
<tr>
<td>Casadesus-Masanell &amp; Ricart (2010)</td>
<td>A business model is […] a reflection of the firm’s realized strategy. (p. 195)</td>
</tr>
<tr>
<td>Osterwalder &amp; Pigneur (2010)</td>
<td>A business model describes the rationale of how an organization creates, delivers, and captures value. (p. 14)</td>
</tr>
<tr>
<td>Zott and Amit (2010)</td>
<td>The business model is a system of interdependent activities that transcends the focal firm and spans its boundaries. (p. 216)</td>
</tr>
<tr>
<td>Teece (2010)</td>
<td>The essence of a business model is in defining the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. (p. 172)</td>
</tr>
</tbody>
</table>
Seen from an activity perspective, Zott & Amit (2010) note that a business model defines the structure of the value chain through which value is created and delivered to customers at an appropriate cost. Similarly, according to Teece (2018), the success of a business model relies on the value it creates for customers and on the ability of providers to turn payments received from customers into profit. Notably, providers cannot generate profit through business models when they fail to attract and engage customers by creating an appealing value. Therefore, after a review of business model’s literature, Zott et al. (2011) concluded that the business model concept revolves around customer-focused value creation.

From another perspective, scholars consider the business model as a value-centric concept that defines the value proposition, the value creation and delivery, and the value capture (Richardson, 2008; Osterwalder & Pigneur, 2010). Therefore, the implementation of a business model has been considered as an iterative process through which companies design and redesign business models in order to maximize the value creation and minimize the waste of value (Boulton et al., 2000). From this perspective, scholars emphasized the need to link the financial performance measurement to the value flowing through the business model. For instance, Montemari et al. (2020) suggested relating financial performance measurement to value drivers for the management of business models. Likewise, Nielsen et al. (2018) suggested linking the value dimensions to financial performance measurement.

However, as argued by Sort & Roslender (2021), the engagement of management accounting with business models’ literature is still very limited. Likewise, Roslender & Hart (2010) argue that although some management accounting techniques attempted to engage with customer perspectives, they ultimately serve the interest of business and disregard customer value. Nielsen & Roslender (2015) consider that management accounting had begun to engage with business models by considering capitals for value creation in the context of Economic Value Added (EVA) and also more recently in the context of integrated reporting (IIRC, 2013). However, Nielsen & Roslender (2015) assert that such initiatives continue to privilege the value capture for shareholders. This has spurred the call for developing performative research in the field of business models that support the implementation and management of different types of business models (Montemari et al., 2020; Nielsen et al., 2018; Roslender & Nielsen, 2019), which is what this thesis seeks to contribute to by considering a particular type of business models, CBMs.
2.3. Circular business models

More recently, the increased awareness of sustainability challenges and environmental issues have spurred the emergence of a sub-field within the business model research concerned with CBMs. The concept of CBMs started to gain more prominence in the last decade, more specifically from 2014 on (see Paper I). Since then, scholars have discussed several aspects of CBMs, such as CBM design, CBM innovation, customer acceptance, drivers, barriers to the CBM transition, and CBM evaluation (Paper I).

In essence, a CBM was defined as a business model that actively operationalizes circular strategies and regenerates value (see definitions in Table 4). For instance, Oghazi & Mostaghel (2018) describe CBMs as business models that create, deliver, and capture value through circular strategies for slowing and closing the material loop. Geissdoerfer et al. (2020) identify four circular strategies for slowing and closing the material loop, namely cycling, extending, intensifying, and/or dematerializing material and energy loops. They define CBMs as a business model that operationalizes one or more of these strategies. Taking a practice perspective, Ünal et al. (2019a, 2019b) perceive CBMs as co-evolving managerial practices that create, deliver and capture value through sustainable solutions. A co-evolutionary view emphasizes the importance of aligning managers practices to circular strategies for creating, delivering, and capturing value.

Other scholars have emphasized the aspect of value regeneration that characterizes CBMs. For instance, Linder & Willander (2017) state that the logic of value creation in CBMs is based on using the residual economic value retained in products in the production of a new offering. Similarly, Nußholz (2017) asserts that the logic of value creation in CBMs is based on improving resource efficiency by extending the useful life of products and parts and closing the material loop. The recreation of value in CBMs leads to an extended value proposition to customers and allows providers to recapture value (Guldmann & Huulgaard, 2020). Taking a systemic perspective, Geissdoerfer et al. (2018) state that CBMs create additional financial and non-financial value through long-term and proactive circular value chain management and stakeholders’ alignment. Hence, CBMs strive to achieve additional sustainable benefits compared to conventional business models, requiring dynamic value chain management and collaboration among stakeholders.

Accordingly, in this thesis, a CBM is viewed as a system of interdependent activities that operationalize circular strategies through which a company creates and recreates value that
extends the offering to customers and satisfies their needs and enables providers to capture and recapture additional financial and non-financial value.

Table 4: Selected CBM definitions

<table>
<thead>
<tr>
<th>Author(s), year</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Linder &amp; Willander (2017)</td>
<td>Circular business model is a business model in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings. (p. 183)</td>
</tr>
<tr>
<td>Nußholz (2017)</td>
<td>A circular business model is how a company creates, captures, and delivers value with the value creation logic designed to improve resource efficiency through contributing to extending useful life of products and parts (e.g., through long-life design, repair, and remanufacturing) and closing material loops. (p. 12)</td>
</tr>
<tr>
<td>Geissdoerfer et al. (2018)</td>
<td>Circular business modes can be defined as sustainable business models which are business models that aim at solutions for sustainable development by creating additional monetary and non-monetary value by the proactive management of a multiple stakeholders and incorporate a long-term perspective that are specifically aiming at solutions for the CE (i.e., closing, narrowing, slowing, intensifying, and dematerializing resource loops) through a circular value chain and stakeholder incentive alignment (p. 713)</td>
</tr>
<tr>
<td>Oghazi &amp; Mostaghel (2018)</td>
<td>Circular business models represent the rationale of how an organization creates, delivers, and captures value with slowing, closing, or narrowing flows of the resource loops. (p. 3)</td>
</tr>
<tr>
<td>Ünal et al. (2019b)</td>
<td>A circular business model represents a holistic system of co-evolving managerial practices for collective value creation, delivery and capture, which provide solutions for sustainable development. (p. 291)</td>
</tr>
<tr>
<td>Geissdoerfer et al. (2020)</td>
<td>Circular business models can be defined as business models that are cycling, extending, intensifying, and/or dematerializing material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organizational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerializing). (p. 7)</td>
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</table>

2.3.1. Circular business models strategies and typologies

CBMs have emerged as drivers for transitioning towards a circular economy, which seeks to decouple environmental impacts from economic growth (Kjaer et al., 2019). Consequently, CBMs should embrace strategies that promote resource efficiency and reduce resource consumption while generating profit (Geissdoerfer et al., 2020). The literature has discussed two fundamental strategies that significantly influence the flow of resources: slowing the resource loop strategies and closing the resource loop strategies. In line with Stahel (1994) and McDonough & Braungart (2010), Bocken et al. (2016) have defined CBM typologies that enable closing and slowing the material loop strategies (see Table 5).
CBMs that aim to slow the material loop intend to maintain the product in use for longer periods and are also addressed as product lifetime extension business models (Geissdoerfer et al., 2020). For slowing the material flow, products are designed for longevity, made with high quality, and offered with additional services for enhancing and prolonging their lifetime. Four typologies of CBMs have been identified by Bocken et al. (2016) for slowing the material loop, including: (i) an access and performance model; (ii) a product value extension model; (iii) a classic long-life model; and (iv) an encourage sufficiency model.

CBMs that aim to close the material loop provide solutions for creating a feedback loop in resources flow. Therefore, products are designed for technological and biological cycles and for dis- and reassembly. Two typologies of CBMs have been identified for closing the material loop, including (i) resource value extension and (ii) industrial symbiosis. It should be noted that industrial symbiosis CBMs suggest a process-oriented solution that operates at the industry level. This typology of CBMs is considered to be beyond the scope of this thesis, focusing on CBMs implemented by a single company. Table 5 presents a description of the different typologies of CBMs and their relative value propositions, principles for value creation and delivery, and principles for value capture. Slowing and closing the loop strategies can be associated with initiatives for narrowing the loop that aim to use less resources in production (Bocken et al., 2016).

As shown in Table 5, CBMs incorporate different types of circular activities and services that allow extending and regenerating value propositions, creation, and capture. Indeed, the value proposed by the CBMs often suggests products that are designed for durability and circularity. Circular activities then play a pivotal role in enhancing and prolonging the value of products and the material they contain. To facilitate circular activities, CBMs suggest extending the offering to customers to include supporting services such as maintenance, repair, upgrade, and the take-back of product at the end of their use (Doni et al., 2019). The offering can also encompass performance-as-a-service, where the value of products, services, and circular activities is proposed to customers as a service. It is then through services and circular activities that CBMs can recreate value, extend their offerings, and recapture additional financial and non-financial value (Sundin & Bras, 2005).
<table>
<thead>
<tr>
<th>Table 5: CBM typologies, description, and value dimensions (Bocken et al., 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental circular strategies</strong></td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Business model for closing the loop</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>Business model for stretching the loop</td>
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</tbody>
</table>
2.4. The transition towards circular business models

Transitioning towards CBMs requires incorporating circular strategies and their underlying circular activities (Bocken et al., 2016; Geissdoerfer et al., 2020). Furthermore, it necessitates integrating services in the offering for enabling the circular activities and extending the value proposed to customers (Copani & Behnam, 2020; Doni et al., 2019). The incorporation of circular activities and the servitization of the offering occur through a business model innovation process.

2.4.1. The incorporation of circular activities

Building on Bocken et al. (2016), Geissdoerfer et al. (2020) have defined four generic CBM strategies and identified circular activities underlying the different strategies. The strategies are cycling, extending, intensifying, and dematerializing. First, a cycling strategy aims to cycle material and energy within the system through reuse, remanufacturing, refurbishment, and recycling activities. The cycling of materials requires a take-back element and an effective reverse manufacturing process, in addition to collaboration throughout the value chain (Bressanelli et al., 2019; Geissdoerfer et al., 2018). Second, an extending strategy aims to make long-lasting products and to encourage long use phases. It is mainly supported by circular activities that include design for durability and upgradability, marketing activities for educating customers and encouraging extended use of products, as well as maintenance and support activities. Third, an intensifying strategy implies an intensification of the use phase through the implementation of new solutions such as sharing, pooling, and leasing. This strategy is mainly supported by activities that encourage the use of existing products for satisfying more than one customer. Fourth, a dematerializing strategy aims to replace material products with services and intangible solutions and to provide product utility instead of ownership. This strategy is supported by circular activities such as the design of products for resource decoupling, as well as maintenance and repair for product lifetime extension. Figure 2 displays the four generic circular strategies and their underlying circular activities.

It should be noted that these four generic strategies can be used in combination in one CBM. The CBM typologies suggested by Bocken et al. (2016) involve one or more of these circular strategies. For instance, access and performance CBM operationalizes mainly a dematerialization strategy. However, it can also include extending and cycling strategies and recreate value through reuse, maintenance, repair, refurbishing, and recycling activities.
Table 6 in section 2.4.2 suggests the generic circular strategies that can be combined in different types of CBMs.

<table>
<thead>
<tr>
<th>CBM generic strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cycling</strong></td>
</tr>
<tr>
<td>Design for modularity</td>
</tr>
<tr>
<td>Reuse</td>
</tr>
<tr>
<td>Repair</td>
</tr>
<tr>
<td>Remanufacturing</td>
</tr>
<tr>
<td>Recycling</td>
</tr>
<tr>
<td>Reverse logistics</td>
</tr>
<tr>
<td>Incentives to return cores</td>
</tr>
<tr>
<td><strong>Extending</strong></td>
</tr>
<tr>
<td>Design for durability</td>
</tr>
<tr>
<td>and upgradability</td>
</tr>
<tr>
<td>Marketing activities</td>
</tr>
<tr>
<td>for consumer education</td>
</tr>
<tr>
<td>Activities for</td>
</tr>
<tr>
<td>encouraging long life</td>
</tr>
<tr>
<td>Maintenance and</td>
</tr>
<tr>
<td>support upgrade</td>
</tr>
<tr>
<td><strong>Intensifying</strong></td>
</tr>
<tr>
<td>Activities for</td>
</tr>
<tr>
<td>encouraging intense product use</td>
</tr>
<tr>
<td>Sharing</td>
</tr>
<tr>
<td>Rental/leasing</td>
</tr>
<tr>
<td>Pooling and using cooperative</td>
</tr>
<tr>
<td><strong>Dematerializing</strong></td>
</tr>
<tr>
<td>Designing product for</td>
</tr>
<tr>
<td>resource decoupling</td>
</tr>
<tr>
<td>Substitution of products with services</td>
</tr>
<tr>
<td>Activities for delivering utility instead of ownership</td>
</tr>
</tbody>
</table>

![Figure 2: Generic CBM strategies and underlying activities (based on Geissdoefer et al., 2020)](image)

The implementation of circular strategies and their underlying circular activities occurs through a business model innovation process that aims to redefine the business model activity system (Frankenberger et al., 2013). The business model innovation process also involves a servitization of the offering, which not only extends the value proposed to customers but also enables the circular activities.

### 2.4.2. Servitization of the offering

In CBMs, services are integrated with products in the offering to customers for supporting and enabling circulation activities (i.e., extending the product lifetime and the take-back of product for reuse). Services also play an important role in extending the value proposed to customers, thus contributing to value capture and recapture in CBMs (Khan et al., 2020).

Integrating service with products in business models has been addressed in the literature as a process of service infusion (Forkmann, et al., 2017a), and as a development of product-service systems (PSS) (Tukker & Tischner, 2006; Reim et al., 2015), but is often labeled as a servitization phenomenon (Baines et al., 2009; Neely, 2008; Wang et al., 2018; Palo et al., 2019; Abdelkafi et al., 2022). Servitization is defined as “a shift in firm’s offerings from traditional core product business to developing ancillary service offerings and value-added solutions” (Eggert et al. 2011, p. 661). It involves a continuum, with an increasing degree of service integration in the offering (Baines et al., 2009). As depicted in Table 6, the degree of service integration is different for different types of CBMs. For instance, offerings can include service as an add-on to products, as is the case for product value extension and encourage
sufficiency CBMs. Services can also become the core offering in which products are considered as add-ons, as is the case for access and performance CBMs (Bocken et al., 2016).

The classification of servitization initiatives has been influenced by the work of Tukker (2004), who presented a comprehensive framework for categorizing servitization in offerings based on the level of service integration and its contribution to value creation. He identified three categories of offerings’ servitization; product-oriented, use-oriented, and result-oriented. The three categories of offering servitization contribute to resource efficiency (Tukker, 2015), and are adopted in accordance with various typologies of CBMs (Bressanelli et al., 2018). In product-oriented servitization, products remain at the core of the offering, and the main drivers of value creation and services are added for supporting product performance. All types of CBMs, except access and performance and industrial symbiosis, involve product-oriented servitization (Table 6). It should be noted that product-focused servitization should be supported by a circular product design for enabling slowing and closing the material loop (Bressanelli et al., 2018; Doni et al., 2019). In use-oriented servitization, products remain at the core of the value creation; however, their usage is what is offered as a service. Hence, product’s ownership remains with the provider who add services for intensifying and extending the product performance. Access and performance CBMs that suggest sharing, leasing, or pooling are examples of use-oriented servitization.

In result-oriented servitization, services take the center stage in the offering and become the primary drivers of value creation (Tukker & Tischner, 2006). Providers retain ownership of the products and offer results/outcomes through a bundle of products and services as-a-service. This approach offers to providers the flexibility to select the products and services to include in the result-based offering (Tukker, 2015). Access and performance CBMs that propose a result or a function without defined physical products involve result-oriented servitization. Scholars argue that this type of servitization incentivizes providers to reduce resource consumption, as resources become cost factors (Bressanelli et al., 2018; Tukker, 2015). Consequently, it offers a significant potential for effective resource and cost management. By focusing on delivering outcomes rather than selling individual products, providers can indeed optimize resource utilization and improve cost-effectiveness. However, prior studies highlighted challenges in measuring the outcomes of result-oriented CBMs and to reaching agreements between customers and providers (Tukker, 2015; Bressanelli et al., 2018).
Table 6: Circular business models strategies and servitization initiatives

<table>
<thead>
<tr>
<th>Business model for slowing the loop</th>
<th>CBM typology</th>
<th>Generic CBM strategies</th>
<th>Possible type of servitization</th>
<th>Use in papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access and performance model</td>
<td>Dematerializing Extending Intensifying Cycling</td>
<td>Usage-focused Result-focused</td>
<td>Paper I and case study in paper II</td>
<td></td>
</tr>
<tr>
<td>Product value extension model</td>
<td>Extending Intensifying Cycling</td>
<td>Product-focused</td>
<td>Paper I and case study paper II</td>
<td></td>
</tr>
<tr>
<td>Classic long-life model</td>
<td>Extending</td>
<td>Product-focused</td>
<td>Paper I and case study paper III</td>
<td></td>
</tr>
<tr>
<td>Encourage sufficiency model</td>
<td>Extending Intensifying</td>
<td>Product-focused</td>
<td>Paper I and case study paper III</td>
<td></td>
</tr>
<tr>
<td>Extending resource value</td>
<td>Extending Cycling</td>
<td>Product-focused (if buyback agreement)</td>
<td>Paper I and case studies in paper II</td>
<td></td>
</tr>
<tr>
<td>Industrial symbiosis</td>
<td>Cycling</td>
<td>Process-focused, no servitization involved</td>
<td>Not considered</td>
<td></td>
</tr>
</tbody>
</table>

Servitization of the offering occurs through a process of business model reconfiguration (Forkmann, et al., 2017a, 2017b; Palo et al., 2019). For instance, according to Forkmann et al. (2017a), servitization is propelled by a process of service infusing and defusing among different actors. These lead to the reconfiguration of the business model’s activity system, including the content, structure and governance of activities. From their perspective, providers primarily infuse services through direct collaboration with customers. Subsequently, after providers have acquired knowledge about the service system and established the content and structure of the business model activities, they withdraw from direct customer interaction. Instead, they engage in a process of service infusion and knowledge transfer with distributors, who become the direct contacts with customers. Forkmann et al. (2017a) consider that providers and distributors continue to collaborate for exchanging technical knowledge and knowledge about customers’ needs. However, the relationship between providers and customers will be limited to cases where customers have specific requirements or where fundamental adaptation of the service systems is required. Accordingly, providers may choose to delegate the governance of activities associated with service delivery to a third party. However, they still endeavor to gather continuous information about customer-related aspects.

Forkmann et al. (2017b) additionally emphasize the importance of adopting a dyadic perspective that considers both providers’ and customers’ views to ensure the successful
infusion of services. Palo et al. (2019) argue that new business model practices, far from product sale, need to be developed for dealing with customers when shifting from product sale to service sale. However, they assert that the shift from product-focused business model practices to service-focused business model practices can give rise to internal contestations. Palo et al. (2019) identify four business areas where practice contestations may emerge, including sales and marketing, the comprehension and advancement of services, knowledge development, and commitment to the value proposition. Neely (2008) considers contestation in business practices as a potential barrier to the financial viability of servitization. In this context, he identifies challenges in modelling and understanding the financial outcomes of servitization.

Similar to the incorporation of circular activities (section 2.4.1), the infusion of services in the offering implies a reconfiguration of the business model, which occurs through a business model innovation process.

2.4.3. Business model innovation

The transition towards CBMs has been addressed in the CBM literature as a process of business model innovation (Geissdoerfer et al., 2018; Frishammar & Parida, 2019; Malefane Sekoboto & Mazanai, 2022). Geissdoerfer et al. (2020, p. 3) define CBM innovation as “the conceptualization and implementation of new business models that can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another. The transformation can affect the entire BM or individual or a combination of its value proposition, value creation and deliver, and value capture elements, the interrelations between the elements, and the value network.” Hence, CBM innovation can lead to the replacement of linear business models by a CBM or the co-existence of both linear and circular business models (i.e., diversification).

In the literature, business model innovation is thought of as a trial-and-error learning process that includes progressive stages of exploration and implementation (Sosna et al., 2010). Business model innovation has also been considered as a re-configuration of system activities that include a redefinition of activities’ content, structure, and governance (Zott & Amit, 2010). Previous studies have identified distinct stages in the CBM innovation process (Bocken et al., 2019; Frishammar & Parida, 2019; Guldmann & Huulgaard, 2020). All the processes of business model innovation could be roughly framed within the framework set out by
Frankenberger et al. (2013), the so-called 4I-framework for business model innovation (see Santa-Maria et al., 2021). The framework includes four iterative stages, initiation (i.e., analysis of the environment), ideation (i.e., generation of the innovative idea), integration (business model development), and finally implementation and evaluation. In line with these stages, Bocken et al. (2019) distinguish three generic phases of business models innovation when reviewing CBM innovation tools, namely ideate and design, implement and test, and finally evaluate and improve. Various tools are needed for supporting these three phases of the transition process, including tools for qualitative and quantitative assessment of CBMs. This hints at the changing needs of decision makers throughout these transition phases (Bocken et al., 2019). Therefore, the three phases of CBM innovation identified by Bocken are adopted in this thesis for examining how financial performance measurement can support the transition towards CBMs (see RQ2).

The first phase of ideate and design, is a conceptualization phase during which possible scenarios of CBMs design are developed (Frankenberger et al., 2013; Bocken et al., 2019). The design of CBM includes the ideation and design of different value dimensions, including the change in the offering (Bertoni et al., 2013; Bertoni, 2019; Pieroni et al., 2019) and the circular activities to be included (Kambanou & Sakao, 2020; Khan et al., 2020). Only one CBM design needs to be selected by decision makers for a potential implementation. The choice of business model design relies on an assessment of different models’ feasibility and viability (Averina et al., 2021; Fornasiero & Sorlini, 2010). This requires a prospective long-term evaluation of the circular strategies implications (Kravchenko et al., 2019). According to Brown et al. (2021), at this initial stage, decision makers are receptive to visualization tools and need to be guided by practical questions for the design of CBMs. However, they need the support of experts to maintain a circularity focus and not be dominated by linear business ideas.

In the second phase of implement and test phase, companies operationalize the selected CBM design, by concretely implementing the circular activities’ content and structure. The implementation phase was considered by Damanpour and Schneider (2006) to be the most complex and challenging phase for decision makers. They argue that the success of this stage relies on the commitment and involvement of all managers, including top- and middle-level managers. It also necessitates incentivizing stakeholders, and particularly customers, to engage in CBMs, CBM implementation also requires high upfront costs and changes in business activities and capabilities, a process which is complex and difficult for established companies (Linder & Willander, 2017). To address the implementation challenges, scholars have
recommended conducting a limited-scale testing of the CBM before its full implementation (Konietzko et al., 2020; Weissbrod & Bocken, 2017). This approach is referred to as an experimentation phase, which involves prototyping the business model (Bocken et al., 2018). CBM experimentation enables the reduction of uncertainties, facilitates learning, and helps bridge the gap between design and implementation (Geissdoerfer et al., 2018; Baldassarre et al., 2020). Then, based on the experimentation outcomes, the business model is adjusted and scaled up (Weissbrod and Bocken, 2017).

In the third phase of evaluate and improve, CBMs performance is retrospectively evaluated through assessing the innovation outcomes and suggesting improvements for aligning realizations and goals (Bocken et al., 2019). Scholars at this stage discussed the importance of Industry 4.0 in measuring and managing the environmental and financial outcomes of CBMs (Mboli et al., 2020; Díaz-Chao et al., 2021). For instance, García-Muiña et al. (2018) suggest using business intelligence and technologies in life cycle assessment. Notably, they emphasize the importance of considering financial performance, in addition to environmental performance, in order to manage the trade-off between economy and sustainability.

In reviewing CBM innovation tools, Bocken et al. (2019) argue that existing literature has provided qualitative tools for supporting the transition phases, often based on business model conceptual frameworks, such as the business model canvas. This highlights the need for interdisciplinary approaches and quantitative tools that support all phases of the transition. In order to realize this aim, future research has been suggested to engage with practitioners though action-oriented research for integrating theoretical and practical knowledge.

2.5. Overview of the theoretical background

This section presents a summary of the theoretical perspectives discussed in this chapter and suggests a framework linking the main theoretical concepts discussed, including CBMs, performance measurement practices, and the transition towards CBMs (Figure 3).

Sustainability challenges have spurred the transition from linear business models to CBM. Compared to linear business models, CBMs suggest the incorporation of circular activities for creating and recreating value. A servitization of the offering is required for enabling circular activities, which also extend the value proposed by CBMs. The changes in the value creation and value proposition dimensions suggest changes in the underpinning of business model

According to Díaz-Chao et al. (2021, p. 2), “Industry 4.0 is a multidimensional and constantly dynamic construct used to define the current process of digital transformation and structural change in industrial firms.”
financial performance, which raises challenges in understanding and measuring business models’ financial outcomes (Gusmerotti et al., 2019; Ghisetti & Montresor, 2020; Werning & Spinler, 2020). Therefore, there is a need for adapting management accounting practices to the new value dimensions in CBMs (Guldmann & Huulgaard, 2020).

Scholars in the management accounting field emphasizes the importance of continuously adapting financial performance measurement to support strategic changes, such as change in business models (Bourne et al., 2000; Bititci et al., 2012; Melnyk et al., 2014). The transition towards CBMs is a business model innovation process that includes three iterative phases; ideate and design, implement and test, and evaluate and improve. This business model innovation process evolves through learning, during which decision makers require various types of information about the outcomes of CBMs. Therefore, the transition towards CBMs needs to be supported by adapted financial performance measurement (Liakos et al., 2019; Kambanou & Sakao, 2020).

In accordance with this aim, the initial step undertaken in this research is to define the key management accounting practices that enable the financial performance measurement of CBMs. Then, this research seeks to examine how financial performance measurement can facilitate the transition towards CBMs. Subsequently, by leveraging the knowledge acquired regarding the financial performance measurement practices of CBMs, this study offers insights into the financial outcomes of CBMs within the context of sustainability-oriented technology development.
Figure 3: Illustration of the link between CBMs, financial performance practices, and the transition towards CBMs.
Chapter 3
Methodology

In this chapter, the research methodology is described and motivated. The chapter begins with presenting the research philosophy, and the research approach. Subsequently, the choice of research strategy is motivated. Thereafter, the research process, including two phases, is illustrated. Further, the data collection and methods for analysis for each of the two phases are described. The chapter ends with discussing the trustworthiness of the thesis’ results.

3.1. Research philosophy

Underlying any form of research is a philosophy of science that informs us of the nature of the phenomenon examined (ontology) and methods for understanding it (epistemology).

(van De Ven, 2007, p. 2)

A researcher’s set of beliefs and understanding of the world determines how he/she perceives and interprets meanings, logical relations, and observations. This thesis follows ontological and epistemological assumptions grounded in the philosophy of critical realism (Archer et al., 2013; Bhaskar, 2013; Bhaskar et al., 1998). Critical realism suggests an objective ontology and recognizes the existence of a real world independent of our cognition (Bhaskar, 1975; Van De Ven, 2007; Wynn & Williams, 2016). The philosophy acknowledges a stratified ontology comprising structures, mechanisms, events and experiences (Wynn & Williams, 2016). In this thesis, the main structures under investigation are financial performance measurement and CBMs, which both exist in the real world irrespective of our perception. Both structures contain substructures, such as the practices involved in financial performance measurement and the value created, delivered, and captured by CBMs.
Critical realism assumes that the real world comprises mechanisms defined as “the way of acting of things” (Bhaskar, 1975, p. 14). The enactment of one or more mechanisms leads to events that can be experienced in each context. Ontologically, critical realism assumes that reality is dynamic and variable, and that it exists in an open system with no clear boundaries (Bhaskar et al., 1998; Bhaskar, 2020). Therefore, the observed events are contextual, and a given set of observations may not be valid in different contextual environments or over time (Sayer, 1992). This means that our understanding of reality is relative and depends on our observations within a specific context and time period. Further, our understanding is influenced by previous theories developed based on scientific inquiries (Wynn & Williams, 2016). Consequently, generalizations derived from critical realist research concern a probabilistic understanding of truth, rather than an absolute truth (Bisman, 2010). This thesis also considers that the financial outcomes of CBMs reflect the effectiveness and efficiency of actions under predefined conditions, in a specific context, and at a given point in time. The observed reality related to financial outcomes might change with changes in the environment— for instance, with changes in the offerings or in customer-perceived value.

Critical realism adopts a subjectivist epistemology and seeks to describe reality by analyzing the experiences observed and interpreted by participants, along with other forms of data (van de Ven, 2007; Wynn & Williams, 2016). Thereby, it seeks to explain the mechanisms that generate events by identifying and understating the causes of certain events (Bhaskar, 1975). The outcomes of this research stem from the analysis and interpretation of the collected data, which is subsequently discussed in the light of existing literature.

3.2. Research approach

Academic literature usually distinguishes two types of research approaches, namely qualitative and quantitative approaches. This distinction is based on the information used for studying the researched phenomena. While quantitative studies rely on quantitative data (i.e., numbers and figures), qualitative studies use qualitative data (i.e., words, narratives, and sentences), and the choice of either approach can be an epistemological issue (Blumberg et al., 2014). Within the critical realist framework, researchers recognize the suitability of both qualitative and quantitative methodologies for investigating the underlying mechanisms that influence actions and events (Bisman, 2010; Healy & Perry, 2000). The research aim and the required information are factors to consider when choosing between the two approaches (Saunders et al., 2009; Blumberg et al., 2014).
The overall aim of this thesis is to develop knowledge about the financial performance measurement of CBMs through understanding the financial implications of the transition towards CBMs. This requires collecting information about the underpinnings of CBMs’ financial performance and the practices used for assessing CBMs’ financial outcomes. Knowledge is transactionally created (in epistemological terms), and the analysis is rather interpretative, seeking to make sense of figures and to explore what drives changes and how. Given this aim, a qualitative approach was deemed suitable for several reasons.

First, the qualitative approach is suggested because it is suited to explorations of substantial, yet understudied areas (Strauss & Corbin, 1998; Merriam, 2002), something which is the case for the financial performance measurement of CBMs (further described in Paper I). Second, a qualitative approach allows conceptualization through understanding and discovering concepts and relationships in raw data, and through organizing these into an explanatory scheme (Strauss & Corbin, 1998). This is required for understanding the financial implications of the transition towards CBMs, including changes in financial constructs and for organizing these under clear categories of costs, revenues and cash flows when developing measurement. Third, through flexible and semi-structured methods, qualitative research offers the opportunity to have interactive and naturalistic discussions with the informants, in order to better understand the meaning of words and the relationship between them (Saunders et al., 2009). The exploration of unexplored research areas is mainly supported by qualitative studies (Blumberg et al., 2014). In this research, qualitative studies allow exploring changes in financial constructs and gaining understanding of the drivers, as well as making links between different constructs for developing the performance measurement process. Fourth, data about financial performance is often considered to be sensitive information that companies are cautious about sharing with external parties. Utilizing a qualitative approach enabled me to establish familiarity with participants and build trust, which in turn facilitated access to the data necessary for the study.

3.3. The role of theory

The research in this thesis starts with a deductive approach, applied through a systematic literature review that contributed to refining the research aim and shaping the research strategy. Findings from the literature review also served as a basis for the empirical investigation. For instance, the later empirical studies aimed to answer research questions suggested in the research agenda developed based on the literature review. An abductive approach was adapted in the empirical phase, allowing the researchers to move back and forth between data and
This kind of process was described by Dewey (1910, p. 79) as “a double movement of reflective thoughts”, whereby the researchers alternate between inductive and deductive approaches for problem-solving. Theory was indeed considered as a reference point for making sense of the observed data, by comparing observations to findings from previous studies. Furthermore, the conclusions derived from the empirical data are analyzed and discussed based on theory.

The abductive approach is an important aspect of the critical realism philosophy underlying this thesis, since phenomena observed in the present are explained by underlying mechanisms that might have produced it (Saunders et al., 2009). Insights about the underlying mechanisms also find support in prior literature. For example, the financial challenges observed due to the change in CBMs’ offerings has been explained in this thesis by the servitization mechanism and its related challenges (see e.g., Palo et al., 2019).

3.4. Research process

The research design is considered as the plan and structure of investigation that is followed for answering the research questions. The research in this thesis could be divided into two phases and three studies, which are the foundations of the three papers included in this thesis (as illustrated in Figure 4).

**Figure 4:** The research design

In the first research phase, a systematic literature review was conducted to gain deep knowledge about the research field and to refine the research aim. Therefore, the review aimed to investigate the extent, context, and content of the financial performance discussions in the CBM literature and in relation to the transition towards CBMs. Based on the review, a future research agenda was developed, including possible research questions that can be addressed...
for developing knowledge about CBMs’ financial performance. The systematic literature review resulted in Paper I. One of the main results from the literature review is that literature is lacking both regarding empirical studies and guidelines for developing knowledge on the prospective financial evaluation of CBMs. This motivated further the empirical studies pursued in the second research phase.

The second phase of the research consists of two action case studies (see Braa & Vidgen, 1999). In both cases, the study aimed not only to explore the researched phenomena, but also to contribute actively to financial performance measurement for companies’ CBMs. The two examined cases involve large OEMs in the Swedish manufacturing industry that are undergoing the transition towards CBMs. However, they are at different stages of the transition process and operate within different contexts. Furthermore, the case companies are transitioning to different types of CBMs. The first case company (Case 1) focuses on the design and implementation of a result-oriented CBM, involving retained product ownership and a transfer of operational costs and risk from the customer to the provider. The second case company (Case 2) has implemented an encourage sufficiency CBM, aiming to reduce end-user energy consumption. To improve its CBM, this company is exploring the implications of maintenance strategies for further improving its sufficiency approach. The diverse types of CBMs and transition phases give rise to different challenges and provide an opportunity to explore the financial performance measurement of CBMs from various perspectives.

3.5. Phase 1: Systematic literature review

The systematic literature review is considered as an important tool for identifying, evaluating, and interpreting available research relevant to a particular topic area (Snyder, 2019; Mengist et al., 2020). To guarantee transparency and reproducibility, the review of literature followed the guidelines and steps suggested by Tranfield et al. (2003). The framework includes three steps: (1) planning the review, (2) conducting the review, and (3) reporting and dissemination.

3.5.1. Planning the review

The first step aims to set the scope for and to develop a protocol for managing the review process. This includes setting criteria for inclusion and exclusion of studies assessed and establishing a search strategy for identifying relevant studies. The literature search covered papers published until 2021. The main characteristics of the review plan are described in Table 7.
Table 7: Description of the review characteristics

<table>
<thead>
<tr>
<th>Search period</th>
<th>Fall 2020 and re-checked spring 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data base</td>
<td>Scopus and Web of Science</td>
</tr>
<tr>
<td>Type of papers</td>
<td>Empirical and conceptual academic articles published in English</td>
</tr>
<tr>
<td>Subject area</td>
<td>Circular business models in manufacturing companies</td>
</tr>
</tbody>
</table>

The most diffused scientific databases in the CBM research field, Web of Science (WoS) as well as Scopus (Oliveira et al., 2018; Sarja et al., 2021), were used in the literature search. The review included empirical and conceptual academic papers published in English—hence, review papers, books and book chapters, and conference papers were excluded. Only papers investigating the business level (or micro-level) of the CE transition and concerned with the manufacturing industry were included in the review. Similarly to what was done in previous reviews in the field (e.g., Fornasiero & Sorlini, 2010; Salvador et al., 2020), umbrella terms were utilized as keywords to ensure optimal literature coverage (Hopkinson et al., 2018). The terms used were “circular business model,” “circular economy,” and “business model.” Boolean operators AND and OR were utilized, resulting in the following search string: “circular business model” OR (“circular economy” AND “business model”)

3.5.2. Conducting the review: data collection and analysis

Figure 5 describes how the review was conducted for the selection of the final sample. The initial search resulted in 934 records (608 from Scopus and 326 from Web of Science). After the elimination of duplicates (192 records removed) and a screening on the basis of titles and abstracts (454 records removed), 288 papers remained for full screening. An additional 147 papers were excluded after the screening of full papers and 141 papers were thereafter retained for deeper analysis. Based on the analysis, four papers were added by a snowballing process, leading to a final sample of 145 papers. Figure 5 displays the process of paper selection.
In order to allow a descriptive analysis, a structured screening of the articles was conducted based on standard dimensions such as authors, title, journal, publication year, and research contribution. Additionally, a visual map was developed to delineate the main terms addressed in the selected literature. Microsoft Excel spreadsheets were then used for analyzing and coding the final sample. Papers were first classified according to their topics and contributions to the transition phases. Based on Bocken et al. (2019), the three phases considered were: (1) ideate and design, (2) implement and test, and (3) evaluate and improve. Then, data on financial performance and its underpinnings, if existent, were identified and coded in an Excel sheet. Codes used for classifying the financial aspects were revenues, costs, cash flows, financial indicators, financial performance, financial drivers, and financial barriers. Finally, to assess the extent of financial discussion, all papers of the final sample were graded using a ratio scale measurement, including six scales ranging from 0 to 5 (Figure 6). To ensure validity and reliability of the rating process, 25 articles from the final sample (17%) were randomly selected and evaluated independently by two researchers. Strength of agreement as measured by Cohen’s Kappa was then calculated, resulting in a 74% level of inter-rater agreement, which is substantial according to Landis and Koch (1977). In case of disagreement on the grading, the researchers settled on the lowest grading.
3.5.3. Reporting and dissemination

In the reporting and dissemination step, results from the descriptive analysis were displayed and results from the content analysis were presented. In the analysis, special focus was placed on studies graded 3 to 5, since they included discussion of financial aspects. The results of the literature review are described and discussed in Paper I and in chapters 4 and 5 of this thesis.

3.6. Phase 2: Action case studies

The aim of the empirical studies in this thesis is to develop knowledge about the financial implications of the transition towards CBMs and about financial performance measurement for CBM evaluation. This implies, first, understanding changes in the financial constructs by comparing the traditional business model (linear) to CBMs. Second, the empirical aims suggest taking actions for developing financial performance measurements. Therefore, the empirical phase of the research builds on action case studies. The action case study is a hybrid research method that uses components from action research and case study research (Braa & Vidgen, 1999). Halecker (2015) describes this hybrid method as a mix of change (action) and understanding (case study) that is useful for interpreting a case study in depth and making interventions based on past time and real time data collection within the distinct environment of the studied organization (Figure 7). According to Halecker (2015), action case studies embrace an abductive approach, combining elements of deduction and induction. They have two primary outcomes: an action outcome that manifests as a beneficial intervention to address organizational concerns, and a research outcome that contributes to answering research questions and advancing existing theories. This enables the intended theoretical and practical contributions aimed by this thesis.

The action case study approach integrates components from both case study and action research methodologies. However, what makes the method different from both alternative research

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**Figure 6:** The grading process

---

**Start the grading**

- Does the paper include any financial aspect?
  - Yes
  - No
  - Rank 0

- Does the paper discuss the specific financial aspects?
  - Yes
  - No
  - Rank 2

- Does the paper relate the specific financial aspects to the financial performance?
  - Yes
  - No
  - Rank 3

- Does the paper have financial performance as the main focus?
  - Yes
  - No
  - Rank 4

**End of the grading**
methods (i.e., case study and action research) is the position and role of the researcher (Halecker, 2015) (Figure 7). In contrast with case study research, the researcher in an action case study has an active role and can participate in the studied organization and accompanies targeted change, but without taking a central position as in action research (Braa & Vidgen, 1999). In both case studies, I have accompanied companies in developing financial performance measurement and participated actively in developing a fair understanding of CBMs’ financial outcomes without being involved in decision stages. Collaboration between practitioners and academics during an economic transition phase is essential for fostering knowledge co-creation and integrating diverse perspectives.

Halecker (2015) advocates the use of action case studies based on abduction for examining aspects related to business model innovation phenomena. The action case study was also deemed to be an appropriate methodology in this study, for several reasons. First, the understanding of changes requires embeddedness for identifying changes at an interconnected level of analysis (Pettigrew, 1990). Such embeddedness is allowed by performing an action case study, permitting an understanding of phenomena in their natural setting, and enabling interactions, establishing connections at different levels for identifying changes (Halecker, 2015). Second, action case studies allow participating in solving concrete problems by proposing small-scale changes (see e.g., Ottosson & Björk, 2004). This is in line with the purpose of this study, aiming to identify key practices for the financial performance measurement of CBMs and to explore how the financial performance measurement of CBM
can support the transition process. Thereby, this thesis intends to bridge a practical gap related to the understanding and evaluation of the financial outcomes of CBMs.

In essence, an action case study assumes the existence of a problem in the real world and aims to suggest a potential solution for it. This aligns with the fundamental principles of critical realism, which presuppose that knowledge is constructed through individuals’ perceptions of reality and their engagement with existing theories (Wynn & Williams, 2016). Critical realism recognizes that our understanding of reality is shaped by social structures such as those constituted by practitioners and coworkers (Healy & Perry, 2000). Therefore, critical realism suggests how to empirically corroborate our understanding of reality and of the contextual conditions under which the studied mechanisms were enacted. An action case study indeed facilitates a dynamic collaboration between practitioners and researchers, fostering the development of knowledge that enhances our understanding of reality. Critical realism is associated with challenging and falsifying established knowledge and is not primarily focused on adopting a fixed position in the world, but rather on critically examining and transforming the world (Bisman, 2010). The action case study approach aims to solve practical problems by implementing changes in the real world. Accordingly, the action case study is considered an appropriate research method, given the critical realist philosophy underpinning this research.

3.6.1. Case selection

The case companies studied in this thesis are large OEMs operating within the Swedish manufacturing industry. Choosing manufacturing companies is motivated by the considerable challenges that prior literature has highlighted for these companies’ transition towards CBMs (Sousa-Zomer et al., 2018; van Loon & van Wassenhove, 2020). Indeed, CBMs entail the integration of products with services, leading to a shift from manufacturers’ traditional focus on product sales to the focus on integrated products and services. This shift in the value proposition necessitates significant changes in long-standing organizational culture and established business practices, which raises contestations and challenges for manufacturing companies. Furthermore, the transition towards CBMs requires changes in product design and in processes due to the involvement of reverse logistics. This requires financial resources and the development of new capabilities, posing further challenges for manufacturers. Despite these challenges and considering the important role that they play in the economy, they are called to take the lead in the transition towards a circular economy (Parida et al., 2019).
Suitable cases within the Swedish manufacturing industry were selected based on several criteria. First, the selected case companies are established manufacturers. They are considered as typical for the manufacturing industry which allows gathering informative data (Yin, 2009). Second, the selected case companies have been working with linear business models and are engaged in different phases of the transition towards CBMs (as defined by Bocken et al., 2019) (Figure 8). Companies have different needs and face different challenges in financial performance measurement when navigating the different transition phases. As indicated by the findings from Paper I, the financial performance measurement of CBMs necessitates adopting different perspectives, based on the specific transition phase which companies are undergoing. Therefore, investigating cases in different phases of the transition is advantageous, and can contribute knowledge for facilitating the transition towards CBMs. Third, both case companies face challenges in the evaluation of the financial performance of CBMs, and they are motivated to develop knowledge in this area, which supports the action approach taken in the case studies. Fourth, the selected case companies are transitioning to different types of CBMs that include active products (i.e., high voltage motors and electric equipment). In contrast with passive products that do not consume energy and material in the use phase, passive products have financial implications for the use phase that are worth investigating more closely (Kaddoura et al., 2019).

Two empirical cases were selected for this study. The first case company (Case 1) has recently engaged in electrification and is at an early stage of CBM design. The circular strategies being considered by the company aim to offer access and performance, and to extend products and resource use (see Table 5). The aim of the first study was thus to understand the financial implications of CBMs with retained ownership from providers’ perspective and to develop
guidelines for prospective financial measurement based on a life cycle costing approach (LCC). The study of this company considers the specific context of electrification when investigating the financial performance of CBMs with retained ownership. For reaching decarbonization goals, several industries have engaged in electrification and in the transition towards CBMs while moving forward in their sustainability agenda. Therefore, it is interesting to study the financial implications of CBMs in this specific context. The first empirical study resulted in Paper II.

The second case company (Case 2) is a manufacturer of high-voltage electric motors. The manufactured motors are active products which, compared to passive products, consume considerable resources (in this case, a big amount of electricity) during their use phase. The company has already established CBMs with a classic long-life for motors (more than 25 years). Additionally, motor design has been improved so that the motors can perform with better efficiency and consume less energy in use. To further encourage resource sufficiency, the company is continuously working on improving the efficiency of electric motors. Furthermore, the company is implementing maintenance strategies for enhancing the reliability of the motors and is intensifying the product and material use. The aim in the second study was, then, to investigate how financial performance measurement can support companies enhancing the potential of their implemented CBMs. Measurement of the total cost of ownership (TCO) is therefore developed and used for investigating the potential value that the circular strategies deliver to customers (i.e., maintenance). The second empirical study resulted in Paper III.

3.6.2. Anonymity

The studied companies and the managers who participated in the data collection have been granted anonymity. Both case companies are transitioning to CBMs, navigating the design, experimentation, or upscaling phases. Information about companies’ future strategic orientations and potential CBMs at such an early stage is deemed confidential. Furthermore, the collected data represents an estimation of the future financial performance due to the implementation of CBMs. Even if the figures were not published in the studies, discussions, and conclusions about how the studied companies might perform in the future are sensitive. The anonymity of the companies and managers might hinder the replicability of the study; however, it was a prerequisite for both studies. Accordingly, in this thesis, the first studied company is addressed as Case 1 and the second studied company as Case 2. Additionally,
managers who participated in the data collection are denoted by their positions within their respective companies instead of names. This is considered sufficient for understanding the different roles they have within the studied companies.

3.6.3. Data collection

This thesis employs triangulation of methods and data sources for investigating the researched phenomenon from different perspectives and increasing the validity of the conclusions (Creswell & Miller, 2000). Triangulation of methods allows a deeper explanation of the studied phenomena and reduces subjectivity in understanding reality. Therefore, it has been recommended in the critical realist approach (van de Ven, 2007). In the first phase, the data was collected through a literature review and academic papers were the only sources of data. In the second phase, the primary mode of empirical data collection (i.e., in the action case studies) was through qualitative interviews with managers involved directly in decision-making related to the transition towards CBMs. The interviews were complemented by observation, workshops, and additional secondary data from internal sources (including for instance presentations and previous financial calculation) and external sources (including for instance press releases and web sites). The information available from secondary sources was also discussed with managers to get updated and relevant data through triangulation. The different data sources for the second phase are described in the next sections.

3.6.3.1. Qualitative interviews

Qualitative interviews are considered as efficient methods for collecting rich empirical data, exploring points of interest, and clarifying and confirming meanings (Eisenhardt, 1989; Saunders et al., 2009). This data collection method is also commonly used in research about CBMs when exploring the challenges and lessons learned from the transition towards CBMs (Oghazi & Mostaghel, 2018; Hofmann & Jaeger-Erben, 2020). In both empirical studies done here, qualitative interviews were deemed to be an appropriate method for data collection for several reasons. First, interviews allow gathering data about facts and opinions from people who have various roles within the organization. This serves the aim of the empirical studies, since for investigating practices engaged in CBMs’ financial performance measurement, there is a need to understand the implications that changes in offering have for business activities. Therefore, engaging in discussions with individuals involved in strategic change is essential to grasp the impact of the transition towards CBMs on various aspects of business activities. Second, along with the action case study approach, the development of financial performance
measurement requires the collection of a diverse set of data that is dispersed across different parts of the organization. To collect this data, it is necessary to hold discussions with individuals representing different organizational entities.

Researchers distinguish between different types of research interviews based on the level of standardization or structure in research interviews and the number of participants and interview modes (Saunders et al., 2009). In line with the exploratory approach, this research uses non-standardized types of interviews, including semi-structured and focused interviews. The semi-structured interviews were based on key open-ended questions and themes. The business model dimensions and characteristics, as well as the relevant financial constructs (such as costs, revenues, and cash flows), are examples of the themes used. The use of open-ended questions in the interviews fostered an interactive environment that allowed combining practical and theoretical perspectives. Furthermore, this method enhanced the co-creation of knowledge which facilitated the understanding of CBMs’ implications and the development of financial performance measurement tools. To narrow the focus, the semi-structured interviews were often followed by focused interviews aiming to ask specific questions, still open-ended, to further clarify or dig deeper into aspects identified through the semi-structured interviews. In both cases, two-to-one and two-to-many (group interviews) participants were involved in the interviews. Such an approach allowed for a productive discussion as participants responded to questions and reflected on others’ perspectives. Most of the interviews were conducted online (via Microsoft Teams). This was more convenient for interviewing a greater number of people from both case companies despite geographic distance. All interviews were recorded and transcribed, and the main insights from the interviews were then summarized. Results from the data collected were also communicated to the interviewees and they were asked to confirm the data gathered from interviews.

3.6.3.2. Workshops

Workshops were organized at both companies at different stages of the data collection. At an initial stage, workshops were initially organized in each of the companies to refine the empirical study design and to agree upon the scenarios to be considered for studying the financial implications of CBMs. Then, workshops were held for co-developing the financial performance measurement method being assessed. In both cases, the model was initially developed by the researcher(s) involved in the study based on theoretical knowledge and insights gained from interviews. The developed models were then discussed and refined, based
on feedback and suggestions from participants during the workshops. Multiple workshops were organized as the process of developing performance measurement iterated between empirical explanations and theoretical foundations.

3.6.3.3. Observation

Marshall & Rossman (1989, p. 143) define observation as "the systematic description of events, behaviors, and artifacts in the social setting chosen for study." At an initial stage of the empirical studies, a site visit was organized for gaining knowledge about the products that are included in the CBM’s offering and the associated manufacturing process. Before discussing the business model and its financial aspects, it was important to see how products are designed and manufactured and to get familiar with the model’s social setting. Blumberg et al. (2014) suggest using observation for enhancing other sources and for sharing tacit knowledge. In both cases, notes have been taken and observations were complemented with discussions with participants from the company.

3.6.3.4. Document-based studies

The primary data was complemented with secondary data from internal sources (i.e., internal presentations, manuals, and previous calculations) and external sources (i.e., the companies’ web sites, press releases, and published annual reports). Triangulation with other sources of data (e.g., interviews) was used for assessing the accuracy of the secondary data.

3.6.4. Data collection in Cases 1 and 2

Tables 8 and 9 below give an overview of the data collection process in Case 1 and Case 2 respectively. The first column in the tables indicates the data collection method used. The second column depicts the number of times a data collection method is used. The third column present the average duration of each data collection activity. The last column indicates the researchers who participated in data collection activities.
Table 8: Overview of the data collection in Case 1

<table>
<thead>
<tr>
<th>Activity</th>
<th>Quantity</th>
<th>Duration</th>
<th>Participating researcher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data collection - Case 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interviews</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head of Electromobility solution sales</td>
<td>12</td>
<td>45 min- 1.5 hours</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Head of business control for service and solution</td>
<td>2</td>
<td>1-1.5 hours</td>
<td>A. Kanzari, H. Nehler</td>
</tr>
<tr>
<td>Head of sales and management of energy solutions</td>
<td>2</td>
<td>45 min-1 hour</td>
<td>A. Kanzari, H. Nehler</td>
</tr>
<tr>
<td><strong>Observation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site visit</td>
<td>1</td>
<td>2 hours</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td><strong>Workshops</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head of Electromobility solution sales</td>
<td>2</td>
<td>1 hour</td>
<td>A. Kanzari, H. Nehler, and J. Rasmussen</td>
</tr>
<tr>
<td>Product development researcher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chief project managers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head of Electromobility solution sales</td>
<td>1</td>
<td>4 hours</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Product development researcher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chief project manager</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head of Electromobility solution sales</td>
<td>1</td>
<td>1 hour</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Head of business control for service and solution</td>
<td>2</td>
<td>1.5- 2 hours</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Head of Equipment as Service</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 9: Overview of the data collection in Case 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Quantity</th>
<th>Duration</th>
<th>Participating researcher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Collection - Case 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interviews</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global product manager</td>
<td>1</td>
<td>2 hours</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Service responsible unit</td>
<td>1</td>
<td>1 hour</td>
<td>A. Kanzari, H. Nehler, J. Rasmussen</td>
</tr>
<tr>
<td>Global R&amp;D manager</td>
<td>1</td>
<td>1 hour</td>
<td>A. Kanzari &amp; H. Nehler</td>
</tr>
<tr>
<td>Global product manager</td>
<td>20</td>
<td>1-2 hour</td>
<td>A. Kanzari and H. Nehler</td>
</tr>
<tr>
<td>Product manager - service responsible unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Observation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site visit</td>
<td>1</td>
<td>3 hours</td>
<td>A. Kanzari, H. Nehler, J. Rasmussen</td>
</tr>
<tr>
<td><strong>Workshops</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global product manager</td>
<td>2</td>
<td>1-2 hours</td>
<td>A. Kanzari, H. Nehler, J. Rasmussen</td>
</tr>
<tr>
<td>Product manager - service responsible unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global product manager</td>
<td>1</td>
<td>1-3 hour</td>
<td>A. Kanzari, H. Nehler, J. Rasmussen</td>
</tr>
<tr>
<td>Product manager - service responsible unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global R&amp;D manager</td>
<td>6</td>
<td>1-2 hours</td>
<td>A. Kanzari, H. Nehler</td>
</tr>
</tbody>
</table>

3.6.5. Data analysis

In both cases, a thematic analysis was used to analyze the qualitative data collected. The thematic analysis is considered as a common approach for qualitative data analysis (Clarke & Braun, 2006). The thematic approach has been described as a method that involves examining the data set to identify, analyze, and report repeated patterns (Clarke & Braun, 2006). Several frameworks and guidelines have been published on how to conduct thematic analysis (Aronson, 1995; Boyatzis, 1998; Attride-Stirling, 2001; Terry et al., 2017). In this thesis, the qualitative data analysis follows the guideline defined by Clarke and Braun (2006) and Terry et al. (2017).
The guideline includes six steps and suggests iterations between these steps for defining and refining themes. The six steps are: familiarizing oneself with the data, generating codes, constructing themes, reviewing potential themes, defining and naming themes, and producing the manuscript.

For getting familiar with the data, Terry et al. (2017) recommended immersing oneself in the data and then searching out patterns. Immersing oneself requires that the researcher read the data actively and engage with it by being observant, noticing patterns, and starting to ask questions. Therefore, in the first stage, for getting acquainted with data, I listened again to the recorded interviews and transcribed the verbal data. Gibson & Brown (2009) consider transcription as a form of representation of the gathered data that is not only a matter of writing down what people said, but also involves making analytic judgements and choosing to focus on certain features of the piece of talk. While transcribing, I highlighted important data, and took notes on important insights gained through the interview. The notes served as a reference point for remembering the transcript content and were also useful for planning for future meetings and preparing follow-up questions for getting a deeper understanding of the previously collected data. While reading and re-reading the transcript, relevant data was highlighted, and comments were added in the margins indicating potential codes (for example change in manufacturing cost and new cash flows out).

In the second stage, each of the interviews was coded by generating labels for specific segments of the dataset that provided potential answers to the research questions (Terry et al., 2017). At that stage, I tried to keep a sufficient level of detail for not losing the data’s context (Bryman et al., 2007). The coding process was iterative, and some codes were revised later in the process when gaining further understanding of the data.

In the subsequent stage, I revised the codes and gathered codes having common aspect(s) under the same clusters. Structuring and defining themes was not a random process, but rather guided by my motivation to find answers to the research questions (Terry et al., 2017). Once all of the themes were structured, I started to identify connection between the themes. In the next stage, I reviewed all the themes and ensured that they were representative of the codes included and that they also were representative of the segments of data. At this stage, some themes were merged, and other themes were divided into sub-themes. Based on this stage, themes were clearly defined and named. The name attributed to each of the themes captures the common aspect identified in the codes and in the underlying data segments (Table 10 and 11). The
overarching themes provide answers to the researched phenomena and were subsequently discussed with participants from the case companies. At the last stage, themes were connected to create a complete story that answered the research questions.

Table 10: Example of the coding, Case 1

<table>
<thead>
<tr>
<th>Example of quotation</th>
<th>Codes</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>It's actually so that the battery is in total will cost almost exactly the same. But the performance of the machine will drastically improve because we will have 50% more energy in the next generation […]. I would say most of the customers even will come to a full working day which means that they don't maybe have to invest this much in charging equipment so the system cost might go down.</td>
<td>The financial implication of technology innovation</td>
<td>Change in cost structure</td>
</tr>
<tr>
<td>But the thing is that we are not selling the equipment, we are not renting the equipment. We are selling what the equipment can do. So, like we used to say that the customer wants to buy a hole and we are trying to sell a drill. But he doesn't want to buy the drill. He wants to buy the hole. […] They are not buying the equipment. I mean we can basically send in 200 men with a shovel to do the same job</td>
<td>Servitization of the offering</td>
<td>Change in the offering</td>
</tr>
<tr>
<td>Then of course, if you have an electric machine, you have the battery swaps like you showed in your calculations and the residual value in the end. And then you have a cycle. So, I think it's important to look at comparing apples to apples and this is also a learning of a mindset that we have.</td>
<td>Considering distinct asset lifecycle cycles in measurement</td>
<td>Change in measurement practices</td>
</tr>
<tr>
<td>Because we cannot do it ourselves. If we could have done it ourselves, it would be less. Then we don't have to go further with the dealer, but we do because we don't have the people and the organization, and the logistics to take care of it.</td>
<td>Need for new capabilities</td>
<td>Change in cost structure</td>
</tr>
<tr>
<td>We need to talk with the customer. We need to have a meeting with the customer, and we are into this together. So, it's really a partnership in a different way. we are not that used to doing it and this is the price we need to pay to get into, to climb the value chain.</td>
<td>The need for developing service capabilities which involve additional costs</td>
<td>The implication of servitization</td>
</tr>
<tr>
<td>We should climb the value chain in certain areas to learn more about the customer because of course there is a risk. As a company we cannot just sit in the back and ignore what is happening out there in the market.</td>
<td>The implication of offering servitization</td>
<td>Risk management</td>
</tr>
<tr>
<td>It also gives them, besides the guarantee on the uptime, I mean they know exactly what they can expect from us. And they know that they have a partner that is dedicated because if he is not dedicated, he will not just lose money. He would get penalties for disturbing production.</td>
<td>Peace of mind</td>
<td>Customer-value creation</td>
</tr>
</tbody>
</table>
Table 11: Example of the coding, Case 2

<table>
<thead>
<tr>
<th>Example of quotations</th>
<th>Codes</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is more of taking care of their problem rather than getting more money for, the scrap.</td>
<td>Non-financial benefit</td>
<td>End of life management</td>
</tr>
<tr>
<td>If the fault happens in a place where it's possible to repair on site, then this might even take a long time for repair. But if it's on the other hand one that you need to take to get a new stator that is essentially to take out the stator or take out the coils of the stator then order new coils, insert new coils, then five weeks is very little time.</td>
<td>Mean time to repair</td>
<td>Unplanned downtime cost</td>
</tr>
<tr>
<td>I mean, it's like we have two recommended spare part packages, one is only the semiconductor spare parts, the other one is that plus the bearing spare parts and some air filters. So, it's then of course you can order absolutely anything as a spare, but that's not so common. But these are typically the ones and the costs for these are probably very minimal, according to the larger TCO.</td>
<td>Spare parts costs</td>
<td>Initial cost</td>
</tr>
<tr>
<td>For the winding, you most probably take the whole motor to a workshop and disassembly it and repair or somehow replace I should say the windings or the full state or and then putting it back and we're talking significant cost.</td>
<td>Repair costs</td>
<td>Unplanned downtime cost</td>
</tr>
<tr>
<td>And if you have a, I mean, whatever process industry that has a yearly shutdown of two to four weeks, then you most probably will handle it then and not wait one more month because you had a few 1000 hours or what or a few 100 hours left but then wait one full year ahead where you have for sure exceeded the interval.</td>
<td>Planned preventive maintenance cost</td>
<td>Planned downtime cost</td>
</tr>
<tr>
<td>The power that is spinning the compressor, that power is not consumed in the motor, it's delivered from the motor. It's a smaller number than you put into the motor, but it's still not consumed by the motor. It's the losses that are consumed by the motor.</td>
<td>Energy cost</td>
<td>Cost of operating</td>
</tr>
</tbody>
</table>

3.7. Assessment of the research quality

The trustworthiness or rigor of a study refers to the level of confidence one can have in the data, interpretation, and methods employed to ensure the quality of the study (Pilot & Beck, 2014). Positivists emphasize reliability, validity, and generalizability as main criteria for assessing the quality of qualitative research. While reliability refers to stability of the results, validity includes the ability to test hypotheses (internal validity) and the ability to extend the results obtained to a wider setting (external validity) (Lincoln & Guba, 1985; Guba & Lincoln, 1994). In qualitative research, especially when based on subjectivist epistemology, reliability and validity retain importance, but are interpreted differently (Golafshani, 2003). Generalizability, in the statistical sense, is not considered a concern in qualitative research, although theoretical generalizability is important (Bisman, 2010; Golafshani, 2003). In the absence of statistical measures in qualitative settings, replicability becomes the main criteria.
for research reliability (Bisman, 2010). Qualitative research therefore tends to consider trustworthiness, credibility, transferability, dependability, and confirmability as a reconceptualization of the validity and reliability criteria (Lincoln & Guba, 1985). The assessment of research quality should take into consideration the philosophy underpinning the research (Spencer et al., 2003). From a critical realist perspective, Bisman (2010) argues that the common criteria for establishing validity in critical realist research are criticality and triangulation, trustworthiness, and analytical generalization. The assessment criteria suggested by Bisman (2010) are reconceptualization of the criterion identified by Lincoln & Guba (1985) for qualitative research. However, Bisman (2010) focuses more on the link between research quality and the epistemological and ontological foundations of critical realism. Therefore, the quality of this research will be assessed based on Bisman (2010).

### 3.7.1. Criticality and triangulation

The notion of criticality embodied within critical realism is often aligned with the falsification of what is considered as believed knowledge (Collier, 1994). Critical realist research is thus not concerned with merely adopting a stance in the world, but with critiquing and altering the world by questioning the mechanisms and events that contribute to a particular reality (Bisman, 2010). This thesis argues that conventional performance measurement practices do not grasp the financial value captured by CBMs and suggests new practices that are adapted to the CBM context. Additionally, following an action case study approach, financial performance measurement was developed based on defined practices and used for evaluation of CBMs. Based on information provided through financial performance measurement, actions that could improve CBMs' financial outcomes have been suggested. Thereby, this research proposed tangible changes that can be implemented in the real world to improve the financial performance of CBMs.

Criticality assumes that researchers, regardless of what is researched, must apply criteria to assess theory, and acknowledges that the data collected is value-laden or theory-laden (Bisman, 2010). The sources of data collection have been described in this thesis. In the first phase of the research, a systematic literature review was conducted to understand how financial performance and its underpinnings were discussed in the CBM literature. I sought to describe the steps used in reviewing the literature as thoroughly as possible. The systematic literature review aimed to answer why financial barriers emerge throughout the transition towards CBMs. Therefore, an assessment of the extent and content of previous studies was done.
according to predefined criteria. In Paper II, the financial performance measurement practices were based on a conceptualization that is theory-laden. However, the theories used were selected based on their appropriateness to explain the researched phenomena. These practices were then discussed with practitioners and tested in a practical setting, which allowed assessing their appropriateness.

Criticality suggests triangulation of research methods for capturing as much as possible of reality (Bhaskar et al., 1998; Healy & Perry, 2000; Sayer, 1992; van de Ven, 2007; Wynn & Williams, 2016). Triangulation has also been encouraged in critical realist research in the management accounting field (Modell, 2009, 2010). Triangulation is suggested as a way of reducing the bias in research and studying the researched phenomena from multiple perspectives (Wynn & Williams, 2016). Triangulation has been considered by Golafshani (2003) as an important criterion for enhancing the quality of qualitative research. A triangulation of research methods can include the use of several methods in one study, the use of multiple sources of data within one method, the use of multiple theoretical perspectives, corroboration with the research subject, an understanding of the phenomena built by several researchers and using different methods (Bisman, 2010). This thesis used these different types of triangulation. Indeed, this thesis was based on different research methods, namely systematic literature review and action case study. Furthermore, multiple sources of data have been used in the action case studies, including the interviewing of multiple participants, in addition to the use of theory in an iterative fashion. Additionally, different theoretical perspectives have been used in this research—including, for instance, circular economy and CBMs, business model innovation, management accounting, performance measurement, and servitization. The studies underlying this thesis have also involved several researchers. The findings of this thesis, discussed further in chapters 5 and 6 below, were derived through a triangulation of the knowledge acquired from the studies that form the foundation of this research.

3.7.2. Trustworthiness

The concept of trustworthiness in realist research refers to the extent to which the research can be examined considering the databases maintained and the use of quotations of research subjects and participants in written research reports (Healy & Perry, 2000). Bisman (2010) suggests a thorough documentation of data collection and analysis methods to support the reliability and replicability of the study. For thorough documentation, he suggested maintaining a clear definition of the constructs used in the research protocol, and a description of the data
collection tools and analysis. In this thesis, I have sought to clearly define all concepts used, as well as how the different concepts are considered in this thesis. Additionally, the research protocol was described in this thesis and in the papers that are the basis of this thesis. The interviews and workshops held online were recorded and transcribed. Furthermore, notes were taken during the initial workshops and site visits in both cases. For the literature review, the selected papers and their grading and content analysis were also documented. In the context of case studies, Yin (2013) asserts that a trustworthy case study should present the most compelling evidence, making it possible for the reader to make independent judgments on the analysis. A table with examples of content analysis and grades was included in the systematic literature review paper (Paper I). In addition, all the references selected, and their relative grades have been included in the paper appendix. In the empirical studies, the data analysis included representative quotations from the participants. In addition, an example of quotes and representative themes have been included in the thesis (Tables 10 and 11).

3.7.3. Analytical generalization

The trustworthiness of research can enable the external replication of a theory; however, analytical replication involves the generalization of a set of results from a case to a broader theoretical context (Yin, 2013). Bisman (2010) asserts that generalizability in the statistical sense is not possible in qualitative research; however, analytical generalization is usually possible. According to Yin (2013, p. 325), analytic generalization involves extracting of a more abstract level of ideas that can be relevant in, and be applied to, new contexts or situations. He suggested linking analytical generalizations to the related literature by identifying areas of overlap or commonalities.

Likewise, Bisman (2010) claims the analytical generalization is iterative and replicated, whereby results are compared with theory for extracting more general ideas that can be used in other cases. The results of this thesis have been discussed with respect to the literature in order to extract general ideas that can also be used in other cases. For instance, it has been demonstrated that the financial performance measurement practices identified could be used for any type of CBM and servitized business models. In the studies underlying this thesis, I have also aimed to use insights from previous literature to discuss and interpret the results obtained. Through this discussion, the main findings were emphasized, along with a comprehensive description of the studies’ respective contexts, which provided insights on the backgrounds leading to these findings. This facilitates study replicability and allows future
research to extract an abstract level of ideas and apply it in a new context, such as to new types of technologies, or for other companies in the manufacturing industry. Furthermore, in chapters 5 and 6 of this introductory essay, I have aimed to link the results of the different studies and discussed these in the context of prior literature for generating more general findings. These findings could be used in different contexts by future researchers for further expanding knowledge about the financial performance measurement of CBMs.

3.8. My contribution to the papers

The following section describes my contribution to the three papers that are the basis of this thesis.

3.8.1. Paper I

As the lead author, I designed the literature review study, and conducted all steps of the systematic review process, including the initial search of paper, the screening and selection of papers, the content analysis, the qualitative analysis, the coding of data, and the grading of papers. A total of 17% of the grades were discussed with my research colleague Fredrik Ingesson to validate my coding. I developed the paper idea and wrote the first full draft. I presented the paper first at a PhD workshop organized by the business administration division at Linköping University and later at the ISDRS conference. Josefine Rasmussen, Henrik Nehler, and I then discussed suggestions received for improvement, which I took the lead to implement. We then worked in iterations, revising the paper before submitting it to Journal of Cleaner Production. During the review process, I took the lead but shared the work with Josefine Rasmussen and Henrik Nehler.

3.8.2. Paper II

I was the lead author. During data collection, I participated actively both in preparations and during interviews, observations, and workshops. An initial version of the financial performance measurement tool was developed by Henrik Nehler. Later, I developed the tool further based on discussions and collaboration with participants of the case study. I presented the initial paper idea and preliminary findings at the ICBS conference. After the conference, I wrote the first full draft of the paper and submitted it to the EIASM conference. I presented the paper in the EIASM conference and then worked in iterations with my co-authors, adjusting the paper before submitting it to scientific journal.
3.8.3. Paper III

As the lead author, I actively participated in the data collection process, which involved conducting interviews, making observations, and contributing to workshops. Additionally, I contributed to the data analysis, including the transcription of the interviews and the coding. I also participated in the process of developing the financial performance measurement tool (TCO). In April 2023, Henrik Nehler and I jointly presented the main findings during a seminar organized by the case company. In writing the paper, I developed the paper idea and wrote the first draft.
Chapter 4
Overview of the papers

This chapter provides a summary of the three papers that are the basis of this thesis. The complete versions of the papers are included in the second part of this thesis.

4.1. Paper I: How financial performance is addressed in light of the transition to circular business models - A systematic literature review.


The transition towards CBMs involves making performance-grounded decisions at various stages. Financial performance measurement is therefore crucial for guiding the transition process. However, previous studies have indicated that companies lack a clear understanding of the financial outcomes associated with CBMs, which hampers their transition efforts. This paper takes a business model innovation perspective, departing from the existing CBM literature, to review how the financial performance of CBMs and its underpinnings have been discussed in relation to different phases of the transition towards CBMs. The objective is to understand the reasons behind the financial barriers that arise and to propose future research directions that can bridge the knowledge gap concerning the financial performance of CBMs. By doing so, this research aims to contribute to facilitating the transition towards CBMs from a financial perspective.

Based on a systematic review, the paper evaluates the content, context, and scope of financial discussions in previous research. The transition towards circular business models is examined as a three-phase process, including ideate and design, implement and test, and finally evaluate and improve. The reviewed papers have been categorized within the different transition phases,
and their content has been analyzed and graded from a financial perspective. The findings indicate that, despite its significance, financial performance remains underexplored in the CBM literature. From a transition standpoint, financial performance receives more attention in studies focusing on the later stages of CBM implementation, while there is a lack of research on prospective financial evaluation during the early ideation and design phase. This knowledge gap can be attributed to uncertainties surrounding ex-ante evaluation, such as future cash flows and customer acceptance.

The review uncovers the conclusion that financial performance measurement still relies on linear logic and fails to reflect the true financial performance of CBMs. Furthermore, performance evaluation often concentrates solely on material or product levels, overlooking the broader value encompassed in the offering (i.e., the products and services provided to deliver a specific value). The paper highlights the importance of adapting the financial performance measurement practices to the different phases of the transition towards CBMs. It emphasizes the importance of prospective financial performance measurement and argues that financial evaluation tools should not only provide information on financial outcomes, but also assist practitioners in identifying areas of improvement within CBMs.

4.2. Paper II: Financial performance measurement of result-oriented circular business models: The case of electrification and assets-as-a-service


This paper explores the adaptation of financial performance measurement to evaluating CBMs, with a specific focus on result-oriented CBMs. More specifically, it suggests management accounting practices for the financial performance measurement of result-oriented CBMs. An empirical example is provided in this study to demonstrate the practical application of these practices. It illustrates how financial performance measurement can support the implementation of result-oriented CBMs in the specific context of electrification. This study contributes to the understanding of financial performance measurement for result-oriented CBMs, which prior research has identified as the most challenging to evaluate.

Prior literature has emphasized the need to align performance measurement practices with evolving business trends. These include the adoption of new business models, the shift towards
value-based competition and the integration of circular activities. These factors characterize the results-oriented CBMs. This study investigates how different contingent factors influence financial performance measurement practices. The study thereby suggests a set of management accounting practices that enable the financial evaluation of result-oriented CBMs. These practices encompass: (a) measuring costs involved in customer-value creation and value recreation; (b) assessing customer value attributes for managing costs that do not contribute to customer value creation and value re-creation; (c) considering the characteristics of the offering for defining the cost structure and future cash flows; (d) measuring costs through multiple product-service lifecycles; (e) incorporating costs related to circular strategies and environmental revenues, and (f) using LCC for developing a future-oriented and long-term measurement, i.e., through the extended product-service lifecycle.

The identified practices have been applied in this study to develop financial performance measurement for result-oriented CBMs in the context of electrification. The results demonstrate that result-oriented CBMs may generate higher profitability compared to linear business models. Furthermore, the findings indicate that technological innovation in a new business model setting may positively impact the financial performance of CBMs. Financial performance measurement of CBMs also offers valuable insights to managers, highlighting areas for improvement, such as the adoption of durable designs for electric equipment to reduce repair and maintenance costs.

4.3. Paper III: Unlocking financial benefits through sufficiency-driven circular business models: The case of high-efficiency motors and maintenance strategies


This paper studies the financial implications of sufficiency-driven CBMs and illustrates the development of financial performance measurement for communicating with customers and for business model management. More specifically, this paper aims to investigate the TCO of solutions involved in sufficiency-driven CBMs in order to understand their financial implications for customers. Furthermore, it illustrates how TCO can be used for supporting the design of sufficiency solutions to customers. The paper is based on an action case study of sufficiency-driven CBMs that suggest solutions of improved efficiency and maintenance for high-voltage motors.
The findings demonstrate that, first, the use phase has the most significant impact on the user's TCO, underscoring the necessity of conducting a comprehensive cost assessment to understand the benefits of sufficiency solutions. Second, the results emphasize the importance of considering hidden costs, such as those arising from unplanned stops, to fully realize the advantages of sufficiency initiatives. Third, the cost benefits of sufficiency solutions depend on the user's risk aversion, which emphasize the importance of enhancing the reliability and cost-effectiveness of sufficiency solutions. This includes not only the design of more reliable products but also of more reliable services.

The findings of this paper contribute to the CBM literature by providing knowledge about the development of financial performance measurement for communication with customers and for the management of CBM. Furthermore, the paper contributes to the emergent literature about sufficiency-based circular economy by illustrating the financial implications of a sufficiency-driven CBM and by providing an example of the development of financial tools that could be used for engaging customer in sufficiency solutions. This also supports the emergent research about the sufficiency-based circular economy.

4.4. Overview of the papers and their links to the thesis

Table 12 below presents an overview of the theoretical framing, methods, and main findings of the three papers underlying this thesis. The table also indicates how each of the three papers contributes to answering the thesis research questions and to the thesis’ overall aim.
Table 12: Overview of the three papers comprising the thesis

<table>
<thead>
<tr>
<th>Papers</th>
<th>Link to aim and research questions</th>
<th>Theoretical framing</th>
<th>Method</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Paper I | RQ1, RQ2 and general aim          | Business model innovation  
Financial performance and its underpinnings | Systematic literature review | Financial performance measurement still relies on linear logic overlooking the broader value encompassed in CBM offerings.  
Financial performance measurement practices need to be adapted to the different phases of the transition towards CBMs |
| Paper II| RQ1, RQ2, RQ3 and general aim     | Financial performance measurement  
Contingency of management accounting practices  
Result-oriented servitization | Action case study | The financial performance measurement of result-oriented CBMs needs to be customer-centric and link customer-value creation to cost management. |
| Paper III| RQ2, RQ3 and general aim           | Sufficiency-based circular economy  
Total cost of ownership       | Action case study | The financial outcomes of encourage sufficiency CBMs rely on the industry and the customer’s risk aversion. Financial performance measurement can be used for communicating with customers and supporting providers’ design of attractive sufficiency-based solutions. |
Chapter 5
Discussion

This chapter discusses the findings of the three appended papers. It begins by presenting the key financial performance measurement practices suggested for enabling the financial performance measurement of CBMs. Then, the chapter examines how financial performance measurement can support organizations in transitioning from linear business models to CBMs. Subsequently, the chapter analyzes the financial outcomes of CBMs implemented in the context of sustainability-oriented technologies, in this case electrification and high-efficiency motors. Thereby, the chapter contributes to answering the three research questions underlying this thesis.

5.1. Key practices enabling the financial performance measurement of CBMs

As stated in the quote by Guldmann and Haulgaard (2020, p. 7) in the introduction, “circular business models need to be evaluated on different terms, and according to parameters that are yet to be developed.” Therefore, the first research question in this thesis aimed to investigate the performance measurement practices that enable the financial performance measurement of CBMs.

In the subsequent sections, the key practices identified in this thesis will be discussed based on the dimensions proposed by Granlund & Lukka (1998). These dimensions include; concepts and ideas incorporated into measurement, techniques employed in measurement, and the purposes behind the utilization of specific information. These dimensions capture the essence of management accounting practices, which is why they were chosen as the basis for describing
the key practices. The main ideas and concepts, techniques, and purposes suggested by this thesis will be discussed in the following sections and summarized in Table 13.

5.1.1. Concepts and ideas

The results of this thesis identify four main ideas and shed light on two main concepts. First, by highlighting the concept of customer-value creation and value recreation, this research suggests that financial performance measurement of CBMs should encompass the costs associated with customer-value creation. This idea aligns with the customer-centric nature of circular business models (Teece, 2010) and their reliance on successful customer value creation (Nielsen et al., 2018). Additionally, considering that CBMs aim to circulate products and materials, financial performance measurement must also account for costs and revenues (or cost savings) related to value recreation. For instance, the empirical study in Paper II suggests that financial performance measurement should include expenses such as battery refurbishment and product take-back which not only add value to customer but also allow the recreation of value. Hence, this idea extends the existing literature by proposing the inclusion of costs associated with both customer-value creation and value recreation in financial performance measurement.

Second, this thesis emphasizes the concept of customer offerings and puts forth the idea of considering the characteristics of the offerings when defining the cost structure. As discussed in Paper II, when the offering in CBMs imply retaining product ownership, in addition to the initial costs, the financial measurement also accounted for the operating costs and the end-of-life management costs associated with the offered assets. Taking into consideration the characteristics of the offering, costs for ensuring availability, as well as savings resulting from retaining ownership of assets, have been accounted for. Likewise, in Paper III, the considered CBM offers sufficient solutions which can include high-efficiency motors and maintenance services. For assessing the financial benefits of such CBM, the cost structure was suggested to include hidden costs that are supported when circular activities are not performed.

Previous studies have often focused on product or resource costing (Gilbert et al., 2017; Bradley et al., 2018; Albuquerque et al., 2019; Kaddoura et al., 2019), and very few studies have considered the broader CBM offering (Kambanou & Sakao, 2020; van Loon et al., 2020). However, scholars identified challenges specifically related to changing offerings and understanding the complex cost structure of CBMs (Oghazi & Mostaghel, 2018; Sousa-Zomer & Cauchick Miguel, 2018). Therefore, this thesis emphasizes the idea of considering the
offering to customers as a unit of evaluation and framing the cost structure from the perspective of the customers value creation.

Third, the complexity in defining the cost structure is also related to the complexity in estimating and understanding future cash flows. CBMs imply long-term returns, and their offerings generate cash flows (in and out) in the long term. However, foreseeing future cash flows is considered as a complex and challenging task (Linder and Willander, 2017). Therefore, this thesis emphasizes the idea of engaging with customers from the early stages of business model ideation and design for understanding their perception of the potential value creation and for better predicting their future behavior. Engaging with customers would reduce uncertainties about CBMs’ future cash flows and enable identifying hidden costs. Paper II also suggests assessing both customer value attributes and their willingness to pay for defining a potential price of the offering. This reduces uncertainties about the potential revenues and financial outcomes of CBMs. As suggested in Paper III, engaging with customers at the early stage of the CBM design allows identifying hidden operational costs that are difficult for providers to identify and foresee. Previous studies suggested involving stakeholders in the ideation and design of CBMs (Brown et al., 2021; Pollard et al., 2021). In this respect, this thesis aligns with previous studies and extends existing literature by underlining the role of customer engagement in reducing uncertainties about CBMs’ financial outcomes and enabling financial performance measurement.

Fourth, financial performance measurement should serve not only to measure the financial performance of CBMs but also to manage it (Bourne et al., 2005). Therefore, this thesis suggests the idea of an outside-in approach for the management of CBMs’ financial outcomes. Emphasizing the customer-centric aspect further, the outside-in approach proposes links cost management to customer-value creation and recreation. This means managing CBMs’ activities and resources in a way that reduces costs while maintaining and enhancing customer-value creation and value re-creation. More specifically, the results of Paper II suggest initiating cost management by defining a price in collaboration with customers, the identifying customer value attributes and ultimately managing costs in order to improve profitability. This approach aligns with the recommendations put forth by Hankammer et al. (2019), proposing that CBM design be initiated by assessing customer needs and then shaping business model activities accordingly. It also aligns with the suggestion made by McNair et al. (2001) to connect cost management with customer value creation in order to enhance a company’s potential for profitability.
To summarize, this thesis suggests focusing on two concepts for adapting financial performance measurement to CBMs. These are customer-value creation and recreation, as well as the offering to customers. In relation to these concepts, four main ideas are proposed to convey the practices that support the financial performance measurement of CBMs. First, it is important to account for the cost associated with customer-value creation and value re-creation. Second, companies should consider the implications that the offering to customers has for cost structure. Third, companies should engage with customers early in the CBM’s design for predicting future cash flows, which can reduce uncertainties about the financial outcomes of CBMs. Fourth, companies should take an outside-in approach for managing costs.

Notably, the suggested ideas and concepts emphasize the customer-centric aspect of financial performance measurement, and also shed light on the importance of maintaining a close relationship with customers for effectively measuring and managing the financial performance of CBMs. To the limit of my knowledge, the role of customers in the financial performance measurement and management of CBMs has not been addressed in the CBM literature.

5.1.2. Measurement techniques

In CBMs, the offering can still generate cash flows in and out after their delivery to customers, LCC is thus suggested as a technique for the offering life cycle management. LCC encompasses the evaluation of the total cost of an asset over its entire lifespan, from acquisition to disposal. (Roda et al., 2020). LCC techniques have been recommended for assets cost management and for the performance measurement of circular strategies (Parker, 1997). The literature review (Paper I) revealed that several studies have also used LCC techniques for assessing costs related to circular activities, but that these have often been linked to product or material lifecycles (Albuquerque et al., 2019; Bradley et al., 2018; Kaddoura et al., 2019). This thesis expand the existent literature and suggests going beyond only products’ or materials’ LCC and developing an LCC that covers the broad offering proposed by the CBM.

CBMs aim to recreate and extend value, which in turn drives long-term financial outcomes and implies value capture and recapture (Guldmann & Huulgaard, 2020). Therefore, LCC recommended to facilitate the evaluation process and account for changes in cost structure over time, along with their impact on cash flows. In addition to the long-term perspective, Paper I and II also suggest considering the multiple use cycles of the offering in financial performance measurement. Indeed, value in CBMs is recreated by using the residual value retained in products after use in generating a new offering (Linder and Williander, 2017). Through circular
activities, a new life cycle is given to the assets offered by CBMs. For instance, in Paper II, the CBM studied suggests the reuse of assets and the regeneration of the offering, therefore the LCC accounted for costs and revenues involved in the multiple offering cycles. This finding aligns with the research conducted by Nußholz (2018), who introduced a CBM mapping tool that includes multiple use cycles for supporting the value creation of extended product lifetimes.

Besides accounting for multiple offering cycles, the results of this thesis suggest that the lifecycles of the different assets included in the offering should also be taken into account when predicting future cash flows. For example, in Paper II, battery replacement and refurbishment have been addressed midway through the usage cycle, separate from the equipment's overall lifecycle. Paper III however focused on a CBM that suggests long-lasting products, highly customized, that are not planned to be reused. Hence, the LCC in this case covered one cycle of the product. However, cycles of the maintenance services and repair associated with the offering have been considered distinctly.

To summarize, this thesis proposes the following techniques for measuring the financial performance of CBMs. First, we recommend the use of the LCC technique, covering broad offering lifecycle costs. Second, LCC is suggested to be used with a long-term perspective and to consider the multiple lifecycles of the offering. Third, LCC should consider the different lifecycles of the assets included in the offering.

5.1.3. Purposes of using specific information

The results of this thesis reveal that, while considering the suggested ideas, concepts and techniques, the financial performance measurement of CBMs can be pursued from different perspectives to capture the financial benefits of CBMs. The different perspectives taken allow for overcoming the different financial challenges faced by CBMs and support the management of their performance. For instance, in Paper II, it is found that LCC entails adopting the provider perspective, as the study focuses on result-oriented CBMs that involve retaining product ownership. Result-oriented CBMs present significant challenges for providers, primarily concerning the shift in operational and end-of-life management costs, as well as their long-term returns (Linder & Williander, 2017; Sousa-Zomer et al., 2018; van Loon et al., 2020). Therefore, the developed LCC aims to assist providers in effectively managing their costs without compromising the promised results and the value delivered to customers.
However, LCC also appears apposite from a user perspective—according to the study in Paper III, focusing on sufficiency-driven CBMs, which aim to reduce the end-user consumption and thus operational costs (Figge et al., 2014; Bocken & Short, 2016; Niessen & Bocken, 2021). This type of CBM suggests the sale of products at a premium price justifying the potential gain in operational costs that they promise. Therefore, LCC techniques have been used from a user perspective to assess the TCO. The findings show that the TCO could assist providers in improving their offering to make it more cost-effective for users (Spangenberg & Lorek, 2019). Although cost savings can be envisioned, customers may lack understanding of the long-term benefits of sufficiency solutions, which hinder their acceptance and engagement (Bocken & Short, 2016). The results of Papers III revealed that LCC, from a user perspective, could be used as a communication tool by providers for demonstrating the financial benefits of sufficiency solutions. This justifies the premium price and promotes the acceptance of sufficiency solutions. This thesis extend the existing literature on this point, by showing that the TCO can also provide relevant information to providers, assisting them in the management of their CBMs.

Based on literature review, the results of Paper I also emphasize the need for adapting the financial performance measurement perspectives to overcome challenges associated with the transition towards CBMs. The results of Paper I suggest that financial performance measurement needs to take both prospective and retrospective measurement perspectives for assisting the different phases of the transition towards CBMs. In Paper II, the developed LCC is prospective, assisting decision makers in the design and upscaling of their CBMs. However, in Paper III, the measurement aimed to improve the offering of an existing sufficiency-driven CBM. Therefore, LCCs developed were based on both prospective and retrospective measurement. The measurement perspectives that support the transition towards CBMs are discussed further in section 5.2.

Accordingly, the use of specific types of information in the financial performance measurement of CBMs serves the following purposes. First, information use addresses various decision-making needs, necessitating different measurement perspectives. Second, information use aims to overcome distinct financial challenges.
5.1.4. Framework of key practices enabling the financial performance measurement of CBMs

Most of the recommended practices, illustrated in Table 13, diverge from the practices utilized for the financial performance measurement of linear business models. This finding aligns with the studies by Guldmann & Huulgaard (2020) and van Loon et al. (2020), arguing that new practices, different from those used for linear business models, are needed for the financial evaluation of CBMs.

Table 13: Framework of key practices that enable the financial performance measurement of CBMs (illustration of practices based on Granlund and Lukka. 1998)

<table>
<thead>
<tr>
<th>Perspective of analysis</th>
<th>Key practices</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts and ideas</td>
<td>Accounting for the cost associated with customer-value creation and value re-creation</td>
<td>The success of a business model relies on customer value creation and re-creation</td>
</tr>
<tr>
<td></td>
<td>Considering the implications of CBM offerings on cost structure</td>
<td>The offering characteristics determine what costs should be included in the financial performance measurement</td>
</tr>
<tr>
<td></td>
<td>Engaging with customers early during the CBM design for reducing uncertainties about future cash flows</td>
<td>CBMs aim for achieving profitability while reducing the environmental impact</td>
</tr>
<tr>
<td></td>
<td>Taking an outside-in approach to manage CBM costs</td>
<td>Linking the cost management to customer value creation</td>
</tr>
<tr>
<td>Techniques</td>
<td>Using an LCC technique that cover the entire offering lifecycle costs</td>
<td>CBM create value through an offering and LCC allows a full costing of the offering</td>
</tr>
<tr>
<td></td>
<td>Adopting a long-term perspective and considering the multiple lifecycles of the CBM offering</td>
<td>CBMs suggest recreating value through the reuse of assets</td>
</tr>
<tr>
<td></td>
<td>Taking into account the different lifecycles of the assets included in the offering</td>
<td>Assets offered have distinct lifecycles that might be different from the total offering lifecycle</td>
</tr>
<tr>
<td>Purposes of using specific information</td>
<td>Adapting the financial performance measurement to align with decision-making needs and address distinct financial challenges</td>
<td>Different types of CBMs entail different benefits and face different challenges</td>
</tr>
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<td></td>
<td></td>
<td>- Decision makers face different challenges when navigating the transition towards CBMs</td>
</tr>
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</table>

Only ideas and concepts that relate to the business model are common between linear business models and circular business models. These include the concepts of customer-value creation and the concept of offerings, excluding the concept of value re-creation. The idea of outside-in
cost management applies also to the linear business models. Likewise, considering the impact of the offering on the cost structure also applies to the linear offering. However, linear business models focus on short-term returns and generate value through product sales, whereas CBMs emphasize long-term returns and create value in use (Lieder & Rashid, 2016) Accounting-based measures are effective in capturing the short-term returns generated by linear business models. However, they are insufficient in reflecting the long-term outcomes of CBMs (Guldmann & Hualgaard, 2020).

Linear business models are based on the idea of take-make-waste and cannot be expected to suggest the take-back and reuse of products and material or to strive for prolonging their lifetime. Therefore, the LCC technique has been often conceived as a purchase tool supporting companies in selecting suppliers (Roda & Garetti, 2014; Roda et al., 2020). According to Roda et al. (2020), LCC and TCO started to be used for managing offerings to customers with the emergence of product-service systems that suggest long-term engagement by providers. Likewise, LCC approaches have been suggested for managing circular strategies that suggest product and material circulation (Parker, 1997). Therefore, for linear CBMs, the LCC technique is suggested to consider the multiple use cycles and to take a long-term perspective, while considering the different assets lifecycles.

Financial performance measurement should adapt to the diverse needs of decision makers and address varying financial challenges. Linear business models focus on product sales without considering reuse or retained ownership. Hence, decision makers face different challenges and would have different requirements when innovating and managing linear business models compared to CBMs, which suggest long-term asset management and circular activities.

5.2. Financial performance measurement driving iterations between transition phases

The second question of this thesis aimed to investigate how financial performance measurement supports the transition towards CBMs. Based on the literature review, the findings of Paper I reveal that financial performance measurement can drive iterations between the transition phases, thereby enhancing learning and facilitating the transition towards CBMs. However, for driving iterations, it is suggested that financial performance measurement embrace both prospective and retrospective measurement perspectives for aligning with the different needs of decision makers in the different phases of the transition process.

During the initial phase of CBM ideation and design, the literature review conducted in Paper I highlighted that financial performance measurement in this context is prospective in nature
and relies heavily on assumptions. Despite the inherent uncertainties surrounding cost structure and future cash flows, prospective measurement can still offer valuable insights that support the development of a potentially viable CBM. Therefore, Paper I recommended further research to support the prospective evaluation of CBMs. In line with this recommendation, Paper II investigated the development of prospective financial performance measurement and suggested companies to involve customers from the early stage of CBM design for reducing uncertainties about future cash flows and designing of potentially viable CBMs. Understanding customer-perceived value and willingness to pay supports decision makers in developing an attractive offering and in defining the business model activities. This reduces uncertainties about cost structure and about risks related to customer engagement. Furthermore, the study suggests maintaining a close relationship with customers during the use phase, facilitating the prediction of future cash flows. This aligns with Mostaghel and Chirumalla (2021) study emphasizing the importance of early customer involvement in shaping and refining CBMs. The results of this thesis highlight also the importance of early customer engagement, not only for shaping the business model but also for reducing uncertainties and facilitating the prospective evaluation of CBMs’ financial performance.

The findings of Paper I suggest that uncertainties pose significant challenges also during the testing and implementation phase of CBMs. To address these challenges, CBM designs are tested on a small scale to gain insights into their financial outcomes and to reduce uncertainties about their financial implications (Bocken et al., 2019). Prior studies have recognized experimentation as an effective approach to bridging the gap between design and implementation (Baldassarre et al., 2020; Konietzko et al., 2020). Paper I emphasized the importance of retrospective measurement for evaluating the financial outcomes resulting from CBM experimentation. Retrospective evaluation of the experiment outcomes provides a basis for making realistic assumptions about CBMs’ future performance and facilitating access to finance. However, it was noted that uncertainties about the outcomes of upscaled CBMs can still pose challenges for providers in proceeding with large-scale implementation (Linder & Willander, 2017; Konietzko et al., 2020). In order to address these challenges, Paper I identified the need for prospective evaluation in order to understand the financial implications of large-scale implementation. Decision makers can then use prospective evaluation results to decide whether to proceed with the full-scale implementation of CBMs, or alternatively choose to redesign the CBM. The iterative process between the design phase and the experimentation phase increases the likelihood of successfully implementing a viable CBM from the early
stages of the transition, which saves resources and costs. The Case 1 company considered in Paper II is experimenting with a result-oriented CBM and planning for its upscaling. Interestingly, it is noticed here that experimentation may overlap with CBM full scale implementation as the CBM has long term returns. Companies can thus experiment with the feasibility of CBMs but may not have sufficient data for assessing the viability of a CBM prototype. Hence, financial performance measurement would here continue to rely on predictions and hypotheses.

Once CBMs are fully implemented and operational, the uncertainties surrounding their financial implications are supposed to decrease, permitting the measurement of realizations and a deeper understanding of the actual financial outcomes (Frankenberg et al., 2013). In this context, Paper I recommends a retrospective evaluation based on realizations, which can provide valuable information to providers regarding the efficiency and effectiveness of the realized actions and assist them in identifying areas for improvement. This drives a feedback loop between the implementation and testing phase and the ideation and design phase, enabling the adjustment of CBMs’ design. In this phase, based on measurement, the financial performance of CBMs can be managed by eliminating costs that do not contribute to customer value creation. This practice, highlighted also in Table 13, allows improving the financial outcomes of CBMs, yet requires a permanent assessment of value for customers. Paper III elucidates the development of financial performance measurement that retrospectively measures the financial outcomes of a sufficiency solution. Based on the retrospective evaluation, decision makers in Case 2 have identified an opportunity for providing predictive maintenance service that has the potential to reduce unplanned stops for customers and enhance the reliability of the offered product. However, the prospective evaluation performed in Paper III for predicting the financial impact of CBM redesign on customers’ TCO indicated that the suggested redesign may not align with the preferences and interests of customers. This underscores the importance of continuously assessing customer-perceived value and willingness to pay when redesigning CBMs.

Accordingly, financial performance measurement supports learning, allows improvements in CBMs’ financial performance, and thereby accelerates the transition process. It is worth highlighting that while both prospective and retrospective evaluations are needed for supporting the transition phases, prospective evaluation plays a crucial role in driving the transition between these phases. Indeed, prospective evaluation would support the effective design of CBMs from the early stages of the transition process, which saves costs and time for
companies. Additionally, it supports the upscale of the business model and its redesign for adjusting to internal and external changes and for improving its performance. For an effective prospective measurement, need to permanently engage with customers for reducing uncertainties about future costs and revenues. Establishing closer relationships with customers is recommended in this thesis for understanding customers’ behavior and intentions, which allows for making realistic assumptions and predicting future cash flows.

It is noteworthy that the key practices outlined in section 5.1 need to be consistently applied for financial performance measurement across all phases of the transition. However, it is recommended to implement these practices within the evaluation perspectives discussed in this section. This allows for adapting measurement to the specific context and objectives of each phase. Figure 9 summarizes the discussion of this section by depicting how financial performance measurement can effectively support and facilitate the transition towards CBMs.

![Diagram](image)

**Figure 9:** Financial performance measurement facilitating the transition towards CBMs
5.3. Sustainability-oriented technologies supporting the financial performance of CBMs

The third research question addressed in this thesis seeks to explore the financial implications associated with the implementation of CBMs within the realm of sustainability-oriented technologies.

According to the literature review conducted in Paper I, the implementation of CBMs has the potential to reduce material cost and to increase revenues from the circulation of products and materials (Agyemang et al., 2019; Gusmerotti et al., 2019). However, the implementation of CBMs raises financial challenges related mainly to the high upfront costs, the change in cost structure, and the long-term nature of the returns (Bressanelli et al., 2019; Oghazi & Mostaghel, 2018; Ormazabal et al., 2018). Therefore, scholars have debated the profitability of CBMs and stressed the need for measurement for understanding their financial outcomes (Liakos et al., 2019). In Papers II and III, financial performance measurements have been developed for examining the financial outcomes of the CBMs implemented by, respectively, Case company 1 and Case company 2. The financial performance measurement in Case 1 revealed that CBMs might be more profitable for providers compared to linear business models. The CBM considered in this case entails retaining the products ownership and the sale of results. According to previous studies, these types of CBMs are the most challenging compared to other types of CBMs and raise more financial challenges and risks since they suggest a shift from product sale to service sale (Vermunt et al., 2019). In Case 1, challenges related to servitization have also been identified, and participants have stressed the need for climbing further up the value chain and developing service capabilities to get closer to the customers and proactively satisfy their requests. This also allows for sustaining the promised offering and adjusting to customers’ needs. Additionally, the shift of operational costs from customers to providers is found to be challenging in term of long-term profitability and risks. However, the study in Paper II revealed that retaining product ownership can also provide opportunities for cost savings, as providers benefit from flexibility in designing their offerings. Additionally, they can effectively manage their activities and product technologies for reducing operational costs. Interestingly, as shown in Case 1, technological innovation is found to be the main enabler for efficiently managing the offering and the operational costs. As an example, improved battery technology has the potential to reduce the need for battery replacement, which lowers operating costs.
In Case 2, technological innovation supporting a sufficiency-oriented CBM is found to financially benefit the users. In this case, the technological innovation allowed for improving product efficiency, which has reduced the users’ energy consumption. Energy-effective products in this case are more expensive than traditional products (i.e., with lower efficiency). However, the result of the study showed that the gain in energy costs far exceeds the difference in price paid for the new technology. In addition to offering long-lasting and high-efficient products, Case 2 suggested expanding their offering by proposing predictive maintenance services. These services allow for improving product reliability and also reduce the risk of unplanned stops for users. Thus, they are expected to drive financial benefits for users. However, the financial performance measurement conducted in this study revealed that suppliers need to develop new capabilities to perform maintenance services without having to stop production. It was thus concluded that providers need to develop service capabilities in order to add value to customers.

Accordingly, in both cases, sustainability-oriented technologies are found to support the transition towards CBMs and to yield financial benefits for both providers (Paper II) and users (Paper III). Likewise, the servitization of the offering as in Case 1 is found to benefit the provider as it offers more flexibility in designing the offering and managing costs. However, as highlighted in Case 2, services are not always beneficial for users and providers may need to develop service-related capabilities for making CBMs more financially attractive for users. The need for developing service-related capabilities has also been stressed by previous studies an identified as a driver for the transition to CBMs, yet not as a driver of CBMs’ financial performance (see e.g., van Loon et al., 2020).

In Papers II and III, several scenarios have been considered in measuring the financial outcomes of CBMs. In both cases, the financial outcomes of CBMs are found to vary depending on customers’ use behavior and aversion to risk. For example, in Case 1, the profitability of CBMs is found to be influenced by customer’s use behavior and intensity. For instance, when the offering is used in heavy-duty applications or when users do not follow the charging scheme recommended, providers tend to experience lower profitability of the CBM compared to its use in medium-duty applications. This is explained by the need for more services and for more frequent battery replacement. Likewise, in Case 2 the financial benefit of sufficiency-driven CBMs depends on the industry in which users operate, and benefits tend to be more pronounced in industries characterized by high downtime costs, such as oil and gas as well as power generation. The attractiveness of maintenance strategies is found to also depend on users’ risk
aversion. Indeed, customers with high risk aversion might have higher acceptance for predictive and preventive maintenance. However, they tend to keep spare parts on site, making repair less costly than maintenance. Accordingly, the financial benefits of CBMs depend on use behavior and use intensity as well as users’ risk aversion. This highlights the importance of considering customer perspective in designing circular solutions, an observation which is also emphasized in previous studies (e.g., Guldmann & Huulgaard, 2020; Salvador et al., 2020).
Chapter 6
Conclusions and contributions

This chapter presents the conclusion of this thesis and summarizes the theoretical and practical contributions. Furthermore, this chapter highlights the limitations of this thesis and suggests future research paths.

6.1. Conclusions

The limited understanding of the financial performance of CBMs has been acknowledged in the existing literature as a significant obstacle to the transition towards a circular economy (Guldmann & Huulgaard, 2020; Liakos et al., 2019; Sousa-Zomer et al., 2018). Building upon this observation, the primary objective of this thesis was to identify the key practices that enable the financial performance measurement of CBMs and that support the transition from linear business models towards CBMs. Furthermore, the thesis sought to contribute with insights about the financial implications of CBMs, specifically in the context of sustainability-oriented technologies.

The findings highlight the customer-centric aspect of financial performance measurement and identify eight key practices for evaluating the financial outcomes of CBMs. These practices can be summarized as follows: (1) accounting for the cost associated with customer-value creation and value re-creation; (2) considering the implications of CBM offerings for cost structure; (3) engaging with customers early during the CBM design for reducing uncertainties about future cash flows; (4) taking an outside-in approach to managing CBM costs; (5) using an LCC technique that covers the entire offering’s lifecycle costs; (6) adopting a long-term perspective and considering the multiple lifecycles of the CBM offering; (7) taking into account the different lifecycles of the assets included in the offering, and (8) adapting the financial
performance measurement to align with decision-making needs and address distinct financial challenges (see also Table 13).

These key practices need to be implemented alongside different evaluation perspectives to support the iterative process during the transition towards CBMs. Prospective measurement has been identified in this thesis as an important tool for reducing uncertainties, enabling the implementation and potential scalability of a viable CBM, and ultimately improving its financial performance. To effectively conduct prospective evaluations, it is recommended to involve customers early in the CBM design process and to maintain a close relationship with them for reducing uncertainties and moving forwards in the transition. This enhances the predictability of changes in cost structures and future cash flows, thereby increasing the effectiveness of prospective evaluations. Retrospective financial performance measurement is important for assessing the realized outcomes of implemented actions and extracting valuable learning for continuous improvement. Through retrospective evaluation, providers can evaluate the financial outcomes of a CBM based on small-scale implementation, which reduces the risk of upscaling a non-viable CBM. However, due to the long-term timescale of CBMs’ returns, upscaling can overlap with the testing phase, which enhances the need for prospective evaluation. Retrospective evaluation allows also for identifying areas of improvement based on the assessment of realized actions. Thereby, they drive a feedback loop from the implementation and testing phase to the design phase, suggesting the need to redesign CBM activities and a potential for improved performance. Accordingly, the utilization of both prospective and retrospective evaluation fosters the transition towards CBMs. However, prospective evaluation plays a crucial role in the transition towards a viable CBM, as it supports the design and redesign of CBMs for achieving better financial performance.

The transition towards CBMs, particularly those involving retained product ownership, has been perceived as challenging (Linder and Williander, 2017; Sousa-Zomer et al., 2018; Vermunt et al., 2019). However, the results of this thesis show that retaining ownership can incentivize providers to reduce resource utilization and to more effectively manage their activities, which yields less costs and generates financial benefits. Sustainability-oriented technological innovation is found to support circular offerings and to contribute to reducing operational costs. When retaining product ownership, providers capture the financial benefits of technological innovation. However, in cases of product sale, users are the ones benefiting from the technological innovation as it lowers their TCO. For enhancing the financial outcomes of CBMs, the results of this thesis emphasize the importance of developing service-related
capabilities. Overall, the transition towards CBMs in the context of sustainability-oriented technologies seems to promise financial benefits for providers and customers, but this needs to be confirmed by more studies. It should be noted that these financial benefits require the development of service capabilities and depends on customer-related aspects of the calculations, such as customer’s use behavior and risk aversion.

6.2. Theoretical contributions

This thesis offers several theoretical contributions. First, prior research has called for adapting the financial performance measurement practices to strategic changes, such as business model innovation (Bititci et al., 2012; Melnyk et al., 2014). However, CBM literature has identified gaps about practices that enable the evaluation of the financial performance of CBMs (Guldmann & Hulgaard, 2020). Furthermore, studies have called for developing tools that demonstrate the profitability of CBMs in comparison to linear business models (van Loon & van Wassenhove, 2020). This thesis contributes to the literature by introducing a framework of key practices that enable the financial performance measurement of CBMs. Moreover, through empirical case studies, it provides insights into how the suggested practices can be applied to develop financial tools and assess the financial outcomes of CBMs.

Second, according to scholars, the existing literature still lacks knowledge on the financial implications of the transition towards CBMs (Liakos et al., 2019). This thesis contributes to the existing literature by providing insights about the financial outcomes of CBMs and highlighting factors that could influence their profitability. Furthermore, it considers the specific context of sustainability-oriented technology, which advances the knowledge about the financial outcomes associated with CBMs and sustainability-oriented technologies, potentially facilitating their wider adoption and contributing to a more sustainable future.

Third, scholars have identified a lack of guidelines that support decision-making in measuring the financial outcomes of CBMs and in navigating the different phases of the transition process (Bocken et al., 2019). This thesis proposes a model elucidating how financial performance measurement practices could be adapted to support the different phases of the transition towards CBMs. The proposed model emphasizes the importance of adjusting the measurement perspectives to the different phases of business model innovation. This aligns with previous studies calling for aligning the financial performance measurement to the different stages of the innovation implementation (Melnyk et al., 2014). Additionally, it extends the existent
literature by focusing on the financial performance measurement that specifically support CBM innovation.

Fourth, the results of this thesis expand the discussion about the role of customers in the transition towards CBMs (Elzinga et al., 2020; Mishra et al., 2018; Zeeuw van der Laan & Aurisicchio, 2019) and contribute to the existent literature by emphasizing the customer-centric aspect of the financial performance measurement of CBMs.

6.3. Practical contributions

This thesis makes practical contributions that can benefit organizations seeking to implement CBMs. First, it suggests a framework with key practices for the financial performance measurement of CBMs, which can be used by practitioners to develop guidelines for the measurement and management of CBMs financial performance.

Second, the empirical studies carried out in the context of this thesis demonstrate how the proposed management accounting practices can be used to develop financial tools. They also show how these tools can, in turn, assist managers in managing their CBMs. This thesis therefore provides insights into the practical application of the proposed practices and their potential benefits for managing the financial outcomes of CBMs.

Third, this thesis proposes a dynamic evaluation throughout the transition towards CBMs, oscillating between retrospective and prospective evaluation. The proposed adjustments in measurement perspectives aim to enhance learning and respond to the evolving needs of decision makers.

Fourth, by shedding light on the financial outcomes of CBMs, this thesis helps to mitigate the uncertainties surrounding the financial outcomes of the transition to CBMs, thereby supporting more informed decision-making.

Ultimately, this thesis emphasizes the importance of establishing and maintaining close customer relationships to reduce uncertainty in prospective financial measurement and to support effective cost management. These findings suggest that managers adopt an outside-in approach and actively engage with customers for supporting the measurement and management of the financial outcomes of CBMs.
6.4. Limitations and future research

This thesis is not without its limitations, and its results also raised further questions for future research.

First, the use of qualitative approaches in the empirical studies conducted in this thesis has inherent limitations regarding the generalizability of the findings beyond the specific context of the studies. Therefore, it is important to interpret the findings within the context of the empirical cases. Both empirical case studies highlight the development of CBMs in the context of sustainability-oriented technological innovation and consider the case of OEMs. While this focus limitation does not directly impact the suggested practices for developing financial performance measurement, it does restrict the understanding of CBM financial outcomes to this context. Therefore, further research is suggested to investigate the financial performance measurement of CBMs in other contexts such as digitalization and SMEs.

Second, action case study was used as a research methodology in both empirical studies (Papers II and III). This choice was motivated by the fact that the two empirical case companies examined in this study were in their early stages of their transition processes and were actively seeking to enhance their understanding of financial performance measurement. Adopting the action case study approach facilitated collaborative knowledge co-creation between practitioners and academics, thereby filling theoretical and practical gaps in the field. Adapting interventionist approach was indeed recommended by Bocken et al. (2019) for developing tools that support the transition process. Nevertheless, alternative research methodologies could have provided additional insights into changes in financial performance measurement practices. For instance, a longitudinal case study approach could have been valuable during the early stages of business model development. However, due to time constraints, the use of such an approach was not feasible within the scope of this thesis. As stated by a participant in this study, “adapting financial performance measurement is a journey”. Therefore, further research is suggested to continue to explore the financial performance measurement of CBMs in collaboration with practitioners. Additionally, alternative research approaches such as longitudinal case studies or multiple case studies could offer valuable insights into the evolving nature of CBM financial performance over time.

Third, this thesis suggests eight practices that enable the financial performance measurement of CBMs. All of these practices are deemed to be necessary for supporting the three phases of the transition process. However, some of these practices may be more relevant than others in
each of the phases. Therefore, further studies are suggested to further investigate practices and their distinct role in driving the transition towards CBMs.

Lastly, it is important to recognize that CBMs generate not only financial benefits but also non-financial ones. While this study specifically focuses on measuring the financial outcomes of CBMs, it is essential for future research to explore the non-financial outcomes as well. These non-financial outcomes may include environmental benefits, social benefits, competitiveness, innovativeness of companies, customer acceptance and engagement, and customer willingness to pay. Investigating different aspects of CBMs performance would provide a more comprehensive understanding of the overall implications of CBMs.
References


Low, J. S. C., & Ng, Y. T. (2018). Improving the economic performance of remanufacturing systems through flexible design strategies: A case study based on remanufacturing laptop


Part II

Appended Papers
Papers

The papers associated with this thesis have been removed for copyright reasons. For more details about these see:

https://doi.org/10.3384/9789180753906
Financial performance measurement supporting the transition towards circular business models

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