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Circular business model implementation: A capability development case study from the manufacturing industry

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Abstract

Circular business models (CBMs) have huge potential to deliver economic, social, and environmental benefits, but CBMs have yet to be implemented widely in industrial settings. One reason is that they are often presented as one-size-fits-all solutions, but this is misplaced because product-specific criteria and company capabilities determine the correct choice and implementation of CBMs. Therefore, the purpose of this paper is to investigate how CBM selection and capability development facilitates the implementation of CBMs. For this purpose, we have adopted a qualitative research approach and undertaken 25 explorative interviews in three large Swedish manufacturing companies. In this paper, a CBM implementation framework consisting of two parts has been developed. The first part addresses the choice of the appropriate CBM based on tactical configurations. The second part provides a capability development path by explicating underlying routines that need to be progressively developed in order to move smoothly to more advanced CBMs.

KEYWORDS

capabilities, circular business models, decision making, product–service systems, service network, servitization

1 | INTRODUCTION

The circular economy is a vital response to the global need for a more sustainable economy, which demands economic activities that are consistent with the three principles of *reduce*, *reuse*, and *recycle* (Ying & Li-Jun, 2012). According to Frishammar and Parida (2019, p. 8), "a circular business model is one in which a focal company, together with partners, uses innovation to create, capture, and deliver value to improve resource efficiency by extending the lifespan of products and parts, thereby realizing environmental, social, and economic benefits." Circular business models (CBMs) feature a conceptual logic in which value creation is based on utilizing economic value retained in products after use (Evans et al., 2017; Linder & Williander, 2017). But, in order to achieve this, it is vital that the implementation of CBMs is extended beyond pilot projects and local initiatives. The manufacturing industry, with its high resource levels, can achieve great benefits through the implementation of CBMs as the core element of their operations (Lüdeke-Freund et al., 2019). However, industry-wide implementation of CBMs is challenging, and many companies fail to successfully implement them and capture their potential (Achtenhagen et al., 2013).

The challenges of implementing CBMs starts with the variety of different business models that all have their varying benefits and trade-offs. Thus, it is important to identify, develop, and implement a CBM that is best suited to the firm's prevailing situation. Choosing the wrong approach can easily result in failure. For example, to create value by introducing a take-back agreement is only a viable option when the remaining value of the product is captured through re-use or re-manufacturing and when the company avoids becoming ensnared in problems related to discarding returned products (Gnoni et al., 2017). Another example of a misfit between company conditions and the CBM is when companies assume responsibility for the conditions of the product or retain ownership without being able to deliver value from that agreement. The problem here is that they lack the digital technology to keep track of the conditions of the product or the competence to solve malfunctions (Reim et al., 2019).

Numerous factors such as diversity of customer segments, product characteristics, delivery networks, and marketing strategies affect the implementation of CBMs. Even though the business model describes how the value in an offer is created, the prevailing view in the business model literature suggests it is the tactical choices that are crucial for the success of the CBM. This is because these choices are defined to determine how much value is created through the business model in practice (Casadesus-Masanell & Ricart, 2010). Only when a company is able to make the right tactical configurations can they successfully offer a particular business model. Therefore, it is important to consider the tactical configurations when choosing between different business model approaches (Reim et al., 2015). A misfit between the tactical configurations and the chosen CBM will mean the full potential of the CBM is not achieved (Parida et al., 2019). Although many frameworks exist that propose CBMs (Lüdeke-Freund et al., 2019), there is a research gap concerning the tactical configurations that manufacturing companies should consider when selecting and implementing CBMs. This paper, therefore, guides the selection of CBMs based on tactical configurations that are lacking in the current literature. This approach helps to steer the right choice of CBM according to the discrete situation and the product-specific criteria pertaining (Reim et al., 2016). Consequently, this would reduce the likelihood of CBM implementation resulting in failure, and it would increase the chance of utilizing the potential for full circularity in the specific application.

Because of the heterogeneity of companies, the implementation of CBMs largely depends on a readiness and willingness to implement CBMs successfully (Lewandowski, 2016; Reim et al., 2019). Despite the fact that there are many possible CBMs, implementation of every new business model requires the development of new organizational capabilities (Lüdeke-Freund et al., 2019; Mezger, 2014; Zollo et al., 2016). The current literature talks mainly about various activities that need to be performed when offering different CBMs (Bocken et al., 2014; Lewandowski, 2016), but a gap exists on how the company should be reorganized to develop capabilities and routines to provide CBMs (Frishammar & Parida, 2019; Inigo et al., 2017). In addition, the various types of CBM need different sets of capabilities. Offering, for example, a business model that optimizes customer operations principally requires the development of internal routines and life-cycle assessment, whereas looping business models need to focus on customer interaction with the delivery organization and routines for reverse logistics (Parida et al., 2015). Even though the importance of business model development for the circular economy has been strongly emphasized in the literature (Lewandowski, 2016), a gap remains on how to analyze and develop capabilities for different types of CBM. To address the research gaps identified, this paper seeks *to investigate how CBM selection and capability development facilitate the implementation of CBMs in manufacturing companies*.

Our results build on an exploratory case study involving three global manufacturing companies. We contribute to the circular economy and business model literature by developing a CBM implementation framework comprising two parts. The first part supports the selection of an appropriate CBM. Eleven criteria are identified that help to determine the CBM that is most appropriate for a particular product in a specific market. The criteria are developed based on CBM tactics, namely, sustainability, product and service design, network, marketing, and contracts. There is no one-size-fits-all solution when implementing CBMs, and a careful analysis of the choice factors is necessary, particularly for large, incumbent companies. The second part of the CBM implementation framework addresses capability development and supports companies in moving to more advanced CBMs. The following section provides the theoretical background to this study. This is followed by a description of the research methodology. In Section 6, the key findings and the decision tool developed from our case study are presented. A description of the capability roadmap then follows. Finally, theoretical and managerial contributions are presented along with suggestions for future research.

2 | THEORETICAL BACKGROUND

2.1 | Circular business models

Over the last century, industrial and technological development, together with global trade, has resulted in enormous economic growth that has enhanced human welfare. However, this development path is rooted in exponentially increasing resource usage (Kok et al., 2013). Implementing sustainability in business operations is a very important and challenging task with a specific evolutionary process (Zollo et al., 2013). The circular economy is a response to this need for sustainability and focuses on the three activities of reduce, reuse, and recycle (Ying & Li-Jun, 2012). Against this background, therefore, CBMs need to be designed to create and capture value while helping to achieve an ideal state of resource usage (e.g., finding a model that most closely resembles nature and comes close to achieving the complete recycling of materials). Accordingly, the goal of the business model shifts from making profits through the sale of products and artefacts to making profits through the flow of resources, materials, and products over time, including reusing goods and recycling resources (Linder & Williander, 2017). This reasoning deems that companies can reduce their negative impact on the environment by using this alternative value proposition to deliver and capture value. However, undertaking an ambitious transformation of such proportions requires close collaboration and coordination between industrial network actors to achieve closed or slow material loops (Klewitz & Hansen, 2014).

Many frameworks proposing CBMs can be found in the literature. For example, Lüdeke-Freund et al. (2019) review 26 frameworks and identify repair and maintenance, reuse and redistribution, refurbishment and remanufacturing, recycling, cascading and repurposing, and organic feedstock as the main business model patterns. The sustainable business model archetypes framework developed by Bocken et al. (2014) is widely recognized in the literature for its identification of technological, social, and organizational groupings to classify sustainable business models. Similarly, Lewandowski (2016) uses six business actions to implement the principles of the circular economy, represented by the ReSOLVE framework (Ellen MacArthur Foundation, 2015). This ReSOLVE framework comprises the elements of *regenerate*, *share*, *optimize*, *loop*, *virtualize*, and *exchange* (Rosa et al., 2019). The framework describes CBMs of special applicability to manufacturing companies. The elements used in the framework by Lüdeke-Freund et al. (2019) are mostly included in the "loop" aspect of the ReSOLVE framework except organic feedstock, which has less relevance for manufacturing companies. Therefore, the framework encompasses a broader perspective on the circular economy, which is valuable when examining potential circular-economy initiatives by manufacturing companies. Besides including options to regenerate and optimize, the ReSOLVE framework highlights the potential of digital technology to contribute significantly to the circular economy (Parida et al., 2019). The six building blocks of the ReSOLVE framework are described as follows. *Regenerate* describes the shift to renewable energy and materials. It is related to returning recovered biological resources to the biosphere. *Share* actions aim to maximize the utilization of products by sharing them among users. Sharing also means reusing products, if that is technically feasible, and prolonging their life through maintenance, repair, and design-enhancing durability. *Optimize* actions are focused on increasing the performance/efficiency of a product and removing waste in the production process and in the supply chain. They can relate to leveraging big data, automation, remote sensing, and steering. What is important is that optimization does not require changing the product or the technology (Lewandowski, 2016). *Loop* actions aim to keep components and materials within closed loops. A higher priority is given to inner loops. *Virtualize* actions seek to deliver a particular utility virtually instead of materially. *Exchange* actions are focused on replacing old materials with advanced nonrenewable materials and/or through applying new technologies (e.g., 3D printing). It can also involve choosing new products and services (Ellen MacArthur Foundation, 2015).

2.2 | Business model tactics

The different types of CBM describe how sustainable value can be created. However, a set of tactics based on that choice will determine how much value will actually be generated. Tactics are defined as the company's residual choices on an operational level after deciding which business model to apply (Casadesus-Masanell & Ricart, 2010). Reim et al. (2015) identified five tactics that should be considered in product–service system (PSS) implementation and that are indeed relevant to CBM implementation. The five tactics are *contracts*, *marketing*, *networks*, *product and service design*, and *sustainability*. These are described in the section that follows as applied to CBMs.

The first of the five tactic areas, *contracts*, addresses how rights and liabilities are distributed among the parties involved (e.g., provider or customer). A CBM contract is designed to address all aspects of service provision and to clearly formulate the rights and liabilities of the parties involved (Albino et al., 2016). Such contracts are significantly more complex than selling a specific product outright, and the terms of the agreement must be adapted according to the context (Richter & Steven, 2009). The complexity of the contract depends on the quantity of the regulations included in the contract. Richter and Steven (2009) perceive contracts as the essential foundation for representing and implementing a particular business model. Formulating the contract has a major impact on creating value and generating revenue when operating under a specific business model. To maximize the captured value of the CBM, it is essential to fully align the contract-related aspects of responsibility and the terms of agreement, the contract formalization and its complexity, and the incentive and risk levels (Reim et al., 2015).

The second of the five identified tactics, *marketing*, describes how CBM providers interact, communicate, and use customer and market insights to implement their business models. Several studies have noted that implementing a business model carries important implications for the company's marketing activities (Kindström, 2010; Schuh et al., 2008). When competing with low-cost producers, the service offering with its sustainability benefits is a very important method of nonprice marketing that can attract customers (Schuh et al., 2008) and, thus, differentiate the provider from competitors. In addition, many authors have stressed that the long-term relationship (as opposed to a transition-based relationship) has a significant impact on customer loyalty in the CBM context (Sundin et al., 2010; Tukker, 2004). Moreover, more intense customer interaction and focus on sustainability means that marketing activities differ significantly from traditional product-oriented or service-oriented innovation marketing.

The third of the five identified tactical areas, *networks*, describes how CBM providers use their network relationships with external partners to ensure successful implementation. Facilitating circularity and providing services add several new tasks to the operations of manufacturing and service companies. Because companies cannot perform these tasks independently, they must develop networks and partnership infrastructures (Baines et al., 2007; Kuo, 2011). In this context, a network describes the relationships and interactions with different external stakeholders (e.g., customers, dealers, service partners, and suppliers). This tactic, however, is concerned not only with whom to collaborate but also with the type of collaboration to undertake, which can differ significantly based on the services offered (Schuh et al., 2008). After choosing partners and determining the level of interaction, a major effort is needed to develop ways to coordinate the relationships and share the right information efficiently throughout the network.

The fourth area, *product and service design*, describes how providers design products and services to meet the diverse needs of customers and to successfully implement CBMs. Product and service requirements change along with the various types of services provided as companies offer circular solutions. To meet new product and service design requirements, special emphasis is placed on aligning physical product characteristics with service offer characteristics and vice versa (Adams et al., 2016). Several preferable product properties (e.g., the ability to be maintained, upgraded, and reused easily) can be identified, which will increase the value creation of the CBM (Sundin & Bras, 2005).

The final tactical area of *sustainability* in operational practices is no less important. Most studies take for granted that implementing CBMs drives environmental benefits. However, recent studies have acknowledged that CBMs, in some cases, sustain only economic benefits and exert a deleterious impact on the environment (Kuo, 2011; Tukker, 2004). Thus, deploying sustainability tactics can ensure that CBMs are implemented successfully since a proactive approach promoting sustainability-driven changes will likely deliver the dual goals of economic and environmental benefits. The highest potential for sustainability improvements results from either increased resource use or innovations that make the production or delivery process more sustainable (Indigo et al., 2017).

2.3 | Capabilities for CBM implementation

The resource-based view of the firm and the capability perspective argue that companies can achieve competitive advantage through developing firm-specific capabilities (Teece et al., 1997). Capabilities are usually inimitable and nontransferable; therefore, they tend to be unique and valuable (Foss, 1999). In addition, capabilities are combinations of routines that provide a structured approach for mitigating new challenges and promoting organizational change (Salvato & Rerup, 2011; Wallin et al., 2015). Thus, for a manufacturing company with a CBM focus, capabilities development is an important requirement for the transformation and innovation sought (Achtenhagen et al., 2013; Inigo et al., 2017). Few studies have focused specifically on the type of capabilities needed to offer, or to make the transformation to, a CBM (Inigo & Albareda, 2019; Mezger, 2014). Nevertheless, such offerings tend to represent major challenges for manufacturing companies (Baines & Lightfoot, 2013). Therefore, this study aims to investigate the capabilities and routines that manufacturing companies need to provide, and to make the transformation to, CBMs.

While still nascent, prior literature has provided hints on the capabilities that are important in this domain. Providers specifically need capabilities to develop and organize new CBMs that create value for customers. This entails extending, repackaging, improving, and introducing new types of offers and services in accordance with market opportunities (Sjödin et al., 2016). Capabilities to develop CBM offers need to establish structures, processes, and activities to develop new product–service combinations (Achtenhagen et al., 2013; Zomerdijk & Voss, 2011). However, CBMs are dependent on network actors and capabilities for the effective management and knowledge sharing with network partners in the service delivery network (Inigo et al., 2017; Sjödin et al., 2016). The service delivery network includes dealers, distributors, service partners, and branches that take an active role in linking forward to customers and users and backward to the provider (Klewitz & Hansen, 2014; Reim et al., 2019; Wallin et al., 2015). This management capability captures the diverse and often distributed knowledge that the firm needs to develop and commercialize innovative product–service combinations. The process entails managing not only technical knowledge about the product and service combinations but also knowledge about market characteristics, customer types, delivery processes, and sales strategies (Sjödin et al., 2016).

Furthermore, CBMs are heavily dependent on technological advancements (Lewandowski, 2016). Manufacturing companies are increasingly adopting digitalization to pursue a CBM and servitization strategy (Kowalkowski & Brehmer, 2008). This means investing significant resources in building new capabilities to support digitalization initiatives in their organizations and to maximize the value-creation potential that exists in their relationships with customers. In fact, prior studies have shown digitalization capabilities to be key enablers of advanced service provision (Parida et al., 2015; Sjödin et al., 2016) For example, some studies show that manufacturing companies are vying for technological superiority in their products by embedding more intelligence and remote functionalities (Iansiti & Lakhani, 2014). Meanwhile, other studies observe that data gathering and analysis are the main focal points to help manufacturing companies achieve the benefits of maximizing value when interacting with customers (Lenka et al., 2017; Opresnik & Taisch, 2015). However, there is a dearth of studies specifying the capabilities that are necessary to support the transformation to more advanced levels of CBM in manufacturing companies and how these capabilities are applied to achieve sustainability benefits.

3 | METHOD

The present study is based on an exploratory case study involving three global Swedish manufacturing company that actively offer CBMs. We studied the case companies from different levels including the strategic and distribution network levels. This research design was chosen because knowledge of how CBMs can be implemented in a global setting and the factors affecting the choice of CBMs is limited. Information from rich real-life cases can help identify new aspects and phenomena derived from reality (Eisenhardt, 1989; Yin, 2014), such as relationships between provider and distributor that lay the foundations for successful CBM implementation. The case companies were chosen because they have long experience in advanced-service provision and global-market operations, which clearly facilitates the implementation of CBMs. In particular, the case companies are working actively to improve sustainability in all aspects of their operations, including their international businesses. Furthermore, they have undertaken significant steps to change their business models in order to ensure advances in sustainability through CBM adoption in heterogeneous markets. Thus, all three companies represent cases that are appropriate to the present exploratory study. Generally, Sweden, with its legislation and culture, has been driving the development of the circular economy forward and now offers excellent conditions for companies to test and implement new CBMs.

Company A is a global leader in the provision of construction equipment. It offers products and services in more than 125 countries through proprietary or independent dealerships. Currently, it offers, in addition to its machines, a range of services including maintenance contracts, extended warranties, and tracking error codes and fuel consumption. Twelve respondents were interviewed who are actively involved in current service provision and development at the company. They were drawn from top management and middle management levels as well as from regional distributors.

Company B manufactures press-hardened automobile parts for the global market. The unit of interest in this case is the tooling department located in Sweden, which supplies the press-hardening factories across the globe. Services currently offered by Company B are maintenance training, simulations, and process optimization. To improve the efficiency of its products, Company B is currently developing a business model based on guaranteeing a certain “number of strokes”; its tools will perform for a specified duration. The improved resource utilization brings significant sustainability benefits. We conducted interviews with six respondents from different segments of the organization—for example, head of products, project manager for products–services, and financial project manager.

Company C manufactures forest machines for the global market. It offers several CBMs, which include fleet management systems and advanced service agreements that control the machine to carry out maintenance in the most appropriate way so that the lifetime of the machine and its individual parts is increased. We conducted interviews with seven respondents from different sectors of the organization—for example, sales manager, business developer, IT manager, and managers of international service points. Table 1 provides a summary of the case company characteristics.

The current study's research approach was qualitative and based on semi-structured and open-ended interviews. The interview guide was designed to explore differences in implementing CBMs, related challenges, and readiness levels. Furthermore, questions on the support needed and future CBM planning were asked so that maturity levels between different settings could be compared.

The face-to-face interviews lasted between 60 and 90 min; interviews were recorded and transcribed in addition to the notes that researchers took during the interview process. The companies also made internal documents available prior to the interviews so that the researchers could better understand company operations. These documents and the transcribed interviews and notes provided the basis for the analysis.

TABLE 1 Company characteristics

Company	Industry	Turnover (EUR)	Employees	No. of interviews	Example of CBM
A	Construction equipment	507 Bn	14,000	12	Keep ownership of machines and offer availability
B	Machine tools	9,5 Bn	550	7	Full-service contracts on machine tools and productivity enhancement
C	Forest machines	26 Bn	590	6	Remote control and assistance

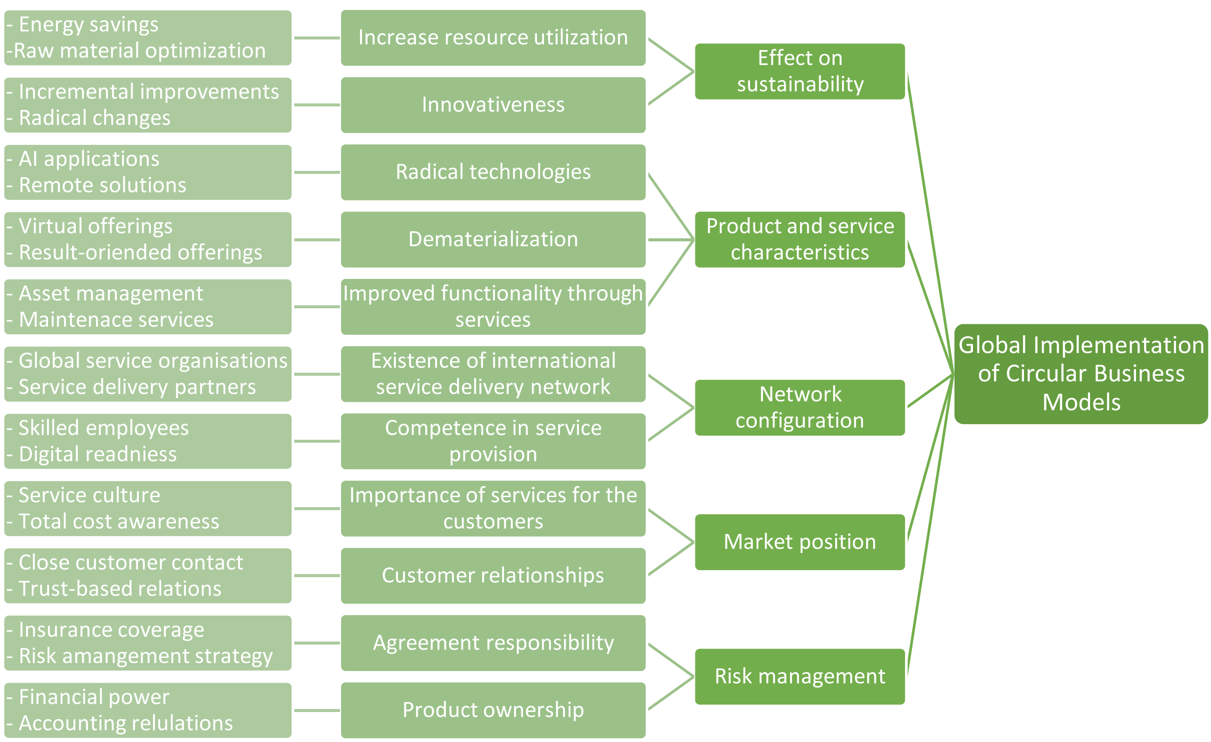


FIGURE 1 Coding tree [Colour figure can be viewed at wileyonlinelibrary.com]

The data analysis was based on open-coding content analysis where headings were written into the transcriptions based on the different risks that were mentioned (Elo & Kyngäs, 2008). These first-order categories were then analyzed for links in order to cluster them into theoretically distinct groups, the second-order themes. Finally, aggregate themes or dimensions were identified (Nag et al., 2007). Figure 1 presents the coding tree. The preliminary results of the present study were shared at the validation workshop, and participants offered comments that supported the findings.

To improve the validity of the study, several measures were taken in different steps (Yin, 2014). The interviews were recorded and transcribed to ensure that the respondents' answers were correct. Respondents were also informed that their answers were anonymized to ensure they felt no reluctance providing honest answers to the interview questions. An interview guide was also used to ensure that the interviews were of a consistent quality.

Patterns were developed by coding data, and triangulation was used in both data collection and analysis to increase the reliability of the study (Leech & Onwuegbuzie, 2008).

4 | RESULTS

Our empirical results clearly show that products and markets vary significantly and that CBMs cannot be implemented as a one-size-fits-all solution. Many companies experience problems in choosing the right

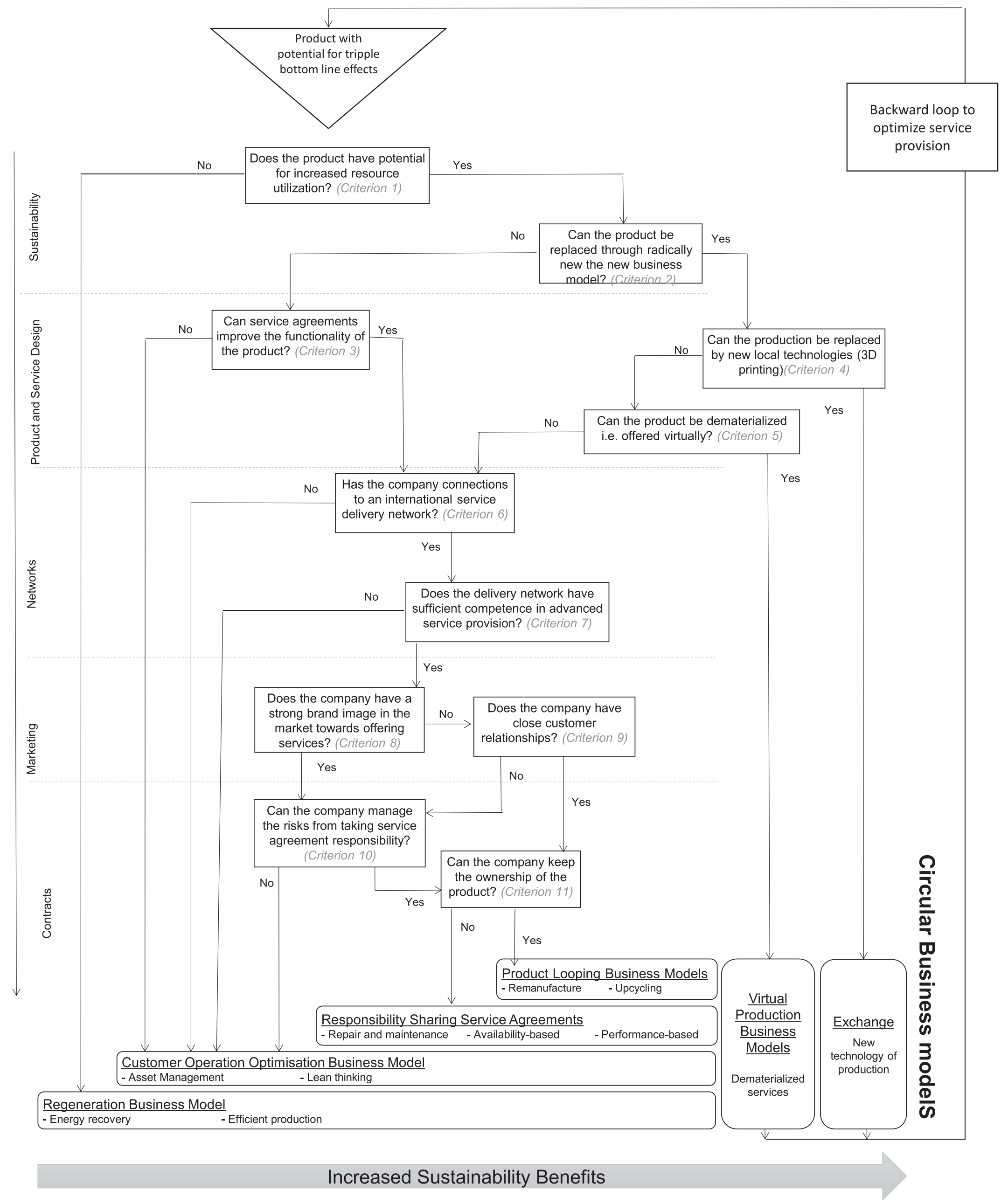


FIGURE 2 Circular business model decision tree

CBM for their specific operations. In order to decide which CBM is most appropriate in a certain market, our study has identified certain tactical choices that can deliver a particular CBM. A decision tree has been developed with 11 tactical choice criteria, which are structures based on PSS implementation tactics (Reim et al., 2015).

Going through the tactical choices will deliver the most appropriate CBM from the ReSOLVE framework with higher sustainability effects the further right one proceeds. It should be noted that a decision to opt for an exchange or virtual production business model might require a backward loop to the top of the decision tree if production and delivery of these products are to be optimized. The order of the tactics in the decision tree was determined by the ability and complexity of the tactic to select a specific CBM. For example, the lack of sustainability potential immediately excludes certain business models. This is the same for the digitalization tactic. The last three tactics are needed to decide between business models that are more similar and, therefore, need more decision steps. Figure 2 shows the decision tree, and the tactical choice criteria are explained in detail in the section that follows.

4.1 | Sustainability tactic for CBM implementation

The decision tree should be used for a specific market and a specific product that has potential with regard to positive triple bottom-line effects. Criterion 1, part of the sustainability tactic, is connected to increased resource utilization. When the product itself has no potential for increased resource utilization, the only possible CBM is the regeneration business model. This model focuses on efficient production and energy recovery in production in order to deliver sustainability benefits.

When the product itself has potential for increased resource utilization, greater benefits are possible. Therefore, Criterion 2 asks which innovation type—incremental or radical—is driving the new CBM. Incremental innovations would leave the underlying technological aspects of the product essentially unchanged, with the way of providing the product and its related services representing the circularity of the business model.

Radical technological innovations question all the underlying assumptions of the product, including technology, distribution, and appearance. These radical innovations have high circularity potential because systems are redesigned from scratch and, thus, circularity can be considered at an early stage. Commonly, certain markets are more open to radical innovations that can change an entire industry. Markets that lag behind may need more intensive preparation for shifts that are bigger than those that can be achieved by implementing more incremental approaches.

4.2 | Digitalization tactic for CBM implementation

Following the path of incremental innovation from the perspective of sustainability, Criterion 3 of the decision tree explores whether service agreements are appropriate in seeking to improve the performance of the product in order to benefit circularity. Service agreements are closely connected to the reuse, remanufacture, and recycle logic of the circular economy. A researcher at Company B emphasizes the point:

> We are very much working with sensor and measuring projects to offer service applications such as predictive maintenance by building on machine learning to do high quality maintenance.

Furthermore, PSS are defined in terms of environmentally friendly values, which are primarily built on increasing the service element of product provision. If service agreements are not suitable for improving the product, the choice of CBM is limited to customer operation optimization business models. This type of CBM is not concerned with product improvement itself but rather how the product is used in relation to other products or equipment on the customer side. A digital platform for fleet management is a common example from our case studies, which can be offered to the customer as an add-on product that can optimize operational sustainability without requiring more advanced service agreements.

Radical innovations are mainly based on new digital technology. Criterion 4 analyzes whether the production of the product can be replaced by local production through, for example, the use of 3D printing. Particularly with spare parts, this can be a disruptive technology that significantly reduces transportation and production of stock. If this is possible, an exchange CBM can be implemented that has the greatest potential in terms of circularity and sustainability. This is the case because this particular business model can make use of the logic that is behind all other CBM types. If the production cannot be replaced, Criterion 5 asks if the product can be dematerialized, for example, by being offered virtually. When the answer is yes, a virtual production business model should be targeted given its significant benefits in terms of sustainability. The tooling manager in Company B explained:

> We need to focus on what we can do from here, on distance. It is not sustainable to fly here and there just because something does not work perfectly.

Other responders frequently remarked that, for example, machine training sessions could be held using remote coaching and based on data analysis instead of requiring a coach to drive to various operator sites.

4.3 | Ecosystem tactic for CBM implementation

For products that can be significantly improved through service agreements but cannot be dematerialized, Criterion 6, which is related to the ecosystem tactic, explores the company's connection to an international service delivery network. Without a supportive service delivery network, implementation of the customer operation optimization business model will be the only viable option. A marked ability to build new partnerships may also be sufficient. The difficulties of collaboration with the service network are highlighted by a global service solutions manager from Company A:

> Offering services is very hard because of the intermediate function of the service network. You need to trust in two parties at the same time because the dealer provides the service and the customer is actually getting the service.

When connections to the international service delivery network exist, it is important to determine whether the service network has sufficient competence to provide advanced services (Criterion 7). A sales manager from Company C explains this challenge:

> You need to be very skilled with data and analytics. For the service agreements, we need people to manage this, otherwise the customers will not be happy. Right now, we are behind here mainly because we have too many agreements and cannot handle them.

If competence is not available, again only customer operation optimization business models should be considered because they do not necessarily require local service delivery networks. Because service delivery network actors can be either owned by the provider company or by external partners, the required competence can be acquired from different sources. But the provider company should be fully cognizant of the current competence level of its service delivery actors. For example, digital readiness to use analytics in service provision is a crucial competency.

4.4 | Market tactic for CBM implementation

Not only does the competence of the service delivery partners vary significantly in different markets but also the market perception of advanced services. Therefore, Criterion 8 analyzes whether the customer in the market is aware of the advantages of service provision. There can be a service culture in the market, unattractive alternatives, or a high life-cycle cost awareness on the part of customers.

If this is not the case, Criterion 9 highlights the importance of a close customer relationship that facilitates the adoption of new service offerings. Customer readiness and acceptance are crucial for the success of the circular economy. A regional manager at Company C explains:

> We need to be close to the customers. Because, if you are close, you also get a relation. You cannot just send emails back and forth.

Trust-based sales relations and a provider's high brand value boost the ability to manage customer relationships. This underscores the high relevance of the market tactic in this setting to prepare customers for new ways of consumption and product ownership.

4.5 | Contract tactic for CBM implementation

When the service demand is high but the relationship with the customer is not very close, it is important for the company to question whether it is able to manage the risks tied to service agreements (Criterion 10). A global product manager from Company A expresses this concern as follows:

> We need to be responsible for a bigger portfolio of agreements or spread out the risks. You can also have people working on managing the agreements and following them up and learn how to mitigate risks and identify negative results early on. You need to be really skilled and a specialist in that.

When no sufficient risk management solution can be found, only customer operation optimization business models should be offered until risk management is secured and more advanced CBMs are implemented. Risk management can also be supported by technological applications to reduce or share risk.

If the risk management question is solved, the company should finally—based on Criterion 11—evaluate whether it is possible to retain ownership of the product. Sufficient financial power and favorable accounting regulations would be required. The difficulty inherent in this issue was exemplified by the portfolio manager of Company A:

> If we want to keep the ownership, we could do it, but this would not be possible without the approval of the company board, and then it depends also on the scale of contracts.

When the company retains ownership, product-looping business models are a good option to implement because remanufacturing and upcycling become wholly feasible. If it is preferred that the ownership is transferred to the customer, there are, in any case, very many service agreements available, which are based on sharing responsibility and which are in line with PSS offerings that facilitate sustainability and circularity.

5 | TOWARDS A CAPABILITY DEVELOPMENT ROADMAP

The CBMs derived from the ReSOLVE framework offer increasing levels of sustainability benefits. In the interviews, respondents from the case companies showed they were highly motivated to reach the higher levels of their CBMs. Explanations about the challenges and the need for additional competence to achieve high levels of sustainability showed potential common paths and capability requirements, which have been consolidated into a CBM capability roadmap in this section. Starting from the most basic level of circular production, companies should aim to move forward to circular service through servitization (see Figure 3). This can also enable product innovation that leads on to the development of circular products. Even though this would mean the highest level of circularity, the upscaling of these products would require the implementation of circular principles in production and the offer of services in combination with circular products.

In order to move to more advanced levels of the CBM, numerous capabilities need to be developed. Moving to the next maturity level is especially challenging when the service level is increased. This is because changes in the service offering affect all functions in the entire organization, allowing several steps to be taken. Capability analysis and development are crucial in order to move to a higher CBM level and to achieve higher sustainability gains.

Figure 4 shows a capability development framework that describes the capabilities and routines that need to be developed when moving to a higher maturity level of CBMs. The capabilities are divided into three categories: solution configuration, orchestration, and digitalization capabilities. Solution configuration capabilities describe how companies combine product–service and digital components to obtain circular benefits. Orchestration capability refers to the routines needed to orchestrate collaboration with new and existing delivery partners and to develop delivery network competencies.

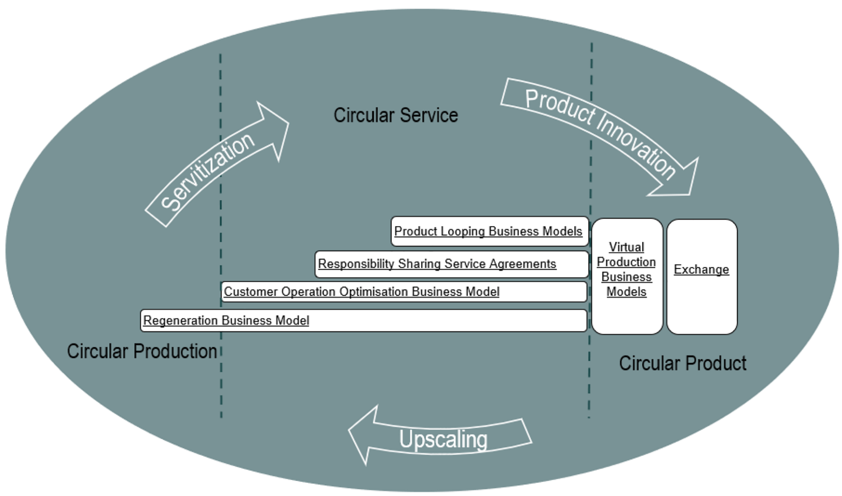
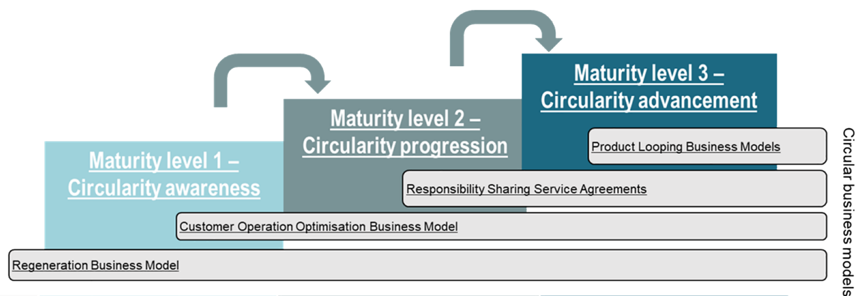


FIGURE 3 Continuous circular business model development [Colour figure can be viewed at wileyonlinelibrary.com]



Circular Business Model Capabilities	**Maturity level 1 – Circularity awareness** *(Key routines)*	**Maturity level 2 – Circularity progression** *(Key routines)*	**Maturity level 3 – Circularity advancement** *(Key routines)*
Solution configuration capability (*How firms combine product-service and digital components for circularity benefits*)	- Develop sustainability awareness measures - Create life cycle assessment tools	- Asses agreement configurations for different customers - Include digital functionalities in all offerings	- Develop ability to manage product ownership over lifetime - Create routines for customer integration
Orchestration capability (*How firms orchestrates collaboration with new/existing delivery partners and develops delivery network competencies*)	- Develop routines for internal service provision organization and responsibilities	- Develop programs for service delivery network development - Promote development of closer customer relationships in delivery network	- Develop systems for re-use and recycling of material - Design organization of reverse logistics
Digitalization capability (*How firms utilizes data and analytics to develop increased product life cycle knowledge*)	- Develop software for assessment of product data - Automate data analysis to provide customer/delivery partner feedback	- Create functionalities for remote monitoring and control - Develop malfunction foresight system	- Develop system for analysis of reusability and remaining value of the returned product - Monitor system implementation

FIGURE 4 Circular business model capability roadmap [Colour figure can be viewed at wileyonlinelibrary.com]

Digitalization capability defines how companies utilize data and analytics to develop increased product life-cycle knowledge. Generally speaking, the capabilities are closely related to the decision criteria outlined in the previous section.

Maturity level 1 is largely concerned with circularity awareness, and it is attained when moving from the regeneration business model to the customer operation optimization business model. Repositioning from a focus on circularity efforts concerning internal production to customer operation optimization requires major capability development. In the case of configuration capability, it is important to develop sustainability-awareness measures that highlight the potential for increased resource utilization. It is important to show actual savings and results of the new business model in order to convince customers about the benefits. In addition, life-cycle assessment tools need to be created to analyze and optimize current operations. Optimization requires in-depth knowledge about the customer organization and how changes at one place affect the totality of operations. Close collaboration with customers will be necessary. Furthermore, to develop routines for the internal service provision organization, orchestration capability is crucial when moving to maturity level 1. Operation optimization is, in most cases, not dependent on the service network; rather, the provider company needs to establish internal competencies and responsibilities for its new offers. Similarly, digitalization capabilities for maturity level 1 require the development of software to assess product data and to automate data analysis so that the customer and the delivery network are provided with feedback and all relevant information.

Maturity level 2 can be seen as circularity progression in moving from the customer operation optimization business model to responsibility-sharing service agreements. To develop an appropriate solution configuration capability, it is necessary not only to assess agreement configurations for different customers but also to include digital functionalities in all offerings to monitor the conditions of the product. For the orchestration capability, it is important to develop programs for service delivery network development and to promote closer customer relationships in the delivery network. Service networks have to change their operations from waiting to handle an emergency to planned services that solve problems before they occur. Creating functionalities for remote monitoring and control as well as developing a malfunction foresight system would produce sufficient digitalization capability for maturity level 2.

Maturity level 3 can be described as circularity advancement, which is reached when moving beyond responsibility-sharing service agreements to product-looping business models. Developing the ability to manage product ownership over its lifetime and creating routines for integration with the customer are important for the development of the solution configuration capability. Organizing accounting and balance sheet routines for the products that traditionally have been sold and did not become assets in the company is important, as is the management of the ongoing customer relationship, which has greater potential for conflict. The orchestration capability means developing systems to re-use and recycle material as well as designing the organization of reverse logistics. Looping business models only make sense when the returned product is really made use of—that course of action requires a considerable amount of new development and many new routines. Finally, the digitalization capability needs routines to develop a system that can analyze the reusability and residual value of the returned product. In addition, a monitoring system should be implemented to keep track of the product through its entire lifespan.

6 | CONCLUSIONS

CBMs serve to create business value by reducing the extraction and use of natural resources and the generation of industrial and consumer wastes. The CBM represents a vital missing piece in the transition to a more resource efficient and circular economy. However, implementing CBMs is not easy and requires companies to consider tactical configuration and capability development to cope with environmental conditions in diverse markets. Our study reports on ways in which manufacturers can implement CBMs and manage the inherent complexity. The most important means seem to be the discovery and analysis of tactical choices and capabilities relating to orchestrating the intra- and inter-firm networks and use of digital capabilities to manage technological systems so that the resource utilization is made visible and transparent for solution configuration. These efforts make it possible for actors to offer more sustainable solutions, which then lead to improved customer orientation and circular economy benefits.

6.1 | Theoretical contributions

The present study makes several theoretical contributions to the literature on CBMs, servitization, and business model implementation. First, this paper contributes to an understanding of the implementation of CBMs in the manufacturing industry. The literature on CBMs commonly focuses on small-scale initiatives in a B2C context (Bocken et al., 2014), even though large manufacturers would benefit the most from implementing CBMs. The main challenges lie in changing their complex, product-centric operations, which require a major transformation if they are to offer CBMs. Manufacturing companies that operate in a traditional industry would especially benefit from deeper understanding and analysis of different degrees of circular transformation rather than descriptions of activities for full-scale CBMs (Frishammar & Parida, 2019). Aligned to this view, the present study provides intermediate steps in implementing different CBMs as well as capabilities with progressively higher sustainability benefits.

The second contribution this study makes is the application of business model tactics to CBMs to support their broad implementation (Reim et al., 2015). The variation in different CBMs makes the choice of an appropriate business model difficult. This is especially important because markets and products are very different from each other, and there is no one-size-fits-all CBM for all providers (Zarpelon Neto et al., 2015). Analyzing the effect of tactical configurations is important in selecting the CBM that a company is able to offer. The categorization of tactics in this present study shows that CBM implementation is affected by factors on various levels and business areas that differ with respect to the readiness level of the provider. Specifically, we have identified 11 decision criteria that guide the choice of an appropriate CBM. In comparison to earlier studies (e.g., Bocken et al., 2014), we provide a more in-depth view of diverse tactical choices that companies need to make in the application of CBMs. Even though the different CBMs have been identified and described in the literature (Lewandowski, 2016), support for the decision-making process has been scant especially when it comes to implementing CBMs. Accordingly, we provide a dynamic perspective on discerning the conditions under which certain CBM types are more applicable.

Finally, we contribute by offering a capability development framework for CBM implementation. Moving to more advanced levels of a CBM is highly desirable, but it is only possible when undertaken with wide-ranging capability development (Parida et al., 2015). Understanding capability development is a necessary part of organizing the transformation of companies to CBMs. Activities and single capabilities are mentioned in the literature but a holistic perspective that identifies capabilities required at different CBM levels has, to this point, been missing. This study provides a detailed exposition of how capabilities for CBM implementation can be developed by showing the progressive development of underlying routines over different maturity levels. Notably, in the implementation of CBMs, companies need to mature in their understanding of the circularity steps they need to take—from heightening awareness to advancing systematically to develop solution–configuration, orchestration, and digitalization capabilities. Moving from low to higher levels of sustainability carries with it certain implications that companies need to appreciate.

6.2 | Managerial implications

This study provides several implications for managers responsible for developing and implementing CBMs. First, incumbent manufacturing companies with their high resource levels and complex operations need specific guidance in the process of becoming CBM providers. This study addresses the transformation process needed to implement CBMs in large manufacturing companies. In contrast, previous literature has focused mainly on the activities and characteristics of different CBMs, often in start-up companies.

Second, it is important to realize that CBMs are very different from each other, and there is no single fit for all companies. The selection of the right business model is based on the characteristics of the company, product, market, and network. This study provides managers with support in analyzing their companies based on the tactical configurations that enable certain types of business model. It is important not to choose too ambitious a business model where the risk of failure is substantial. Rather the company should aim for stepwise advancement in business model development.

Third, implementing CBMs requires companies to reorganize their operations based on the business model that is best fit for their specific purpose. This requires the development of new capabilities and routines. Therefore, this study contends that different capabilities are required for different business models and that the transformation to offering CBMs will only succeed when the capabilities and routines are developed at the right level. This study also helps managers to develop an appreciation of their company's boundaries when it comes to implementing advanced CBMs.

6.3 | Limitations and direction for future studies

Although the results provide several contributions to the emerging CBM literature, the present study has certain limitations that should be weighed in the balance when interpreting the results. Accordingly, the limitations provide a starting point for future research.

First, by choosing cases in which companies are actively working to develop their CBM offerings, we gained insights from their long experience. These insights, however, are limited to large Swedish manufacturing companies. Thus, adopting a broader case selection would provide scope for better cross-case analysis. Future research could conduct further empirical studies to validate or extend the present study's findings through quantitative analysis.

Second, our research analyzed CBM implementation from the manufacturer's viewpoint. Therefore, we recommend that future research adopts a different standpoint and develops CBM implementation strategies that are also based on the internal activities of the service network. For example, vital actors such as distributors, remanufacturing agents, and digital system providers can offer crucial insights on the transition to a circular economy and, consequently, should be studied further. In addition, the transition to a circular economy requires coordinated change in larger ecosystems of providers, partners, and customers, and this ecosystem perspective remains ripe for further study (Parida et al., 2019; Sjödin, 2019).

Future research should investigate whether our findings hold under other cultural and industrial conditions (e.g., companies from Asian countries or B2C companies). Finally, the present study identifies criteria that have a direct bearing on the choice of CBM. Our list may be incomplete, however, and the criteria are not weighted to determine which are the most critical. Creating this weighting of criteria would likely prove very beneficial for future CBM implementation.

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