Circular business models

Where does Swedish industry stand?

Vinit Parida

Johan Frishammar

SWEDISH ENTREPRENEURSHIP FORUM

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Vinit Parida
Luleå University of Technology

Johan Frishammar
Luleå University of Technology

Entreprenörskapsforum
Örebro universitet, 701 82 Örebro
E-post: info@entreprenorskapsforum.se

Författare: Vinit Parida och Johan Frishammar
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Preface

Over the past ten years, so called circular business models have become a central framework for addressing climate change through transformation at the firm level. A shift towards circularity means that a firm will revise its ways of creating, delivering, and capturing value so that this is done in a more resource efficient way. This report for Swedish Entrepreneurship Forum offers an in-depth analysis of the diffusion, problems, and opportunities regarding circular business models in Swedish industrial firms.

In Circular business models - Where does Swedish industry stand? the authors have reviewed the extant literature on circular business models in Swedish manufacturing industry. The report also draws on a series of in-dept case studies on the implementation of the models in large manufacturing firms. The authors show that Swedish firms are actively experimenting with new value propositions building on the logic of circular business models, but also that there are many barriers to the implementation of circular business models.

The authors offer concrete advise for Swedish firms that want to implement a more circular business logic: How to integrate resource efficiency in business strategy, how to revise value propositions to customers, how to build necessary organizational competencies and capacity for scaling. They also discuss policy initiatives that may mitigate barriers and speed up the implementation of circular production practices. Important advice is to remove regulatory disparities, and to embrace standardization.

The authors are Vinit Parida and Johan Frishammar, both Professors at Luleå University of Technology.

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Anders Broström, Managing Director Swedish Entrepreneurship Forum and Professor University of Gothenburg

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Swedish Summary

Denna rapport för Entreprenörskapsforum ger en djupgående analys av cirkulära affärsmodeller i svenska industriföretag. En affärsmodell tydliggör hur företag skapar, fångar och levererar värde. En cirkulär affärsmodell gör detsamma men med ett medvetet fokus på hållbarhet och resurseffektivitet. En cirkulär affärsmodell strävar efter att bromsa in, minska eller till och med ”stänga av” resursflöden så att tillväxt och resursförbrukning gradvis frikopplas.

En cirkulär affärsmodell förutsätter samarbete mellan flera företag och organisationer som är ömsesidigt beroende av varandra – till exempel ett tillverkningsföretag, dess kunder, tjänsteleverantörer, underleverantörer samt aktörer specialiserade på återvinning. Till följd av ett uttalat fokus på hållbarhet och resurseffektivitet, och att samarbete mellan företag är så centralt, är det utmanande och komplext att designa, utveckla och implementera en cirkulär affärsmodell. I praktiken innebär det en övergång från produktförsäljning till att företag tillhandahåller avancerade kombinationer av produkter och tjänster.

Eftersom en cirkulär affärsmodell blivit det dominerande ramverket för hur företag adresserar hållbarhet och cirkuläritet på företagsnivå, är det viktigt att belysa var svenska industriföretag står. I en värld som i allt högre grad efterfrågar mer miljövänliga och hållbara produkter och tjänster kan cirkulära affärsmodeller vara en källa till konkurrensfördelar, åtminstone på kort till medellång sikt. De kan också generera positiva miljö- och klimatvinster för samhället vilket går utöver enskilda företags ekonomiska vinster och förluster. Men det finns också svåra avvägningar att ta hänsyn till, exempelvis när investeringar i nya cirkulära affärsmodeller driver kostnader på kort sikt men inte genererar tillräckliga intäkter.

Rapporten inleds med att belysa några av de hållbarhetsutmaningar som svensk industri står inför, och det efterföljande behovet av att klara övergången från en linjär till en cirkulär ekonomi. Vi definierar begreppet cirkulär affärsmodell och förklarar de viktigaste utmaningarna som stora och små företag står inför när det gäller cirkuläritet. Huvuddelen av rapporten tar därefter upp två centrala frågor:

1. Vilka barriärer möter svenska industriföretag när de designar, utvecklar och implementerar cirkulära affärsmodeller?

2. Vilka praktiker använder svenska industriföretag när de designar, utvecklar och implementerar cirkulära affärsmodeller?

Var står då svenska industriföretag angående cirkulära affärsmodeller? Är vi bra eller dåliga, ledande, eller släpar vi efter? Historiskt har Sverige av många setts som ett föregångsland inom hållbarhet. Det är därför lite paradoxalt att hindren för att införa cirkulära affärsmodeller är många och starka. Parallellt är de cirkulära affärsmodellspraktiker som svenska industriföretag ägnar sig åt till stor del experimentella och i tidig fas. En analys av barriärer för cirkulära affärsmodeller visar att dessa tenderar att vara inriktade på olika dimensioner av en cirkulär affärsmodell:

- Att misslyckas med att använda framväxande teknologier, att på djupet involvera kunder och att skapa värde gemensamt med ekosystemaktörer utgör barriärer för cirkulärt *värdeskapande*.

- Hindren för att *leverera värde* är fundamentalt annorlunda. Här utgör underutvecklade tjänsteleveransorganisationer och externa partnernätverk de viktigaste barriärerna. Ett bristfälligt partnernätverk utgör ofta en särskilt central barriär då en cirkulär affärsmodell för det mesta förutsätter samarbete utanför den befintliga värdekedjan i ett företag.

- Slutligen, höga initiala investeringskostnader, utmaningar med att utforma en hållbar intäktsmodell och en oförmåga att förutse och motverka risker utgör hinder för att *fånga värde*.

- Rapporten påvisar därtill att de barriärer som hindrar cirkulära affärsmodeller är mångfacetterade, komplicerade och ofta sammanlänkade.

I vid bemärkelse grundar de sig i nödvändigheten för industriföretag att utveckla nya förmågor och kompetenser för att effektivt utveckla och implementera cirkulära affärsmodeller.

Analys av praktiker för cirkulära affärsmodeller visar följande:

- Svenska industriföretag arbetar aktivt med att designa och experimentera med nya typer av värdeerbjudanden, inklusive nya typer av cirkulära värdelogiker och nya typer av intäktsmodeller (till exempel *betala-per-användning* eller *betala-för-resultat*).

- Svenska industriföretag ägnar sig systematiskt åt kompetensuppbyggnad – till exempel genom att implementera nya metoder för storskalig dataanalys vilket möjliggör ökad cirkuläritet.

- Svenska industriföretag engagerar sig aktivt i att skapa och orkestrera ekosystem av samarbetspartners, inklusive anpassning av incitament och arbetsfördelning till de krav som cirkulära affärsmodeller ställer.

- Många av dessa praktiker är dock i relativt tidiga faser, och vi som författare känner inte till ett enda stort svenskt industriföretag som framgångsrikt har skalat upp en cirkulär affärsmodell för att ersätta sin traditionella linjära affärsmodell.

Både barriärer och praktiker för cirkulära affärsmodeller illustreras med en mängd exempel från svenska industriföretag. Rapporten belyser också att det inte finns någon enhetlig cirkulär affärsmodell som passar alla företag, och en cirkulär affärsmodell är inte 0 eller 1. I stora industriföretag innebär övergången mot cirkulära affärsmodeller att gradvis förbättra resurseffektiviteten och därmed ta steg mot ökad cirkuläritet. Ofta samexisterar gamla och nya affärsmodeller, vilket återspeglar komplexiteten och den gradvisa karaktären av cirkulär transformation.

Genom att tydliggöra både barriärer och praktiker så ger rapporten praktiska förslag på hur svenska industriföretag kan motverka eller mildra barriärer och gradvis förbättra de praktiker och aktiviteter som möjliggör cirkulära affärsmodeller. De flesta av barriärerna och praktikerna faller inom industriföretagens eller deras samarbetspartners direkta påverkanssfär.

Dessa kan alltså påverkas direkt av företagen. Det innebär att svenska industriföretag kan och bör ta itu med dessa barriärer och praktiker av skäl som berör både konkurrensfördelar och hållbarhet.

Därtill styr politiska initiativ, såsom Sveriges klimatmål och klimatpolitiska ramverk, tillsammans med initiativ likt EU:s handlingsplan för cirkulär ekonomi, redan idag svenska industriföretag i en mer cirkulär riktning. Det är svårt att säga om de politiska initiativen som redan finns i form av lagar, regleringar och industripolitik räcker till eller om det behövs mer. Med det sagt, offentligt stöd via riktade FoU-program och proaktiv koordinering av nätverk skulle kunna påskynda övergången till cirkulära affärsmodeller. Sammanfattningsvis kan Sverige och svenska industriföretag proaktivt ta betydande steg mot förbättrade konkurrensfördelar och en mer hållbar och cirkulär industriell framtid.

Executive Summary

This report for Swedish Entrepreneurship Forum offers an in-depth analysis of circular business models (CBMs) in Swedish industrial firms. A business model centers on how firms create, capture, and deliver value. A circular business model does the same but with a deliberate focus on sustainability and resource efficiency. A CBM seeks to slow down, narrow, or even close resource flows so that growth and resource consumption are decoupled.

A CBM often presupposes collaboration between multiple firms and organizations that are mutually dependent on each other – for example a manufacturing firm, its customers, service providers, sub-suppliers, and actors specializing in recycling. Due to its focus on sustainability and resource efficiency, and because of its collaborative nature, designing, developing, and implementing CBMs is challenging and complex. In practice, for industrial firms, it brings about a shift from product sales to providing advanced combinations of products and services.
Because CBMs have recently emerged as the perhaps dominant framework for how to address sustainability and circularity at the firm level, it is important to shed light on where Swedish industrial firms stand. In a world that is increasingly asking for more environmentally friendly and sustainable products and services, CBMs can be a clear source of competitive advantage, at least short- to medium-term. They can also generate positive environmental and climate effects, which are good for society, and which go beyond the profits and losses of single firms. However, there could also be trade-offs at play, such as when investments into new CBMs drive costs short-term but fail to generate sufficient revenues.

The report begins with a section that illuminates the sustainability challenges that Swedish industry face, and the subsequent need to make the transition from a "linear economy paradigm" to a "circular economy paradigm". It defines the concept of a circular business model and explains the key challenges facing large and small firms in going circular. The main body of the report addresses two central questions:

1. What barriers do Swedish industrial firms face when designing, developing, and implementing CBMs?

2. Which practices do Swedish industrial firms engage in when designing, developing, and implementing CBMs?

Where do Swedish industrial firms stand regarding CBMs? Are we good or bad, leading or lagging? Sweden has historically been seen by many as a front-runner in sustainability. It is, therefore, somewhat paradoxical to witness that there are many and strong barriers to introducing CBMs. Parallelly, the CBM practices that Swedish industrial firms engage in are generally early phase, experimental, and somewhat premature. Analysis of barriers to CBMs shows that these tend to be geared towards different components or dimensions of a CBM.

- Failing to utilize emerging technologies, to thoroughly involve customers, and to create value with ecosystem partners acts as significant barriers to circular *value creation*.

- The barriers to *value delivery*, however, are vastly different. Here, underdeveloped service delivery organizations and external partner networks are the key barriers. A deficient partner network can act as a particular impediment because a CBM often presupposes collaboration outside the existing value chain of a company.

- Finally, high up-front investment costs, challenges in designing a viable revenue model, and a failure to anticipate and mitigate risks act as obstacles to *value capture*.

- Furthermore, the report makes clear that the barriers impeding the widespread adoption of CBMs are multifaceted, intricate, and often interconnected. In the broadest sense, they stem from the necessity for industrial firms to develop new capabilities and competencies to effectively implement CBMs.

Analysis of CBM practices shows the following:

- Swedish industrial firms are actively working to design and experiment with new types of value propositions, including new types of circular value logics and new types of revenue models (e.g., pay per use or pay for results).

- Swedish industrial firms systematically engage in competency building – for example, by deploying new types of data analysis and analytics.

- Swedish industrial firms actively engage in creating and orchestrating ecosystems of collaborating partners, including planned attempts at reconfiguration and alignment of incentives and the division of labor.

- However, many of these practices are in relatively early phases, and we are not aware of one single large Swedish industrial firm which has successfully scaled a CBM to replace its incumbent traditional or linear business model.

Both CBM barriers and CBM practices are illustrated with a variety of examples from Swedish industrial firms. The report acknowledges that there is no one-size-fits-all CBM, and a CBM is not 0 or 1. In large industrial firms, it has more to do with improving resource efficiency stepwise and moving along a learning curve. Often, old and new business models coexist, reflecting the complexities and gradual nature of this transformation.

By making both CBM barriers and practices explicit, the report provides practical propositions for how Swedish industrial firms can mitigate the barriers and improve their practices. In particular, most of the barriers and practices fall within the sphere of influence of industrial firms or their collaborative partners. This means that Swedish industrial firms can and should address these for reasons of both competitive advantage and sustainability. In addition, broader policy initiatives, such as Sweden's climate act and climate policy framework, along with initiatives such as the EU circular economy action plan, are already steering industrial firms in a more circular direction. It is hard to say if the policy initiatives already in place do the job, or if more is needed. That said, public support via R&D programs and proactive network management could speed up the transition to CBMs. In conclusion, by nurturing collaborative ecosystems and unraveling the complexities of CBMs, Sweden and Swedish industrial firms can make significant strides towards improved competitive advantage and a more sustainable and circular industrial future.

Introduction 1

1.1 Background

The world is facing a daunting climate crisis. The recent 2023 IPCC synthesis report is an important read to illuminate the problems we face. This report makes it clear beyond any doubt that global temperatures are rapidly rising, and that human activities are the main cause. The IPCC synthesis report clearly states that: "*Human activities, principally through emission of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020*" (IPCC, 2023, p. 4). It is important to point out that the 1.1°C increase is *the average*. The increase over oceans is lower, which means the average increase over land is above the 1.1 level. At the moment, Europe is the continent that is heating up the fastest (Wang et al., 2022). In some scenarios, we could approach +3°C by the end of this century. To put this into perspective, the last ice age was around -3°C. This global heating has widespread negative consequences for nature, people, and society – a prospect that we assume readers of this report for Swedish Entrepreneurship Forum are well aware of.

While global warming may be the most important environmental problem, it is far from the only one. Loss of biodiversity, resource depletion, pollution, and many more prevail (Azam et al., 2023). These environmental problems have not passed unnoticed. Sweden, for example, has ambitious climate targets and has declared it should become the first fossil-free welfare state (Fossil Free Sweden, 2023). Indeed, most advanced countries have set targets to get to net zero by 2045–2050. But how do we get there?

In many respects, getting to a more sustainable economy is a "wicked problem". It is complex, it is difficult to fully anticipate how to best get there, and it requires adaptive strategies by multiple actors across both business and policy domains. It demands "*…a reshaping of the logic of value creation at multiple levels, including product, consumers, individual firms, value chains, and institutional and policy environments*" (Aarika-Stenroos et al., 2023). What is needed is a society that becomes more circular, with firms deploying business models that embrace the circular logic (Frishammar & Parida, 2019). Some would call this a paradigm shift (Toth-Peter et al., 2023). Policy initiatives inevitably play a major role in this shift, but industry too is proactively approaching the sustainability issue. For example, the CEO of Volvo recently went public and called for a quicker shift to sustainability and tighter rules for emitters (Volvo Group, 2023). An intermediate conclusion finds that we need to use less resources and a smarter way. This brings the concept of the circular economy (CE) and, by extension, the concept of the circular business model (CBM) to the forefront of the conversation.

1.2 The circular economy paradigm

To put the so-called circular economy (CE) paradigm into context, it is useful to remind ourselves of what the opposite "linear economy paradigm" looks like. The linear paradigm or model is based on the extraction of virgin raw materials from nature to produce new goods. Once consumed, the goods or products produced lose much of their value and are eventually discarded as waste (Bigliardi & Filippelli, 2021). This has been called the "take-make-dispose" model (Ellen McArthur Foundation, 2015). The linear model has several key axioms or building blocks: i) there is a linear path from extraction to production to consumption and finally to product disposal; ii) production and consumption processes generate a lot of waste; iii) it presupposes the depletion of non-renewable resources, such as fossil fuels; iv) it is energy intense (which contributes to greenhouse gas emissions); and v) it is poor in retaining value in whatever is produced over time – in other words, products end up as waste (Sariatli, 2017). As writers of this report, we view the linear economy paradigm as an ideal type, which in essence is a simplification of the reality we face. Hence, its underpinning logic has indeed clear limitations, and we view it as unsustainable.

What does the contrasting CE paradigm look like? The CE has been described as an umbrella concept (Blomsma & Brennan, 2017). It seeks to overcome the currently dominant linear take-make-dispose model of production and consumption (Urbinati et al., 2017). It is not new as such but is rooted in several prior concepts and research fields, such as industrial ecology (Frosch & Gallopoulos, 1989), biomimicry (Benyus, 1997), and the cradle-to-cradle concept (McDonough & Braungart, 2010). The CE paradigm gained traction through the Ellen McArthur Foundation (2013, p. 7) who defined it as an "industrial system that is restorative or regenerative by intention and design".

This circular model has several key axioms or building blocks. Its core idea is that of a "closed loop" system in which a continuous flow of technical and biological materials is enhanced in a value circle while always keeping products, components, and materials at their highest value (Geissdoerfer et al., 2017; Donner et al., 2020). This means reducing waste to an absolute minimum (Elgie et al., 2021). A second assumption or building block is the need to purposefully design out waste and pollution because natural resources (energy, water, raw material) are limited (Ellen McArthur Foundation, 2015). Moreover, it presupposes restorative thinking and focuses on optimizing a system rather than on individual products or components. The idea of restorative thinking goes beyond the classic conception of sustainability in that it aims for positive restoration of the environment (Murray et al., 2017). By extension, it seeks to decouple growth and resource consumption (Ellen McArthur Foundation, 2015) and to advocate a society in which resources flow in closed circles and retain their value.

1.3 From the circular economy paradigm to circular business models

On a more concrete level, the CE seeks to design out waste and increase resource efficiency by means of different circular strategies (also referred to as value retention options or value principles). These strategies range from the 3Rs of "reduce, reuse, and recycle" all the way up to the more ambitious list of the 10Rs of "refuse, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recover, and remine" (Ghafoor et al., 2023; Reike et al., 2018). As can be seen, these Rs have clear circular business model implications. The different circular strategies are not mutually exclusive and are often combined in practice to narrow, slow, or close resource loops (Bocken et al., 2016). That said, the different strategies vary in the extent to which they are resource efficient. It is, for example, more efficient to reuse a component than to have it disassembled and recycled. This is sometimes called the "waste hierarchy" among the Rs (Kirchherr et al., 2017).

How would a company improve its resource efficiency and deploy its firm-specific combination of Rs in practice? Many authors (Bocken, 2015; Bocken & Ritala, 2021; Geissdoerfer et al., 2020) including the current authors (Frishammar & Parida, 2021) have shown that improved resource efficiency can be enabled by designing, implementing, and subsequently scaling a CBM. The reason is that CBMs help to prolong the lifespan of products and parts through successive cycles of reuse, repair, remanufacturing, and closing material loops (Nußholz, 2017). However, these improvements require significant investments from incumbents, increasing the price of the circular offerings and potentially making them less appealing to customers. For example, new collaboration with value chain stakeholders, new manufacturing processes, and the introduction of renewable and recycled materials in product development, led to higher costs for incumbents as they operationalized CE principles. Thus, carefully designing, developing, and commercializing CBM becomes even more important.

A circular business model is one where a company designs its value creation, value capture, and value delivery mechanisms so that resource efficiency is improved, which delivers both environmental and commercial value (c.f. Frishammar & Parida, 2019). In fact, "*…a circular economy understanding lacking business models is one with no driver at the steering wheel*" (Kirchherr et al., 2017, p. 228). Over time, CBMs have become the dominant framework to think about how climate change can be mitigated and how net zero can be reached in practice (Bocken & Ritala, 2021).

1.4 The circular economy and circular business models in practice

The CE and CBMs are without doubt a hot topic in both industry and public debates on the means to improve sustainability and reach net zero (Urbinati et al., 2017). But as early as the 1990s, the Swedish government made a proposal on societal development based on the cradle-to-cradle logic (The Swedish Parliament, 1992). Recently, the European Union (EU) and several governments including China, Finland, France, Japan, the Netherlands, the United Kingdom, and Sweden have promoted the CE and CBMs (Korhonen et al., 2018). In 2020, the Swedish government decided on a national strategy for a CE, realizing its importance in achieving environmental and climate goals (Svensson & Funck, 2019).

In addition, large industrial firms, such as the heavy truck manufacturers, Volvo and Scania, are working progressively with circular solutions – for example, efficient logistic route optimization, increased electrification, and smart and safe transportation (Averina et al., 2022). But it remains an open question where Swedish industry stands on the issue of CBMs. Is Swedish industry ahead of the competition, are we about average, or are current industrial efforts still largely at the bench scale?

1.5 Purpose of the report

This report for Swedish Entrepreneurship Forum seeks to illuminate where Swedish industry stands on circular business models. The analysis is important not only because of climate change and the potential of CBMs to mitigate it but CBMs can also be a key source of competitive advantage (Frishammar & Parida, 2019). Recently, Sweden has dropped in the so-called wealth league with visible signs of lacking competitive advantage (Deiaco, 2022). So, determining where Swedish industry currently stands and what Sweden needs to do to move forward with CBMs is of critical importance. This is the essential purpose of our report.

In addressing this purpose, we will consider several intertwined questions: What are the barriers to CBMs? What circular business model practices are the Swedish industry engaged in? Regarding these practices, which work well (are mature) and which less well (are premature and/or less well developed)?

1.6 Demarcations and research approach

A transition to a CE through CBMs will depend on the strategic actions of policy makers and businesses (Lewandowski, 2016). The focus of the report, however, is primarily on what industry is doing – and should be doing. Although we outline some policy implications at the end. Our sole focus is on the business-to-business (B2B) industrial context and, consequently, we have not studied business-to-consumer (B2C) context, such as the fashion and clothing industry, car sharing services, or other offerings targeted directly at consumers. Finally, there is a sizeable literature on the role of digital technology and its role in improving sustainability (some of it is published under the "twin transition" label). This deserves a report on its own. We do acknowledge the role of digital technologies in enabling CBMs (Chauhan et al., 2022; Garcia Martin et al., 2023; Linde et al., 2021) but address it only where it shows up in the CBM literature.

The research approach is a desktop analysis of the extant literature. We began with a Scopus search on "circular economy" and "Sweden" in the titles, abstracts, and keywords. This generated a list of 185 articles. We considered only articles from management, social studies, environment, business administration, and other related domains, which reduced the number of articles to 111. We removed duplicates, non-peer reviewed studies, works not in English, and a few articles where CBM was almost absent. This resulted in 97 articles. Abstracts for all these articles were read by both authors. Based on this reading, we removed articles published by Swedish researchers where the empirical materials came from other countries. Articles focusing on a business-to-consumer (B2C) setting were disregarded, as were conceptual papers (without empirical analysis). Work from Swedish authors where the empirical materials were sourced from outside Sweden were also removed. Papers by international researchers were retained where the empirical materials pertained to Sweden. This resulted in 68 articles. At this stage, we added some relevant papers where the context was Sweden and the work was on sustainable business models, product service systems, servitization, foundational works defining concepts, and so on. This resulted in 132 articles. We considered gray literature, such as annual reports, sustainability reports, magazines, from Swedish industrial firms. The final list of articles underpinning the report comprised 167 articles.

In addition to desktop analysis, we also build upon the extensive experience of researchers' direct interactions with leading Swedish firms, such as ABB, Epiroc, Getinge, Volvo CE, Volvo trucks, Volvo cars, Mobilaris, Swecon, Scania, Komatsu Forest AB, Hitachi Energy, Rangsells, Metso Outotec, Sandvik Coromant, SCA, Boliden, Ericsson, LKAB, BillerudKorsnäs and others. Over the last ten years, we have followed numerous CE and CBM initiatives within these organizations and interacted with senior management as a part of data collection initiatives. Although we don't directly cite or quote interview data, it forms the basis for our analysis and findings.

1.7 Disposition

This report is structured in the following way. First, in the next chapter, we define circularity and CBMs. Chapter 3 analyzes the literature on barriers to CBMs in Sweden, while chapter 4 focuses on activities and practices – that is to say, what firms do when engaging in CBMs. The report ends with a discussion section, which outlines the implications for both industry and policy.

Circular business models: What are they? 2

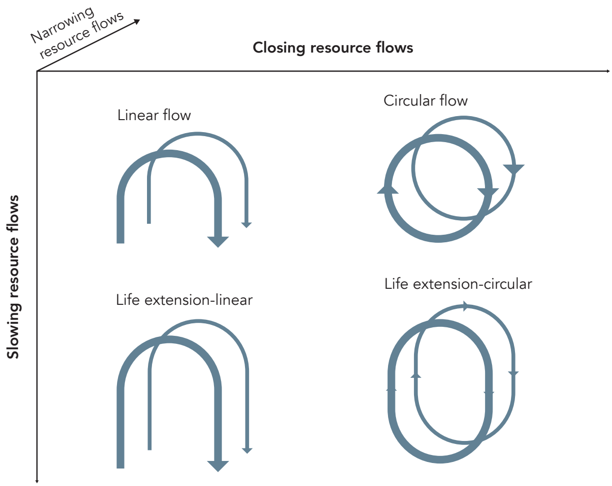
2.1 What does circularity in a circular business model context mean?

In a nutshell, the CE strives for circularity by designing and implementing a circular business model. This circularity is achieved by creating a system in which input resources, different forms of waste, emissions, and energy leakage are minimized by slowing down, closing, or narrowing material and energy loops (Geissdoerfer et al., 2018). The idea of circularity through resource efficiency should be viewed not as a final goal but as an ongoing process (Lüdeke-Freund et al., 2019). Prior research shows greater progress in some dimensions – for example, recycling – whereas slowing down consumption is much less widespread (Bocken & Short, 2016).

Nancy Bocken and colleagues have outlined a straight-forward and effective way to think about circularity (Figure 1) (Bocken et al., 2016).

- **Slowing resource loops** seeks to accomplish a slowdown in the flow of resources – in other words, to use less. This entails designing products and parts for a longer life as well as working proactively with product life extensions (such as services extending the product's life through repair or remanufacturing). It can also involve repairs, refurbishment, and remanufacturing to prolong a product's useful life for either the same user or other users (Nußholz, 2017). *An example from a Swedish industry context is the e-air product from Atlas Copco. It is designed to have a longer life span compared to traditional compressed air solutions, emphasizing durability and reliability. It* *can be used across various industries for extended periods, reducing the need for frequent replacements and minimizing the consumption of new resources. Additionally, Atlas Copco provides services such as maintenance, repair, and refurbishment to prolong the product's useful life. This means that e-air units are not disposed of after a short period of use but are instead refurbished and maintained for long-term performance* (Atlas Copco, 2019). The slowing dimension is, therefore, about prolonged use and reuse over time.

Figure 1: Framework of closing, slowing, and narrowing resource loops.



Source: Bocken et al. (2016)

- **Closing resource loops** is about closing the loop between production and post-use, thus creating a circular flow of resources. This is primarily done through activities such as recycling. An example from a Swedish industry context is the *SKF Group, which emphasizes closing resource loops through its remanufacturing services. It collects used bearings and remanufactures them to meet original equipment manufacturers' (OEM) specifications, reducing the need for new production while ensuring quality and performance. This practice reflects the closing dimension because materials are reintegrated into the value chain* (SKF Group, 2021). Consequently, the closing dimension is about the reuse of materials and refers to the recovery of materials once the product end of life is reached. Materials, products, and parts need to be collected somehow and reintegrated into the value chain. This can take place downstream from a producer (e.g., by acquiring secondary materials as inputs to its own production) or upstream (e.g., through a take-back system from its customers or users) (Nußholz, 2017).

- **Narrowing resource flows** concerns resource efficiency – namely, using fewer resources per product. *Alfa Laval, specializing in heat transfer, separation, and fluid handling technologies, showcases the narrowing resource flows approach. It develops innovative solutions that optimize processes, reduce energy consumption, and minimize waste in industrial operations. Alfa Laval's focus on resource efficiency aligns with the concept of reducing resource use in product development and production* (Alfa Laval, 2023). Thus, the narrowing dimension is about reducing resource use in the product development and production process.

Several important comments are relevant here. First, narrowing resource flows is distinct from slowing resource loops because it does not influence the speed of the flow, nor does it involve any services, such as repairing products. Second, narrowing resource flows is an important resource efficiency option but it applies equally to the linear take-make-dispose type of business model. That said, it is often used in conjunction with the other two in a firm-specific circular business model. Third, slowing and narrowing could eventually lead to the same result – in other words, less resources used. The primary distinction between the two is how they comprehend the time dimension. Here, the narrowing approach implicitly accepts the speed of resource flows while slowing concerns reducing the speed of time. As Bocken and colleagues point out, this is a key critique of the efficiency approach: "*…if we do not address the time dimension, resource efficiency can easily lead to further speeding up of linear resource flows (selling more of a more efficient product), resulting in very little overall savings*" (Bocken et al., 2016, p. 310).

The focus on circularity through resource efficiency has profound business model implications. For example, when products are designed as higher quality to sustain a longer life, its very consumption is reduced while product unit cost increases. Likewise, recycled material inputs, continuous recycling of materials, and waste reduction can directly influence core elements of any business model (Urbinati et al., 2017).

2.2 What is meant by a circular business model?

As already pointed out, business models play an important role in the transition to a CE. In contrast to traditional or "linear" business models – where products and parts over time are downgraded after a single-use phase and their value is consequently lost – CBMs seek to preserve both the environmental and economic value (Stahel, 1994; Velte & Steinhilper, 2016). There are multiple definitions of a circular business model in the literature. It can be defined as "*…the rationale of how an organization creates, delivers, and captures value to close and slow material loops*" (Heesbeen & Prieto, 2020). Many authors acknowledge the networked nature of a CBM. For example, it describes how an organization or an ecosystem of organizations creates, delivers, and captures value by slowing, closing or narrowing flows of energy and materials (Pieroni et al., 2020) (see also Nußholz, 2017; Oghazi & Mostaghel, 2018). According to Mentink (2014, p. 35), a circular business model is "the rationale of how an organization creates, delivers, and captures value with and within closed material loops". Linder and Williander (2017, p. 2) proposed the following definition: "A business model in which the conceptual logic for value creation is based on utilizing the economic value retained in products after use…". We use the definition proposed by Frishammar and Parida (2019, p. 6) because it brings together some of the core ideas from the other definitions. Therefore, we define a CBM as:

> *"…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****".*

The key components of this definition are in bold. In the paragraphs below, we illuminate the content and meaning of those components.

1. A focal company. According to Kanda and colleagues, the prevalent unit of analysis for a circular business model is the firm level (Kanda et al., 2021). We view this as a half-truth. It is correct in that most CBMs have a dominant firm at the center – that is, an actor performing the role of a hub firm or keystone player (Frishammar & Parida, 2019). So, a focal company is typically at the core. But it is incorrect that most, if not all, CBMs are distributed among a group of ecosystem actors (Frishammar & Parida, 2021).

2. Together with partners. Pursuing a circular business model requires companies to move from a firm-centric focus in their operational logic to intensive interaction with an ecosystem of actors (Pieroni et al., 2020). Because core competencies are never complete, even the largest companies cannot do CBMs by themselves (Frishammar & Parida, 2021). In fact, CBMs are by nature networked: they require collaboration and coordination within complex networks of interdependent but independent actors/stakeholders (Heesbeen & Prieto, 2020).

When production inputs are composed of used or recycled materials, the involvement of partners and experts who are knowledgeable about the benefits and limitations of such materials is required. Customers can also perform important roles, extending their experience and responsibility (Lüdeke-Freund et al., 2019). Because of their systematic nature, circular business models require the deeper involvement of ecosystem partners compared with linear business models where most activities are conducted within the traditional value chain of a focal company (Averina et al., 2022; Geissdoerfer et al., 2018). In fact, the fundamental challenge in implementing a circular business model is to rethink supply chains and find the correct set of new partners (Schaltegger et al., 2016).

3. Uses innovation to create, capture, and deliver value. A business model represents the rationale of how a firm creates, delivers, and captures value. Business model innovation concerns novel ways of creating, delivering, and capturing value, which is achieved by changing one or more components in the business model (Osterwalder & Pigneur, 2010). Disruptive business models are needed to move towards the CE (Neligan et al., 2023). Consequently, companies need to rethink their view on value, including how the product is produced and delivered (Antikainen & Valkokari, 2016).

Circular value creation is characterized by offering products with improved design for recycling. This is achieved by extending product life, enhancing the extent of upgradability, and increasing resource efficiency (Centobelli et al., 2020). Moreover, circular value creation means that an industrial firm must integrate itself more deeply into the operations of its customers, co-create value with partners, and emphasize "value in use" rather than "value in transaction" (Frishammar & Parida, 2021).

Circular value capture centers on using innovative revenue models that shift the focus from up-front transactions to monthly fees based on service contracts. In financial terms, this represents an evolution from revenue flow based on capital expenditure (CapEx) to revenue flow based on operational expenditure (OpEx) (Frishammar & Parida, 2021).

Circular value delivery focuses on utilizing new delivery capabilities – for instance, better process control and take-back management (Linde et al., 2021). Examples include building service delivery organizations and forming strategic partnerships with external technology and service providers (Frishammar & Parida, 2021).

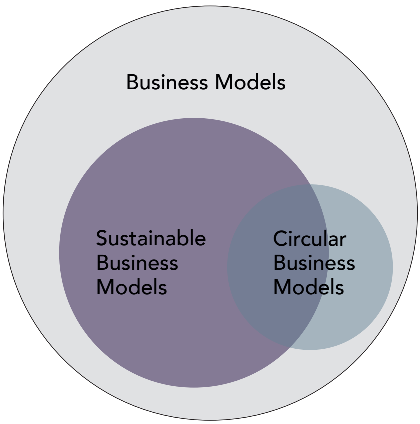
4. Resource efficiency. The overall goal of a circular business model is to help companies create and deliver value by using resources in a much more effective way. In a best-case scenario, waste is to be avoided (Lewandowski, 2016). But, in either case, a firm along with its partners would opt for a specific combination of circularity through resource efficiency as described in section 2.1 – that is, narrowing, slowing, or closing loops. To achieve this in practice, the input side – the transformation processes – and the output side of CBMs must frequently change (Lüdeke-Freund et al., 2019).

5. Environmental, social, and economic benefits. The impacts or results of CBMs for companies, customers, the environment, and society include cost savings and reduced negative ecological and social impacts through reduced consumption of virgin materials and energy. Other expected effects include extended customer experiences, new market segments, and additional revenues (Lüdeke-Freund et al., 2019).

2.3 Are circular and sustainable business models the same thing?

The short answer is no. The literature on CBMs and sustainable business models overlaps, and the former can be considered a part of the latter. This is because a circular business model also seeks sustainability outcomes but in a way that is both narrower and more ambitious. See figure 2 below.

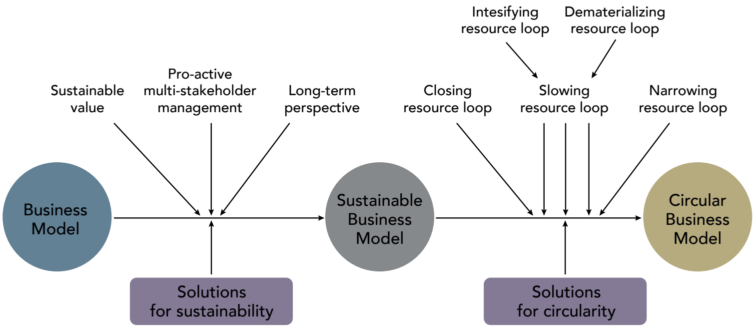
Figure 2: Imperfect overlap of the sustainable business model concept and its sub-categories, such as the circular business model



Source: Geissdoerfer (2018, p. 406).

Greissdoerfer and colleagues define a sustainable business model as "*…business models that incorporate pro-active multi-stakeholder management, the creation of monetary and non-monetary value for a broad range of stakeholders and hold a long-term perspective*". (Geissdoerfer et al., 2018, pp. 403). Our position is that a circular business model is more ambitious in the type of sustainability outcomes it seeks, and the literature on CBMs has also (implicitly or explicitly) de-emphasized the social dimension of sustainability, thus bringing environmental/ecological and economic outcomes to the forefront. Our view, therefore, corresponds to that of Geissdoerfer and colleagues (see Figure 3) in which a sustainable business model serves as an intermediate step towards a circular business model.

Figure 3: A comparison between traditional, sustainable, and circular business models



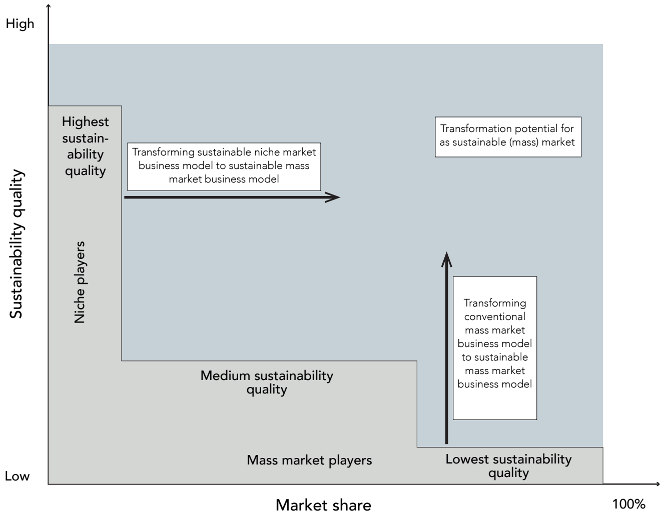
Source: Adapted from Geissdoerfer et al. (2018)

Sustainable development aims to satisfy current needs without harming the needs of future generations (WCED, 1987). A sustainable business model departs from a traditional or conventional business model in the sense that it modifies the traditional model to integrate the sustainability dimension. It includes practices and principles that enable a company to target its sustainability ambitions through value creation, delivery and capture. This involves a broadening of the concept of value in which costs and benefits are important not only for the individual company but also for other stakeholders and the wider society (Bigliardi & Filippelli, 2021). In doing so, a sustainable business model deliberately targets the so-called triple bottom line of economic, environmental, and social sustainability (Bocken et al., 2014; Manninen et al., 2018).

2.4 From what to how: Circular business model transformation/innovation

Pursuing CBMs can imply very different things for niche players and industrial firms (see Figure 4 below). For mass market industrial firms in particular, the challenge is to move from a traditional to a circular model by making value creation, value delivery, and value capture more sustainable.

Figure 4: Sustainability transformation potential for sustainable entrepreneurship



Source: Hockerts & Wüstenhagen, 2010.

Such changes are referred to as circular business model innovation or transformation. These innovation or transformation processes are highly complex not only because value creation, delivery, and capture mechanisms are exposed to radical change but also because these changes happen across firm boundaries in an ecosystem of collaborating partners (Bigliardi & Filippelli, 2021).

Designing a circular business model is one thing, the "what", – transforming and scaling is a totally different matter. In most cases, it is an iterative process that involves multiple phases and activities, including ideation, implementation, and evaluation, and it encompasses changes at different levels (Nußholz, 2017). The circular business model transformation process is particularly important in industrial firms. In such firms: "…even moderate sustainability upgrading can have enormous environmental effects because of these companies' large market shares" (Frishammar & Parida, 2021, p. 6). In pursuing such a journey, any firm is liable to face critical barriers as it engages in practices related to circular business model development and scaling. We start to elaborate on this issue in the next section.

Barriers to circular business models for Swedish industrial firms

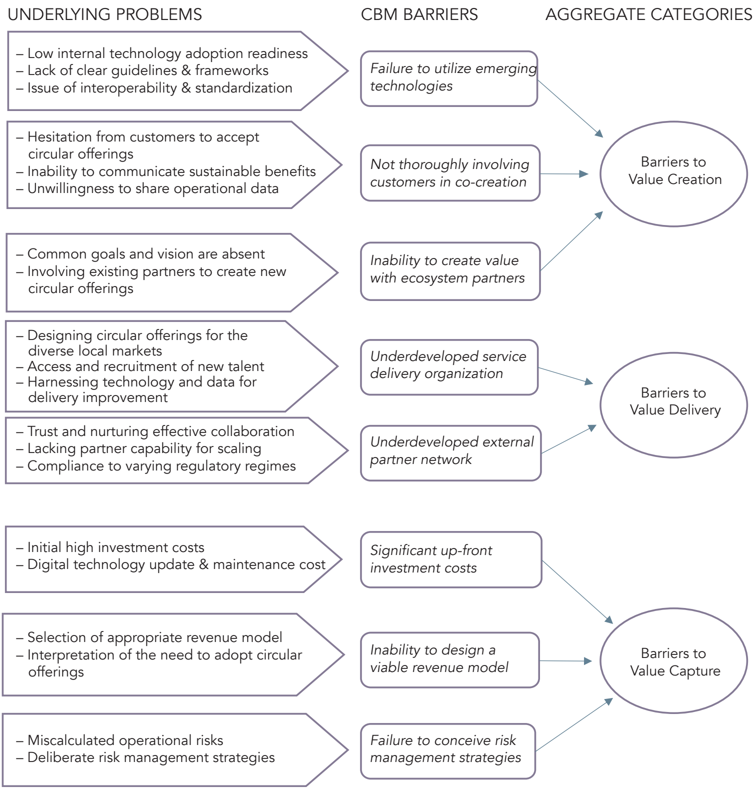
3

In the context of CBMs, a barrier denotes a significant obstruction or challenge that hampers the development, implementation, and scaling of a circular business model. These barriers encompass a spectrum of challenges encountered during value creation, value delivery, and value capture activities, impeding the successful transition to a CBM. Clearly, such barriers make it harder to successfully establish a well-functioning CBM. The aim of this section is to delve into the origins and underlying reasons for the barriers present in the three distinct business model elements, as indicated in the literature underpinning this report. Sub-sections have been specifically crafted to explain the obstacles encountered in each of these business model elements. In these sub-sections, the specific barrier is introduced in the initial segment, followed by a section that explores the fundamental reasons for the barrier's existence. Figure 5 provides a visual structure of the barriers.

3.1 Barriers to value creation

The value creation component of a CBM represents what is offered to customers (or, in barrier terms, what prohibits such offerings from materializing). Here, the set of barriers focuses on the technological considerations when implementing CBM. Moreover, it emphasizes why co-creation is so important when proposing circular offerings, and it underscores the importance of reaching a common goal during the design of circular offerings. Another issue to consider is how to manage information flow to reduce the communication gap during CBM implementation.

Figure 5: Coding tree for barriers to CBM implementation



• *Difficulty in leveraging emerging technologies for a CBM*

Integrating emerging technologies, such as artificial intelligence (AI) algorithms, Internet of things (IoT) applications, big data analytics, and blockchain, enhances the successful implementation of CBMs. Conversely, failure to integrate properly erects a barrier (Chauhan et al., 2022; Ranta et al., 2021). These technological advances have the potential to improve resource management, production optimization, and supply chain transparency. For instance, blockchain as a decentralized ledger facilitates product life-cycle management and helps to easily verify sustainability claims (Wolf et al., 2022). IoT can track resource (i.e., energy, water, and materials) usage, AI predicts demand and optimizes production planning, (Ramadoss et al., 2018), blockchain promotes supply chain transparency and recycling and reuse, and machine learning algorithms optimize production processes, reduce waste, and enable predictive maintenance (Abideen et al., 2021). This enhances internal efficiency and product quality, leading to improved value creation. Ericsson, a global Swedish industrial firm, was confronted, like many firms, with urgent challenges related to CO2 emissions and global climate change. Considering this pressing need, Ericsson has embarked on a mission to address these critical challenges with the utmost seriousness. Understanding the imminent threat, Ericsson has made a resolute commitment to achieve net zero emissions throughout its entire value chain by 2040. To set the wheels in motion, Ericsson set up a significant milestone: a bold pledge to slash emissions by a substantial 50 percent in its supply chain and portfolio by 2030 and net zero emissions in its own operational activities. For its solution, Ericsson harnessed the power of applied AI as a dynamic tool to tackle these environmental challenges. The application of AI has been instrumental in identifying and addressing high levels of carbon emissions within the company's supply chain. This innovative approach empowered Ericsson to optimize the transportation of its products, reducing CO2 emissions significantly. By actively leveraging applied AI, Ericsson effectively navigated the complex terrain of climate change and sustainability, actively contributing to an eco-friendlier and more sustainable world (Ericsson Blog, 2022).

Siemens, another industrial firm with operations in Sweden, was faced with a significant challenge: the substantial carbon emissions resulting from its industrial processes and energy generation. Recognizing the pressing need for sustainability, Siemens decided to take decisive action. It deployed an array of approximately 500 advanced sensors in its gas turbines, creating a sophisticated system to continuously monitor and assess the operational conditions of these turbines. This strategic utilization of sensor technology marked a pivotal turning point in Siemens' mission to combat carbon emissions. By closely monitoring and fine-tuning the performance of its gas turbines, Siemens achieved remarkable results. Its modern gas turbines now produce electricity with an impressive 50–60 percent less CO2 emissions per megawatt-hour generated. This substantial carbon reduction is equivalent to the emissions savings that would have been accomplished by putting a staggering 200 million electric vehicles on the road during the same time (Siemens Engineer Innovation, 2020). However, for numerous reasons, most industrial firms struggle to effectively utilize advanced technologies for CBM implementation.

Leveraging emerging technology often faces a hurdle due to low *internal technology adoption* readiness in industrial firms. This arises from issues such as limited digital literacy, resistance to change, and inadequate infrastructure. Overcoming these challenges requires targeted efforts in training, change management, and infrastructure improvement. Additionally, industrial firms *lack data sharing and security guidelines* to implement and scale up emerging technologies for CBMs (Rizos et al., 2016). Complexity and uncertainty associated with data privacy, security, and intellectual property concerns negatively impact firms' willingness to invest in and adopt these technologies (Ding et al., 2023). Another significant problem arises from the issue of *interoperability and standardization* at the industrial level. Given the diverse range of emerging technologies employed in CBMs, compatibility issues can arise, leading to difficulties in seamlessly integrating these technologies into existing legacy systems. This lack of harmonization hampers efficient data exchange and collaboration among stakeholders (Chiaroni et al., 2021).

• A failure to thoroughly involve customers in the co-creation of circular offerings

Active customer involvement in co-creating circular offerings is vital. Value co-creation that is driven by in-depth customer participation extends to crafting circular offerings with a strong sustainability proposition, minimizing waste, and involving customers in the complete life cycle of the product or service (Kanda et al., 2021). Therefore, numerous industrial firms are increasingly involving their customers in design, customization, and collaborative feedback when creating circular offerings.

In response to the pressing climate challenge and increasingly stringent legislation regarding carbon emissions, Volvo Group found itself facing a significant problem. To combat and achieve swift and substantial reduction in carbon emissions, it made a resolute commitment: by 2030, it would offer only electric vehicles. However, the path to achieving this goal was not just about innovation in vehicle technology. To make this effort more customer inclusive, Volvo Group started to implement the "Volvo

Flexi-Gold Contract", which provides a flexible and comprehensive maintenance contract for customers' trucks (Volvo Group, 2019; Volvo Trucks, 2019). This contract allowed customers to customize maintenance services according to their specific needs. Another example is Swedish industrial firm, SKF, which is a global supplier of bearings, seals, lubrication systems, and other solutions for various industries especially vessels such as cargo ships. The firm faced the problem of the discharged water from cargo ships, which must comply with the Maritime Organization (IMO) and US Coast Guard (USCG) standards. Since this industrial firm serves a diverse customer base, the solution demanded customization. To overcome this problem, SKF collaborated with its clients to design and develop customized solutions that address their specific needs and challenges. This strategy involved intimate collaboration with customers to craft products that amplify performance, effectiveness, and environmental consciousness in their operations (SKF Group, 2021). However, many industrial firms struggle much more than Volvo and SKF did because they run up against barriers during customer engagement in the co-creation process. The reasons are described below.

Industrial firms developing circular offerings often make the shift from selling products to selling services. However, they may face ***customer hesitation*** in buying these advanced services because, as novel offerings, they require a sizeable investment in time and resources, and a new commercial logic will have to be followed. Moreover, many customers fear that agreeing to multi-year service contracts will lead to lock-in effects and compromise their ability to negotiate (Reim et al., 2019). The provider also lacks the ***ability to communicate the sustainable value*** related to the circular offering, which is often new to the market and the firm (Kumar et al., 2019). For example, the adoption of a circular offering delivers a range of sustainable benefits. These encompass the creation of new job opportunities in local communities, the compliance with regulations, the opening of fresh markets for recycling and remanufacturing, the establishment of new revenue streams, and substantial environmental advantages including reduced environmental penalties and minimized waste generation. This diminishes the attractiveness of the offering, changing the status quo of what has been traditionally offered when purchased in product format. Another significant problem is the ***lack of interest in sharing internal data and operations insights*** from the customer end, which reduces the ability to offer circular solutions (Frishammar & Parida, 2019). This reluctance stems from a variety of factors, including concerns over proprietary information, competitive advantage, and data security. Industrial customers often consider their operational data as an asset that sets them apart from competitors. Sharing this information with external partners, even with the intention of co-creating circular offerings, is perceived as a potential compromise of their competitive position. The fear of exposing critical business processes and sensitive data to external parties can create a substantial barrier to engaging in the value co-creation of novel circular offerings. Ultimately, this array of challenges inhibits industrial firms from engaging customers effectively in the co-creation process.

• ***Difficulty in creating new types of sustainable value with existing and new internal ecosystem partners***

The transition to CBMs represents a shift from a firm-centric to an ecosystem-centric view, emphasizing dynamic interactions among diverse stakeholders to generate environmental and socio-economic value (Todeschini et al., 2017; Kanda et al., 2021). This multi-actor-centric view focuses on value co-creation through reciprocal exchanges between resource-integrating actors beyond the customer (Wieland et al., 2017). This actor constellation could involve existing supply chain partners and new partners, such as innovative SMEs, technology providers, service organizations, and recycling companies. Collaboration between interdependent actors in circular systems advances sustainable value creation (Stewart & Niero, 2018). For instance, Scania, a Swedish manufacturer renowned for its heavy trucks, buses, and engines, found itself grappling with a substantial difficulty – the pressing issue of carbon emissions and its cascading environmental effects. The significant carbon footprint, stemming from both direct and indirect greenhouse gas emissions, waste generation, and fuel-related activities, posed a formidable challenge. Moreover, there was a growing need for enhanced sustainability in the treatment of the products they sold to reduce direct and indirect greenhouse gas emissions, waste generation, and fuel energy-related activities, and to improve the lifespan of products. This industrial firm had strategically partnered with global entities, such as Siemens and Northvolt, battery manufacturers, energy companies, and charging infrastructure providers (Scania, 2022). This collaboration aimed to create a comprehensive ecosystem to facilitate the widespread adoption of electric vehicles (EVs). By teaming up with key players across the EV value chain, Scania addressed the multifaceted challenges associated with EV adoption, including charging infrastructure, battery technology, energy supply, and efficient manufacturing processes. However, our review of Swedish manufacturing industries shows that, when industrial firms collaborate with existing and with new ecosystem partners, this collaboration is always far from easy. These impediments are outlined below.

The most significant problem is to arrive at *common goals or a shared vision* with new partners – namely, technology providers, sustainability consultants, and reverse logistics service providers to secure the buy-in (Sjödin et al., 2018; Frishammar & Parida, 2019). Here, key hindrances include differing priorities (Gerassimidou et al., 2022), limited awareness and understanding of goals (Tseng et al., 2022), different mindsets due to experience working in various industries or regions, and perception of risks among existing and new ecosystem partners in creating value. Finally, industrial firms often encounter challenges *in managing ongoing relationships with their existing ecosystem partners* when transitioning to CBMs. One significant obstacle is the need for change management because the shift to circularity can disrupt established processes and roles within the ecosystem. Moreover, reallocating resources to support circular initiatives may lead to uncertainties and resistance among partners. Balancing competing priorities and aligning diverse interests poses another hurdle, requiring effective communication and negotiation. Thus, industrial firms are faced with difficulties in finding a balance between long-term sustainability objectives and partners' short-term financial goals (Frishammar & Parida, 2019; Burström et al., 2021).

3.2 Barriers to value delivery

The value delivery dimension focuses on the activities and processes employed to deliver the promised value through a CBM. Here, the challenges focus on the specific logistic resources and capabilities required for circular offerings, and the problem areas where firms struggle to collaborate with new ecosystem partners.

• Challenges in developing the firm's service delivery organization

Industrial firms moving to circular offerings are involved in a transition from selling products and basic support services to offering advanced services that generate greater sustainability value for customers. In this context, the role of the service delivery organization, – that is, the customer-facing unit – becomes central. Industrial firms recognize that these units need to develop new capabilities because they are mostly responsible for service customization and co-creating value with customers, although such capabilities tend to be developed in time-consuming learning cycles over time.

One such example is the ABB Group, a multinational corporation specializing in robotics, power, and automation technology, which faced a pressing and multifaceted problem. The challenge revolved around three critical strategic pillars: reducing carbon emissions, preserving vital resources, and fostering social progress. The stark reality was that its conventional approach of selling traditional products was no longer sufficient to effectively tackle these complex issues. To combat the difficulties, it shifted its focus from selling traditional products to providing comprehensive solutions, and it has begun to implement sustainability-oriented services, such as the "take-back and recycling business model", by establishing collaborative efforts with Stena and its customer base (ABB, 2023). Collectively, it established industry standards in predictive maintenance, remote monitoring, and energy efficiency optimization for its customers' manufacturing processes. However, this type of transition in the form of servitization is associated with many challenges because it demands large-scale changes in the service delivery organization and associated processes.

A primary concern is to *make delivery of the circular offering suitable for diverse markets*. As most large Swedish industrial firms are global players, they face the challenge of adapting their offerings according to local market conditions. This slows diffusion of the CBM and acts as a barrier to scaling. Moreover, unique local conditions, such as different economic conditions, local geography, regulatory restrictions, and different standards related to product quality, safety, and environmental sustainability, can impede profitable delivery of advanced circular offerings. The second problem is *access to and recruitment of new talent* for the service organization. Industrial firms increasingly understand the need to hire personnel who are not solely schooled in product sales but also possess expertise in advanced service delivery methods and routines. Indeed, the workforce in the service organization needs to possess skills in utilizing digital technologies to enhance efficiency and refinement of the service delivery procedures. However, accessing such qualified personnel poses a significant challenge, particularly when firms are operating outside their national markets. Another pertinent challenge is ***harnessing technology and data for improved service delivery***. Most case firms lack sufficient familiarity with the latest digital technology to optimize their service delivery. So, they are often required to make substantial investments in digital technologies – for example, data analysis operations concerning demand and supply and predicting prices – with the aim of integrating digital solutions into existing systems to deliver their circular offerings. This makes the entire process expensive and time-consuming.

• Difficulty in developing external partner networks

Collaborating with external partner networks during the value delivery phase of the CBM offers valuable advantages (von Kolpinski et al., 2023; Re & Magnani, 2022). These partnerships provide access to innovative ideas, specialized expertise, and agility in expediting circular practices. By teaming up, industrial firms tap into niche knowledge, synergize strengths, and enhance their offerings. Often external partner networks – for example, startups/SMEs – offer the flexibility needed for rapid prototyping, intensifying customer reach and markets (Suchek et al., 2021). Such collaboration promotes a thriving CE ecosystem and fosters innovation and knowledge exchange. This strategy promotes the adoption of circular practice, boosting industrial firms' competitiveness and helping to grow the CE (Parida et al., 2019).

Facing significant challenges in its quest for more sustainable and circular operations, Sandvik, a prominent Swedish industrial firm, recognized the need for transformative solutions that were beyond its current capabilities. The firm had also to contend with the complexities of modernizing its practices to meet the evolving demands of environmental responsibility. In response to these substantial challenges, Sandvik chose a proactive path. The firm sought collaboration with various partners, especially customers, specializing in advanced materials and innovative manufacturing techniques. These strategic partnerships not only brought fresh perspectives and out-of-the-box thinking but also provided Sandvik with access to cutting-edge technologies and novel solutions that were previously beyond its reach. This collaboration proved instrumental in addressing Sandvik's operational limitations. In alliance with customers, colleagues from Sandvik Mining and Rock Solutions and Sandvik Manufacturing and Machining Solutions' Wolfram division introduced an innovative technology for recycling tungsten inserts from drill bits directly on customer sites. This cutting-edge technology promises a very pronounced impact on reducing CO2 emissions. In fact, it is expected to result in approximately 64 percent less carbon emissions than the traditional mining of virgin raw materials. Moreover, it brings positive economic consequences by increasing employment opportunities in the communities near the mining sites (Sandvik, 2022).

The problem for these industrial firms is establishing ***open and trusting innovative collaboration*** with external partners – for example, SMEs and startups. Newly formed relationships between large industrial firms and SMEs can be affected by an imbalance in negotiating power, which can precipitate startup concerns about intellectual property rights, resource allocation, and fear of losing autonomy. Furthermore, there can be confusion over who will assume ownership and take the risks associated with the delivery of circular offerings (Garcia Martin et al., 2023; von Kolpinski et al., 2023). In addition, problems can escalate if both parties are reluctant to openly share their knowledge and other operational insights. This further exacerbates the problem of distrust, hindering effective collaboration and hampering successful value delivery.

Industrial firms may also face challenges with ***scaling circular offerings*** in cooperation with comparatively small external partners due to their inability to meet the demand of increased production volumes. A CBM requires scalability to achieve significant environmental and economic impact. Sometimes, external partners lack the funds and need support from industrial firms to deliver the promised offerings (von Kolpinski et al., 2023). Another problem revolves around diverging approaches to the delivery processes in this context. Industrial firms are generally more rigid and structured in their traditional delivery ecosystem. On the other hand, external partners who are the new players in the market may try to intervene with an agile approach to affecting value delivery. This can increase tension and generate resistance to change (Garcia Martin et al., 2023). Moreover, when it comes to the integration of an existing technology with an innovative one, as suggested by external partners, the industrial firms are not fully aligned with these suggestions, which can lead to a lack of synchronization in adopting these advancements. Convincing and incentivizing industrial firms' delivery organizations to promote and offer advanced circular offerings, jointly built with external parties, can be challenging too (Reim et al., 2021). Thus, the said issues hamper effective value delivery of the circular offerings. Collaboration between industrial firms with external networks, especially those from different countries, often encounters ***challenges related to varying regulatory regimes***, certifications, and standardization policies. In a global business landscape, regulatory frameworks can differ significantly from one country to another, leading to complex compliance issues that need to be navigated. Certifications, which are essential for ensuring product quality and safety, may have diverse requirements and standards across regions, requiring careful adaptation and alignment. Moreover, the lack of uniformity in standardization policies can create barriers to seamless collaboration because companies may need to reconcile differing protocols and practices (Rizos et al., 2016; Suchek et al., 2021).

3.3 Barriers to value capture

The value capture dimension aims to maximize the economic, environmental, and social benefits from resources, products, and materials when implementing a CBM. Here, barriers relate to how firms handle serious issues, given their substantial investments in circular offerings. What are the challenges when selecting the revenue model for CBM implementation? What are the obstacles faced by firms which must manage the risks associated with circular offerings?

• Significant up-front investment costs

Creating and delivering circular offerings require companies to commit substantial investments across a range of domains, encompassing the acquisition of cutting-edge technology, the establishment of essential infrastructure, and the overhaul of operations to align with circular principles. Despite the benefits of successful CBM offerings, such as reduced environmental impact, enhanced reputation, and the nurturing of innovation, it is a costly journey that faces attendant challenges. The substantial level of investment increases the price of circular offerings, making them potentially less appealing to customers. For example, Swedish industrial firms, such as Tetra Pak, are known for their significant investments in the development of Tetra Pak E3/Flex technology-enabled sustainable packaging solutions to reduce their environmental footprints (Tetra Pak, 2022). They have faced tremendous challenges because these innovations effectively reduced the cost of selling products traditionally packaged in heavy and costly bottles. The challenge was further compounded by the fact that the layers in these packaging solutions require meticulous separation to maintain their quality – a process that demands specialized machinery and, therefore, substantial investment. Similarly, Atlas Copco, a provider of industrial productivity solutions, despite incurring significant upfront costs, decided to invest extensively in the development of both energy- and resource-efficient equipment and technologies to optimize energy consumption in industrial processes, remanufacturing, and refurbishing equipment, extending the life cycle of products and minimizing waste to achieve circular outcomes (Atlas Copco, 2022). The following segment discusses the underlying reasons why Swedish industrial firms face significant barriers arising from the substantial investment and increasing cost involved in the value capture phase.

Implementing CBM imposes ***high initial costs*** from feasibility studies, market research, certifications, and regulatory compliance for sustainable practices (Sousa-Zomer et al., 2018). Collaboration with value chain stakeholders, such as suppliers, customers, and waste management entities, incurs partnership establishment costs (Nandi et al., 2020). Additional costs arise from retooling machines, relocating factories, and establishing new distribution and logistics arrangements. Staff retraining to meet CBM requirements incurs expenses (Jaeger & Upadhyay, 2020). Furthermore, organizations face costs related to redesigning products and packaging to align with circular principles, and utilizing recyclable or biodegradable materials adds further expenditure. Restrictive terms and agreements, such as minimum order quantities or exclusive supplier arrangements, can impede the adoption of circular practices or hinder the establishment of new partnerships that facilitate circular value capture (Hofmann & Jaeger‐Erben, 2020). Another significant investment occurs when ***adopting digital technology and investments in emerging technologies*** (Kristoffersen et al., 2021; Lahti et al., 2018). Industrial firms must introduce digital infrastructure, install hardware, and recruit and train skilled developers to handle software, all of which are essential elements in the process of adopting emerging technologies. Moreover, staying current with evolving technologies demands a commitment to regular updates and maintenance, further amplifying investment costs.

• Failure to design a viable revenue model

A revenue model refers to the revenue sources, their volume, and distribution that enables the capture of value (Linde et al., 2021). In the context of implementing CBMs, revenue models play a crucial role in ensuring that the new value created is captured through revenue streams that allow the industrial firm to cover its costs from circular activities and investments to make profits. To this end, industrial firms are experimenting with new models, such as "product as a service" (PaaS) where industrial firms offer products as services. This allows customers to pay for usage or performance rather than take ownership. This approach extends product life cycles and allows industrial firms to retain ownership. Additional viable revenue models include remanufacturing and refurbishment, where used products are repaired and resold, and leasing and rental options, which provide recurring revenue. Upcycling waste into valuable products and selling individual components are other possible approaches. In theory, these revenue models enhance resource efficiency and sustainability benefits, but they also flip revenue streams from CAPEX to OPEX to the extent that revenues from up-front sales shrink and those from monthly licensing fees increase. This same challenge was experienced by Tetra Pak, when implementing the PaaS revenue model. By allowing clients to use packaging materials while retaining ownership, the company ventured into a model that transitioned from traditional up-front sales to recurring monthly fees. This approach certainly offered environmental and sustainability benefits by extending product life cycles, but it required a substantial annual investment of up to 40 million euros (Tetra Pak, 2023). Designing such revenue models poses certain challenges (listed below), requiring industrial firms to give the approach careful consideration.

In this context, problems can arise at the design, development, and implementation stages of circular offering commercialization. During the early development stage, many industrial firms struggle to make an *inappropriate selection of the revenue model*. Firms need to consider carefully which revenue model is most suitable for their operational process. Inappropriately mapping business operations with a particular revenue model often causes serious problems. A suitable selection depends on the type of circular offering opted for as well as the degree of customer understanding, the extent of digital readiness, and the scope of the digital ecosystem partnership (Tabares et al., 2023).

An additional challenge arises during the development phase from *incorrectly interpreting customer willingness to pay to adopt a circular offering*. Differentiating whether the need stems from market demand or provider-driven motives is crucial. An incorrect identification of this need can lead to the development of ineffective and unprofitable revenue models (Linde et al., 2021). There are many factors accounting for fluctuations in the market demand for circular offerings. Changing environmental awareness, regulatory shifts, recessions, the entry of new players, and innovative solutions can all make it very difficult to predict market demand beforehand and fix a price for circular offerings (Linder & Williander, 2017). This problem is amplified when customer feedback and opinions are neglected. Failing to strengthen the feedback mechanism for customer input on the revenue model can lead to significant stress, harming the relationship between the provider and the customer and hindering open, collaborative, and trusted co-creation. The lack of transparency in revenue models on sharing rewards to balance risks acts as a barrier, but joint investments and linking prices to achieve shared outcomes can help address this issue (Linde et al., 2021). These issues underscore the importance of establishing clear and mutually beneficial agreements, fostering trust, and ensuring that both parties are aligned in their objectives and obligations for successful implementation.

• Inability to deploy appropriate risk management strategies

Risk management strategies are crucial to ensure profitable CBM implementation. Risks in this context are characterized by the probability of loss and the potential impact on the organization (Mitchell, 1995). It is important to distinguish risks from uncertainties, which cannot be predicted or calculated in advance (Knight, 1921). This is highly relevant for industrial firms because it encompasses both technical and behavioral aspects and acts as a principal hindrance when providing circular offerings (Richter et al., 2010). These risks pose significant hurdles for organizations as they navigate the complexities of value capture in the CE (Reim et al., 2015). However, it is important to note that risks are not inherently negative but can present opportunities for providers to generate additional revenue by assuming and effectively managing risks through diverse risk management approaches and strategies (Tukker, 2004).

For instance, Atlas Copco faced many challenges related to identifying potential threats associated with product quality, supply chain vulnerabilities, and market fluctuations, to name a few. A proactive approach to risk management is needed to combat these challenges (Atlas Copco, 2022). This approach enabled the firm to develop tailored risk management strategies that encompass quality control measures, diversified sourcing strategies, and flexible production planning to shield against market volatilities. Similarly, Sandvik, a specialized firm in metal cutting, mining, rock excavation, and materials technology, faced risks driven by external factors beyond its capacity to control and, hence, came with risk management strategies by focusing on adaptability and agility (Sandvik, 2022). Sandvik also prioritizes risk assessment and mitigation as part of its commitment to delivering top-tier products and services to clients.

In the context of providing advanced circular offerings, various risks can arise. ***Miscalculated operational risks*** pose a serious challenge. Operational risks are often encountered, with a focus on issues such as unexpected product breakdowns, which lead to increased repair and maintenance costs (Erkoyuncu et al., 2013). Technical issues and obsolescence are common risk factors associated with the state of the technology involved (Sakao et al., 2013). Operational risk is tied to the firm's competence and capability to deliver the agreed product service to customers because circular offerings often involve the provider partially taking over the customer's operations. Dependence on reliability increases the importance of addressing these risks. Another risk factor commanding considerable attention is unintended and adverse customer behavior, such as overloading or extensive usage that negatively impacts the condition of the product (Reim et al., 2018). Opportunistic behavior, where customers seek to maximize personal benefits without considering the provider's efforts, exacerbates such risks.

Another risk is adverse selection, where customers only show interest in purchasing the product as a service for fear of machinery being prone to breakdown, leading to unprofitable agreements for the provider (Ulaga & Reinartz, 2011).

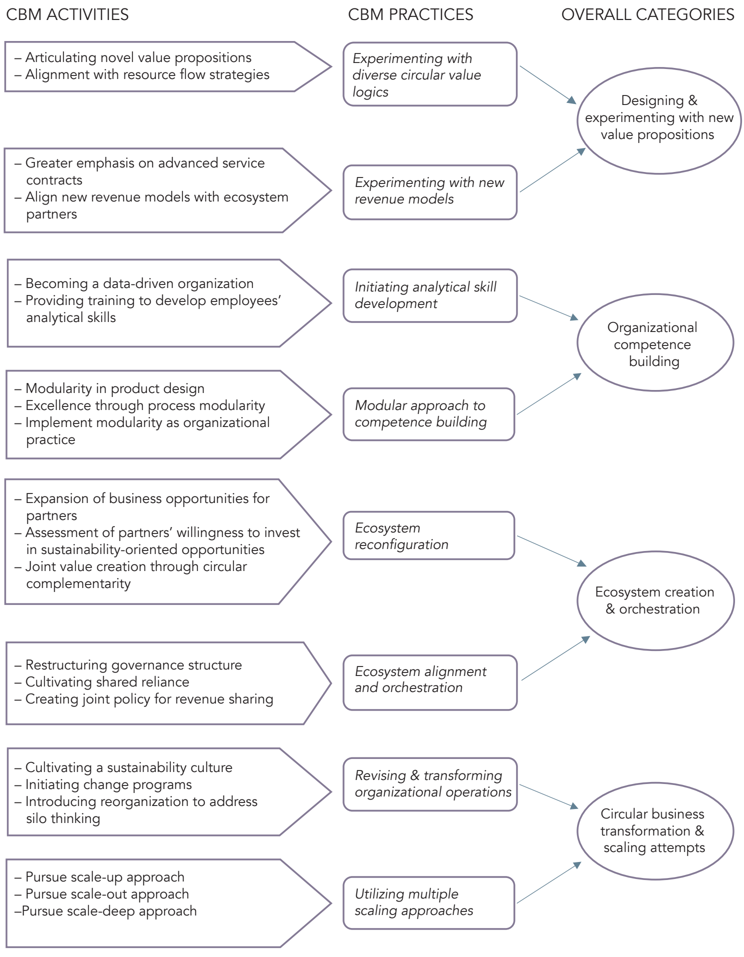
Another significant challenge pertains to the selection of *inappropriate risk management strategies*. Established practice categorizes these strategies into four types: risk avoidance, risk reduction, risk sharing/transfer, and risk retention. Each of these approaches carries its own set of advantages and drawbacks, rendering the decision-making process critical. For instance, risk avoidance entails the selective targeting of customers, refraining from offering circular-based services to everyone. However, this strategy may not be suitable for a firm that perceives profitability in effectively managing associated risks (Reim et al., 2016). Similarly, if a company lacks the technological infrastructure to monitor breakdowns or maintenance alerts, pursuing a risk reduction strategy may prove inappropriate. Furthermore, if the firm cannot allocate additional resources for repairs or maintain an adequate supply of spare parts, this strategy may falter. A shortage of resources can lead to customer dissatisfaction because prolonged service times for repairs increase behavioral risks (Linder & Williander, 2017). Firms often struggle with their risk-sharing strategy, which involves revenue-sharing agreements with customers or risk transfer to insurance companies. Industrial firms may find this strategy inappropriate if they lack the required percentage for sharing, face challenges in negotiation, or struggle with the complexities of involving an insurance party (Toxopeus et al., 2021). Moreover, risk retention can pose difficulties because firms must determine the final price for circular offerings after factoring in the cost of risk. This challenge intensifies when proper customer segmentation is not conducted, leading to the provision of such services to the wrong customer cluster.

Circular business model practices in Swedish industrial firms 4

To implement a CBM, we took the lens of ”strategy as practice” (Whittington, 1996) to analyze what Swedish firms actually do. This concept emphasizes that strategy is not solely a set of plans, decisions, and documents but is fundamentally a practice or ongoing set of activities (Whittington, 2014). Deploying this lens, "strategy as practice" allowed us to see that industrial firms recognize that a CBM is not merely a theoretical concept.

To compose this section, we initiated our process by examining the diverse activities adopted by these industrial firms during their transformative journey to circularity. Utilizing a thematic analysis, we grouped similar activities into relevant CBM practice. In this context, we define "practice" as a set of specific, well-defined activities or routines adopted by industrial firms to design, develop, or implement a CBM. It helps to understand and categorize the concrete steps and methods that industrial firms employ in their pursuit of circularity, forming the basis for further analysis and evaluation. Through this iterative analytical process, we identified eight CBM practices. Moreover, we clustered CBM practices into four distinct categories. These categories encompass independent but interrelated CBM practices and, thus, form aggregate themes. Figure 6 serves as a visual representation of this structure.

Figure 6: Coding tree for business practices



Practices category 1: Designing and experimenting with new value propositions

To take advantage of a dynamic and competitive industrial landscape, Swedish industrial firms are implementing CBMs, which require innovation not only in product design but also in conceptualizing new value propositions (Storbacka et al., 2012). The novel CBM value proposition lies in reimagining how new combinations (both existing and new) of products and services can bring sustainable value to the firm and the entire ecosystem (Konietzko et al., 2020). This journey commences with crafting innovative designs and conducting experiments to refine value propositions, and then embraces an appropriate revenue model to facilitate implementation of the CBM. In this section, we describe various practices related to the value proposition with examples from Swedish industrial firms.

Experimenting with diverse circular value logics

Swedish industrial firms are in the early phase of designing circular offerings. This shift has led many industrial firms to explore various ways to evaluate value propositions and make the correct choice. The appropriate choice has become more difficult because they belong to various industries with different capabilities (da Costa Fernandes et al., 2020). Value propositions can be defined as a clear statement that outlines the unique advantages and benefits that a company delivers to other businesses through its circular products or services (da Costa Fernandes et al., 2020). Swedish industrial firms communicate their value propositions by giving their circular offerings distinct names, emphasizing the sustainable advantages they provide. A case in point is ABB, which brands its digital energy management and optimization services for industries under the umbrella of “ABB Ability”. This service is further segmented into specific offerings such as “ABB Ability™ Smart Sensor”, enabling real-time performance data capture and predictive maintenance, and “ABB Ability™ eMine” tailored for the mining sector and focused on energy and resource conservation alongside enhanced safety measures. These practices clearly communicate the unique value propositions associated with these circular solutions. Indeed, these value propositions convey the specific value that an industrial firm’s circular solutions provide to other businesses, addressing their sustainability and circularity needs and demonstrating how their offerings outperform alternatives (Ranta et al., 2020). Essentially, it is an articulation of why other businesses should choose their circular solutions and how they will meet their sustainability goals and operational requirements more effectively than other available options (McDonough & Braungart, 2010). The circular value proposition is like a roadmap that helps create greater value when firms offer products and services in a circular way. It is about making things that last longer and that can be reused, with benefits for both the business and the environment (Manninen et al., 2018). The following sections discuss various logics to create value propositions and their alignment with resource strategies, with examples from Swedish industrial firms.

Firms are articulating ***novel value propositions*** that make the implementation of CBMs acceptable among different industrial firms from different industries (Frishammar & Parida, 2019). New ways of proposing value acts as an important guideline or market-shaping device that makes the offering – in our case, circular offering – more clearly differentiated (Nenonen et al., 2019). In the context of developing circular offerings, new ways of creating value enable firms not only to address circularity requirements but also to proactively influence market dynamics, fostering a competitive advantage by aligning multiple actors of the ecosystem with common circular principles (Ranta et al., 2020).

Industrial firms are relying primarily on four logics for incorporating value propositions into their circular offerings (Ranta et al., 2020; Rusthollkarhu et al., 2021). Industrial firms are revitalizing used and discarded products and materials by recycling, refurbishing, and reintroducing them into the market. This practice is typically determined by the supplier and follows a one-way process, emphasizing the novel innovation the supplier uses to introduce change and the value that is produced for its stakeholders. This is how they utilize resurrect value propositions logic in their circular offerings (Ranta et al., 2020). Industrial firms are tapping into underutilized assets and resources, such as vehicles, industrial equipment, machinery, and surplus materials. They do so to enable the development of multiple products and services. This practice is driven by the goal of achieving economic benefits through cost reduction and enhanced resource utilization. It is how they practice share value propositions logic (Ranta et al., 2020). Industrial firms are concentrating on extracting more value from fewer resources, effectively extending the utility of existing resources. This strategy, often referred to as value extension, enables industrial firms to expand value creation from existing resources. Its primary aim is to deliver economic and functional advantages, leading to cost savings and prolonged product life cycles. This is exactly like optimize value propositions logic (Ranta et al., 2020). Another common business practice is for industrial firms to proactively replace their current products with significantly improved alternatives. This approach centers primarily on realizing functional, environmental, and social benefits. The underlying concept is that customers can experience immediate enhancements in functionality and societal performance, which is an example of replacing value propositions (Ranta et al., 2020).

Once the appropriate logic for the value proposition is selected, its *alignment with the resource flow strategies* becomes prominent. The reason is that, through value propositions, the industrial firm can target customers and communicate the benefits that the circular offering can bring. But to execute or offer the circular product, the industrial firm needs to manage the resources internally through resource flow strategies, which include slowing resource loops, closing resource loops, and narrowing resource flow (Bocken et al., 2016). To provide resurrect value proposition-related benefits, industrial firms manage their internal resources in a way that is similar to closing the resource loop. This involves reusing materials to minimize waste and extend the life of products and resources. To ensure that circular offerings adhere to share and optimize value propositions, industrial firms often rely on narrowing the resource strategy to make the production process more efficient and on minimizing resource usage to reduce environmental impacts. Replace value propositions involve replacing existing products with significantly better alternatives. They center primarily on delivering functional, environmental, and social benefits, and on providing immediate improvements. Here, industrial firms are practicing the slow resource loop, which aims to extend a product's life cycle and tackle overconsumption. They can design long-lasting products because slowing resource loops contribute to waste reduction and encourage the use of more sustainable alternatives (Bocken & Ritala, 2021; Ranta et al., 2020).

> ***Industrial examples: Evaluating circular value proposition practices at Volvo Group and SKF***
>
> *Volvo Group demonstrates the resurrect value strategy by actively engaging in remanufacturing and refurbishment. It refurbishes and restores used components and parts to their original specifications, extending their lifespan and reducing waste. This approach is aligned with circular principles, conserving resources while providing customers with reliable and cost-effective alternatives (Volvo Group, 2021).*

> *SKF follows the share value strategy through its "Asset Efficiency Optimization" service. SKF collaborates with leading industrial clients, offering services that focus on optimizing the performance of their machinery and equipment. By sharing its expertise and resources, SKF helps customers achieve operational excellence, increase efficiency, and minimize downtime, thereby enhancing overall productivity (SKF Group, 2014; SKF Group, 2019).*

Experimenting with new revenue models

A revenue model outlines how a firm can extract value from its offering – in this context, circular offerings – by specifying the source of revenues, their quantity, and their allocation (Linde et al., 2021). In a CBM, revenues can originate from diverse sources, including product sales, service contracts, lease agreements, resource recovery, subscription models, sharing economy platforms, and product-as-a-service arrangements. These revenue streams are tailored to emphasize product longevity, resource efficiency, and sustainability. The revenue model in the context of CBM implementation plays a pivotal role (Ranta et al., 2018). Industrial firms with an inappropriate revenue model often failed to capture value or remained unpaid for their circular offerings (Reim et al., 2019). Circular revenue models play a vital role in fostering a more sustainable future, where the emphasis shifts from one-time product sales to long-term customer relationships and responsible resource management. In this section, two types of revenue models are discussed, which are increasingly being adopted by the Swedish industrial firms.

In the journey to implement CBMs, industrial firms are placing ***greater emphasis on advanced service contracts*** by adopting a user-oriented or results-oriented revenue model. The user-oriented revenue model explores how a company offers its products through rental or lease agreements while retaining ownership. In this setup, the product is not sold to the customer; instead, the customer pays for its availability over a predetermined period, during which the provider receives regular payments (Frishammar & Parida, 2019). This model aligns with CBM principles by incentivizing industrial firms to maintain and repair products to ensure their continued usability, reducing the need for frequent replacements. Essentially, it encourages a shift from the traditional linear "take-make-dispose" model to a more circular and sustainable one. Customers benefit from having access to the latest technology without the need for large upfront investments, while industrial firms can promote product longevity and sustainability, which is essential in the CE (Junnila et al., 2018). The result-oriented revenue model, however, is about providing a specific outcome or result for the customer rather than just supplying access to a product. The customer pays for a predefined result, and the firm takes full responsibility for delivering that result. This model is closely related to CBMs in the sense that it shifts the focus from the mere consumption of products to the achievement of specific outcomes, which often involves resource efficiency, reduced waste, and sustainability (Frishammar & Parida, 2019).

Designing CBM practice is a complex and uncertain process as industrial firms ***align new revenue models with ecosystem partners***. When multiple actors across firm boundaries collaborate during the value-proposition phase, they need to align on how to share revenue. This sharing ensures that all contributors are incentivized to sustainably drive the circular process forward. In the transition to circularity, the revenue model becomes a pivotal element, and involving ecosystem partners early in the design process can be beneficial. This collaborative approach ensures that the profit formula aligns with the objectives of the CBM and creates a win-win situation for all ecosystem partners. Ecosystem partners can contribute essential insights, whether as suppliers, recycling companies, or any other service providers to the core industrial firm. Together, they can co-create revenue models that emphasize long-term value creation, resource optimization, and sustainability (Dahan et al., 2010). This collaborative revenue design phase not only strengthens the partnership between the industrial firm and its ecosystem but also leads to more robust, mutually beneficial profit-sharing agreements. By working together to define the revenue model, industrial firms and their partners can ensure that the CBM is not only environmentally sound but also financially sustainable, reinforcing CE principles of resource efficiency and value retention. Revenue models enable businesses to collectively access and utilize assets, such as specialized equipment, research and development facilities, materials, transportation, and even skilled labor (Henry et al., 2021). By doing so, they reduce costs, optimize resource utilization, and minimize waste while fostering collaborative innovation and promoting CE principles (Henry et al., 2021). Aligning revenue models with ecosystem partners is integral to modern manufacturing, allowing industrial firms to thrive in a resource-conscious and interconnected business landscape.

> ***Industrial examples: Experimenting with different revenue model practices at Husqvarna, SKF, and Alfa Laval***
>
> *Husqvarna Group has adopted a circular approach through its "Husqvarna Battery Box" service. This service offers professional users, such as landscapers and municipalities, access to battery-powered landscaping equipment through a subscription model. Customers pay a monthly fee to use equipment, such as battery-powered lawnmowers and trimmers. This approach encourages longer lasting and durable product design since Husqvarna retains ownership of the equipment. The company also manages maintenance and replacements, ensuring that equipment is in optimal condition, reducing downtime, and promoting the efficient use of resources (Husqvarna Group, 2017).*
>
> *SKF has launched the RecondOil system, a pioneering CBM. By sharing this system, industrial customers can extend the life of their lubricating oils through purification and continuous reuse. SKF provides the equipment and expertise for oil regeneration, allowing multiple businesses to share the same oil resources. This approach reduces the need for frequent oil replacement, minimizes waste, and lowers the environmental impact associated with oil production and disposal. It exemplifies SKF's commitment to circular economy principles and collaborative resource management (SKF Group, 2022b).*
>
> *Another example is Alfa Laval, which offers a sharing business model for its PureBallast ballast water treatment system. Shipping companies face regulatory requirements to treat ballast water to prevent the spread of invasive species. By sharing this system, many shipping companies can lease and share Alfa Laval's PureBallast system, ensuring compliance with regulations without the need for significant upfront investment. This approach allows multiple shipping companies to collectively utilize and maintain the same equipment, reducing costs and optimizing resource utilization (Alfa Laval, 2023).*

Practices category 2: Organizational competence building

Successfully implementing a CBM requires more than a change of strategy; it requires a holistic transformation of a firm's competency profile (Bertassini et al., 2021). This transformation encompasses a multifaceted approach, with a keen focus on being a data-driven organization, improving analytical skills, and changing the operational mode by adopting modularity concepts. In this section, we discuss some features and industrial examples related to technological and operational competence, which Swedish industrial firms are adopting as part of their transformative journey to achieve circularity.

Initiating analytical skill development

Industrial firms consistently invest in building technological expertise and emphasize the development of analytical skills. Technological competencies drive a CBM by optimizing the reduction, reuse, and recycling of resources (Ganiyu et al., 2020). Some of the industrial firms are in the early stages, while some have already built strong technical competency and are focusing on the latest emerging technologies. These initiatives often amount to a firm ***becoming a data-driven organization***, where it relies on data, analytics, and insights to drive informed decision making, enhance operational efficiency, and support strategic endeavors, during the implementation of its CBM (Kiron, 2017). An emerging trend among industrial firms is the integration of internal platforms, combining newly acquired systems with existing ones to create a unified, standardized environment. This integrated system empowers all divisions and employees by providing them with insights into various aspects of the operation, such as resource flows, recycling rates, initiatives for product/material reuse, and product life-cycle stages. This fosters accountability and trust through the establishment of common standards and protocols (Ramadoss et al., 2018; Thomson et al., 2023). Moreover, industrial firms are extending this integration to include their suppliers and customers. This integrated system can be in the form of a common digital platform to maintain transparency. This is a crucial element when shared revenue models are being developed and negotiations for profit sharing are being undertaken. Industrial firms are prioritizing user-friendly digital platforms as they embark on the journey to circularity. Implementing a CBM often involves a shift from a product-centric to a service-oriented organization. To streamline data-related tasks, these firms are increasingly embracing sensor-based, RFID, and IoT-powered systems, simplifying procedures such as barcode scanning and invoice generation. This, in turn, enhances the efficiency of administrative functions and supports well-informed decision making (Ramadoss et al., 2018). To build technical expertise, industrial firms are automating their processes. Identifying surplus materials, tracking stock movements, and issuing maintenance notifications are all pivotal elements in developing circular practice (Blackburn et al., 2023).

To upgrade the workforce, industrial firms are ***providing training to develop employees' analytical skills***. Swedish industrial firms often link up with public organizations (for example, Nordic Innovation) or private partners to provide digital or face-to-face training and workshops for understanding CBM concepts and the steps a firm needs to take during this transformative journey. Moreover, industrial firms are hiring experts from organizations and linking with startups to provide training for their employees on data analytics and machine learning (Straub et al., 2023). This type of training equips the workforce with the competencies required to effectively navigate the complexities of circularity. Employees can learn how to collect, interpret, and utilize data related to resource flows, product life cycles, and environmental impacts. This analytical acumen enables them to identify areas for improvement, optimize processes, and make informed decisions that are aligned with circular principles (Straub et al., 2023). In essence, these efforts enable the internal workforce to harness its technical competence more effectively and contribute to the firm's circular objectives. To enhance the technical competencies in the workforce, firms are emphasizing the development of various skill sets related to CBMs. This involves fostering expertise in material analysis (Janssens et al., 2021), mastering skills related to multiple product-use cycles and recovery processes (den Hollander et al., 2017), cultivating sustainable design proficiency using software such as AutoCAD and Solidworks, applying principles of "design thinking" (Straub et al., 2023), expanding knowledge of environmental engineering, and acquiring engineering skills linked to maintenance, reverse re-manufacturing, and repair (Khan et al., 2020; Sumter et al., 2021). Employees are encouraged to participate in training and skill development sessions to gain expertise in these areas.

Industrial examples: Technological competence and analytical skill development at SCA and Atlas Copco

Through the adept use of cutting-edge technology, SCA optimizes every stage of its operations to maximize value while minimizing environmental impact. The application of computerized tomography, image processing, and artificial intelligence ensures that every log processed at Bollsta sawmill reaches its full potential. This meticulous analysis continues throughout the sawmill's various processing stages, resulting in both optimized product value for customers and enhanced profitability for the company. Additionally, SCA's investment in a state-of-the-art paper machine and ownership of wind power exemplify its commitment to pioneering technologies for sustainability. The acquisition of wind turbines in 2022 aligns with the company's dedication to providing renewable energy, capitalizing on the well-developed production technology in the wind power sector. SCA's robust IT management model, focusing on governance, standardized processes, and security measures, reinforces its competence in the digital realm. This holistic approach is complemented by employee training in IT security and compliance with regulations, such as the General Data Protection Regulation (GDPR), underlining SCA's commitment to leveraging technology for sustainable, secure, and efficient operations (SCA, 2022).

Atlas Copco has partnered with CoachHub to invest in training programs aimed at upskilling employees. These initiatives empower its workforce to analyze equipment performance data, predict maintenance needs, and optimize resource usage. By fostering a data-driven culture through training, these firms enhance their capacity to implement CBMs that emphasize resource efficiency, waste reduction, and sustainable product life cycles. Ultimately, such training initiatives contribute to the successful adoption and execution of circular strategies in the organization, resulting in improved environmental sustainability and business. competitiveness (Atlas Copco, 2022).

A modular approach to competence building

In addition to technical competence, industrial firms are improving their operational competencies to make CBM implementation more effective. Adopting a modular approach to capacity building can prove highly advantageous in this endeavor (Machado & Morioka, 2021). Modularity, as defined by Baldwin and Clark (2002), involves structuring products and processes using independently designed modules that seamlessly integrate. The effectiveness of modularity is gauged by a system's ability to flexibly adapt and alter its modules (Hölttä & Otto, 2005). Modularity aligns with several circular principles, including cost reduction, reduced repair rates, enhanced maintenance, recyclability, prolonged product lifespans, and increased reusability (Machado & Morioka, 2021). This approach offers multifaceted advantages to enhance a manufacturing firm's operational competencies. First, it promotes adaptability, enabling firms to promptly respond to shifting market dynamics and customer demands. Modularity often leads to standardization, simplifying the establishment of standard operating procedures (SOPs) and best practices. This standardization aids competency development by providing employees with clear guidelines and enables scalable competency enhancement.

Swedish industrial firms are implementing ***modularity in product design*** by establishing structural and functional independence between modules and structural and functional cohesion within modules (Gershenson et al., 2003). By establishing structural and functional independence between modules, these firms can efficiently manage and maintain various components, allowing for targeted maintenance and replacement, extending product lifespans and reducing waste, which are key aspects of circularity. Industrial firms can incorporate standardization of modules into their business practice. This standardization involves the establishment of uniform and interchangeable components and designs, facilitating the reuse and recycling of components, a fundamental aspect of circularity. This practice ensures compatibility, facilitates rapid deployment, and streamlines maintenance procedures across various systems. Standardized components enable multiple suppliers to deliver interchangeable parts. This reduces reliance on specific vendors and enhances operational flexibility, contributing to a more resilient and circular ecosystem (Lange & Imsdahl, 2013).

To gain operational ***excellence through process modularity,*** industrial firms are dividing complex processes and systems into smaller, independent, and interchangeable modules or components (Jacobs et al., 2007). Each module performs a specific function or task within the overall process: it can be designed, implemented, and maintained separately. The key idea behind process modularity is to increase flexibility, scalability, and efficiency in managing complex processes or systems. It facilitates easier customization, maintenance, and upgrading of individual modules without disrupting the entire process. Firms can enjoy the benefits of optimized workflows, reduced downtime, and enhanced system performance, prolonging lifespan, which is a key aspect of circularity (Jacobs et al., 2007).

To obtain the benefits from a modular approach for the long term and to make it a regular activity, industrial firms recognize the need to ***implement modularity as an organizational practice***. To this end, industrial firms focus on the systematic integration of modular principles and strategies in a company's structure and operations. It encompasses the design and implementation of modular components in various aspects of the organization, including products, processes, communication, branding, governance, measurement, and metrics (Miguel, 2005). In essence, incorporating modularity as a core organizational practice empowers industrial firms to optimize their operations and drive forward with the principles of the CBM. This strategic approach not only streamlines processes but also places a strong emphasis on sustainability through which industrial firms can effectively implement CBMs by prioritizing resource conservation and environmental responsibility.

> ***Industrial examples: Modular approach to capacity building practices at Volvo Construction Equipment, ABB, and SKF***
>
> *Volvo Construction Equipment exemplifies the practice of modularity through its development of standardized machine platforms for various construction equipment. These platforms incorporate consistent components, designs, and technologies that can be applied across the product range, including excavators, wheel loaders, and articulated haulers. This approach ensures interchangeability of parts, cost efficiency in manufacturing, product consistency, and customization options for customers. By prioritizing standardization, Volvo Construction Equipment enhances the efficiency, reliability, and cost effectiveness of its products, ultimately catering to the diverse needs of the construction industry (Volvo Group, 2019).*
>
> *An Integrated Operation Center, often known as an ABB Operation & Collaboration Center, serves as an extension of the conventional control room, playing a vital role in achieving process modularity by enhancing collaboration and communication, ensuring efficient coordination between*

> *modular units, and optimizing overall operations. Its primary purpose is to facilitate enhanced collaboration across various disciplines within an organization and foster cooperation both within and between control rooms. These centers are typically located onshore but are designed to provide users with an immersive experience akin to being in an offshore setting. This is achieved through advanced visual, audio, and data presentation techniques. In the context of process modularity, such centers likely play a crucial role in optimizing operations, enhancing communication, and ensuring efficient coordination across the organization (ABB, 2023).*
>
> *SKF practices modularity at an organization level through communication and branding related activities. The company's corporate messaging revolves around the environmental benefits of its modular bearing solutions, which enable customers to replace individual bearing components rather than entire units, thus reducing waste and extending the lifespan of equipment. SKF's communication efforts underscore its commitment to sustainability, innovation, and advanced engineering, positioning the company as an industry leader in providing modular solutions that align with environmentally conscious principles. Through various engagement channels, SKF effectively communicates the advantages of modularity to its customers, reinforcing its reputation as a forward-thinking and environmentally responsible manufacturer (SKF Group, 2021).*

Practices category 3: Ecosystem creation and orchestration

An ecosystem refers to a network of interconnected organizations, stakeholders, and resources that collaborate to create, deliver, and capture value within a closed-loop system (Blew, 1996). This ecosystem typically involves various actors, such as industrial firms, suppliers, customers, recyclers, and service providers, working together to optimize the use of resources, minimize waste, and promote sustainability (Kanda et al., 2021). Ecosystem creation and orchestration play a pivotal role in the successful implementation of CBMs (Antikainen & Valkokari, 2016). They are essential for optimizing resources, fostering innovation, expanding into new markets, ensuring compliance with sustainability standards, mitigating risks, engaging customers, and enhancing operational efficiency. By bringing together diverse stakeholders, businesses can efficiently access external resources, promote sustainability, and develop innovative solutions to close the resource loop (Sjödin et al., 2022). Furthermore, orchestrated ecosystems facilitate compliance with environmental regulations and standards, and they help firms navigate supply chain disruptions. In an era where sustainability is a critical driver of business success, effective ecosystem creation and orchestration are key to achieving both environmental and economic objectives in the CE (Rattalino, 2018).

Ecosystem reconfiguration

During this transformative approach to implementing CBM successfully, industrial firms are engaging in the strategic reconfiguration and expansion of ecosystems, where companies seek to form new partnerships and recalibrate existing ones (Antikainen & Valkokari, 2016). This strategic move is fueled by three objectives: expanding business opportunities for partners, assessing partners' willingness to invest in sustainability-oriented ventures, and co-creating value through circular complementarity. This section outlines the essential activities associated with these CBM practices, with accompanying examples of how Swedish industrial firms are striving to integrate these activities into their business operations.

In initiating these activities, industrial firms are recognizing the need to manage the ***expansion of business opportunities for partners*** by both onboarding new partners and revitalizing existing ones. Partnership initiation demands substantial effort from firms to find collaborators capable of addressing internal capability gaps (e.g., providing digital platforms, support to utilize emerging technologies, modular plant design, support to standardize modules), which can foster customer value creation. Importantly, industrial firms are not restricted to themselves or complementary partners but can also consider original equipment manufacturers and even competitors as potential allies (Sjödin et al., 2022). In addition, industrial firms are tapping into innovative startups and extracting valuable ideas from initiatives such as hackathons. On this journey, startups sometimes require support to scale or fund their ideas. Here, industrial firms can enhance their agility and adaptability by responding to this need. Furthermore, industrial firms can reconfigure their existing partnerships by encouraging the adoption of a CBM instead of seeking entirely new alliances (Sjödin et al., 2022). Existing partners often possess a deep understanding of the firm's operations and the industry, making them invaluable resources. By initiating dialogue, offering knowledge sharing, and providing incentives, industrial firms can help their partners embrace circular practices. This collaborative approach can foster mutual growth within the ecosystem and facilitate a smoother transition to more sustainable and circular operations.

Another activity that industrial firms can usefully engage in is the ***assessment of partners' willingness to invest in sustainability-oriented opportunities*** for CBM implementation. The main purpose is to ensure that all ecosystem partners gain a deeper understanding of the steps and the gaps related to CBM implementation. For example, firms conduct an external trend assessment (environmentally friendly technology, way of changing operations, measuring environmental impacts) and check the partner's compatibility in response to this requirement. Industrial firms have periodic strategic meetings with representatives from each partner organization about the changes needed to achieve circularity (Parida et al., 2019). Industrial firms are also engaging in policy and regulatory alterations and assessing the willingness of ecosystem partners to accommodate these changes (Rattalino, 2018). Implementing a CBM requires a significant shift in current business operations, and this transformation extends beyond the industrial firm alone. The entire ecosystem of partners is shifting from a product-centric to a service-centric approach. It is crucial to ensure that all ecosystem partners are adaptable and prepared for this transition (Parida et al., 2019).

Moreover, industrial firms are exploring joint ***value creation through circular complementarity***. In following this approach, firms are engaging both existing and new ecosystem partners to co-create circular offerings with customers. Industrial firms are strategically building their ecosystems by partnering with entities with whom they can co-create value through complementarities (Tapaninaho & Heikkinen, 2022). Rather than simply seeking partners who mirror their operations, industrial firms are looking for collaborators whose strengths align with their weaknesses, creating a synergy that benefits both parties. This approach encourages a holistic view of the ecosystem, recognizing that each partner brings a unique set of capabilities and resources to the table (Tapaninaho & Heikkinen, 2022). By fostering such collaborations, industrial firms can tap into the full potential of their ecosystem, optimize resource utilization, and drive sustainable and circular practices across the value chain.

Industrial examples: Ecosystem reconfiguration and expansion practices at ABB and SKF

ABB's SynerLeap program is an innovation initiative and an innovation growth hub. It was developed by ABB to collaborate with start-ups and scale-ups, providing them with an environment to develop and expand their technologies, products, and services, often in the areas of industrial automation, robotics, and energy technologies. The SynerLeap program typically offers start-ups access to ABB's resources, expertise, and global network. This can include mentorship, technical support, investment opportunities, pilot projects, and collaboration with ABB experts. The goal is to facilitate innovation and the development of technologies that align with ABB's areas of interest. In return, ABB may benefit from early access to innovative solutions and emerging technologies. There are more start-up initiatives at ABB such as ABB Technology Ventures (ATV) and ABB Industrial AI Accelerator. ATV is the venture capital arm of ABB, a pioneering technology company. ATV is devoted to identifying and investing in start-ups and companies that are innovating in areas closely aligned with ABB's core businesses. ABB Industrial AI Accelerator is an initiative developed by ABB, a global technology company, to leverage artificial intelligence (AI) in industrial applications. This initiative is designed to harness the power of AI and advanced analytics to enhance industrial processes, improve efficiency, and drive innovation in various sectors, including manufacturing, energy, and infrastructure (ABB Group SynerLeap, 2023).

SKF Group serves as an exemplary model for value co-creation through complementarity within its ecosystem. SKF strategically collaborates with a diverse range of partners, including research institutions, suppliers, and customers, to harness the synergies of complementary capabilities. For instance, SKF actively engages with academic institutions and research organizations to stay at the forefront of technological advancements in its industry. This proactive collaboration enables SKF to access state-of-the-art research and innovative concepts that can be seamlessly integrated into its product and service offerings. Furthermore, SKF has cultivated robust partnerships with its suppliers, who play a pivotal role in providing essential components and materials for its products. These symbiotic relationships ensure a constant supply of high-quality resources, thereby enhancing the reliability and excellence of SKF's offerings (SKF Group, 2021).

Ecosystem alignment and orchestration

Once an ecosystem is reconfigured around a CBM, the need for alignment and orchestration becomes apparent. In this context, alignment refers to the coordination and synchronization of various stakeholders, partners, and actors within an ecosystem to work together towards common goals and objectives – in this case, the implementation of a CBM. It involves ensuring that all participants in the ecosystem are on the same page, understand their roles and contributions, and are moving in the same direction. Alignment is crucial to create a cohesive and integrated ecosystem where all members collaborate effectively. Orchestration goes a step further. It involves actively managing and organizing the interactions, activities, and resources of the ecosystem's partners to achieve specific outcomes. Orchestration includes designing and implementing strategies, rules, and governance mechanisms that guide the ecosystem's functioning. It often falls to a central entity or platform that takes on the role of orchestrator, facilitating and optimizing the activities of the ecosystem to create value for all participants. In short, orchestration refers to a series of purposeful and deliberate actions undertaken by a central firm within the ecosystem (Dhanaraj & Parkhe, 2006). These actions serve to provide the business ecosystem with a sense of institutional stability (Thomas et al., 2014). This role of orchestration encompasses activities that involve enforcing established rules and ensuring the compliance of ecosystem partners. These activities may entail promoting transparency among partners to mitigate the risks associated with moral hazard and, in some cases, imposing sanctions or excluding stakeholders who fail to adhere to the defined rules (Parida et al., 2019). Ecosystem orchestrators play a pivotal role in coordinating and managing the diverse interests of ecosystem partners, fostering alignment between them. This section highlights three critical activities that contribute to the success of orchestration, illustrated with examples from Swedish industrial firms.

Here, the first important activity the industrial firms consider is ***restructuring the governance structure***. Orchestrating the ecosystem involves revising operational processes, roles, and activities within the value delivery process. Industrial firms are legitimating this through their governance structure. For instance, firms establish internal service level agreements with circular ecosystem partners to define their respective functions, information sharing, and service standards, ensuring clear role allocation (Chen et al., 2020). Moreover, they adopt a centralized monitoring mechanism to oversee service processes across ecosystem actors, especially when technology and operational methods related to the CBM are at the initial phase, which may change frequently or demand customization. Industrial firms are making provision for adjustments in revenue and risk-sharing agreements to manage complex interdependencies before switching to a shared revenue model. Changes in standards and regulations to achieve circularity often stem from national or international authorities. Industrial networks of ecosystem partners are diverse and belong to different industries with varying capability levels (Chen et al., 2020). Mostly, ecosystem orchestrators or core firms are proactively engaging in discussions about defining industry standards. Along with adhering to government regulations, these orchestrators establish their own standards for partners within the circular ecosystem. This may involve undergoing a certification process to ensure quality or undertaking audits to achieve better comprehension and adherence (Parida et al., 2019).

To make the orchestration successful, the orchestrator ***cultivates shared reliance***. Industrial firms shoulder the initial investment costs associated with transitioning to the CE because many ecosystem partners face significant obstacles due to a lack of resources, particularly financial. They also assist their ecosystem partners in tackling other uncertainties of a market, regulatory, or environmental nature. Ecosystem orchestrators establish new routines and processes in collaboration with their chosen partners. This includes extending the use of digitalization for enhanced service delivery, building competencies, offering support for revenue and cost calculations, portfolio management, and refining the configurability of product and service components (Parida et al., 2019). Industrial firms also stress the willingness of their ecosystem partners to openly share essential knowledge and intellectual property (IP) materials relevant to CBM implementation. They fully understand that sharing knowledge and IP serves as a catalyst for complementary innovation and forms a foundation for fostering new ecosystem partnerships. It is a pivotal element in transforming the ecosystem so that business solutions consistent with circularity principles can be offered (Parida et al., 2019).

Finally, the orchestrator ***creates joint policy for revenue sharing*** through the negotiation mechanism. Sharing profits with ecosystem partners is crucial for industrial firms which aim to thrive in the CE landscape. By distributing a portion of the earnings among ecosystem participants, firms foster a sense of collective ownership and commitment to the CBM. This practice not only incentivizes partners to actively contribute to CBM initiatives but also aligns their interests with the industrial firm's long-term sustainability goals. Moreover, sharing profits can attract partners who are essential to the ecosystem and ensure their continued participation and collaboration (Schwanholz & Leipold, 2020). Additionally, revenue sharing can be viewed as a fair and equitable way to acknowledge the value generated by each participant in the circular value chain. In essence, profit sharing serves as a powerful mechanism to promote cooperation, mutual growth, and the collective advancement of circularity principles within the ecosystem (Sjödin et al., 2022). The orchestrator – that is, the industrial firm – has a comprehensive manual that clearly describes all the negotiation related to profit sharing and purchasing arrangements. Furthermore, it serves as the basis for evaluating the roles and responsibilities essential to the successful implementation of the CBM.

> ***Industrial examples: Ecosystem alignment and orchestration practices at Ericsson***
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> *Ericsson fosters creative partnerships with ecosystem collaborators to advance sustainability and cutting-edge applications in the domain of 6G technologies. With a strong dedication to sustainable principles and a keen understanding of the potential of circularity, Ericsson actively leads the way in orchestrating collaboration that not only pushes the boundaries of telecommunications but also underscores environmental responsibility. Through cooperation with partners spanning diverse industries, Ericsson's goal is to jointly craft solutions that reduce electronic waste, boost resource efficiency, and extend the lifespan of network infrastructure. This comprehensive strategy lies at the core of Ericsson's vision of a circular economy, ensuring that the evolution of 6G applications harmonize with a commitment to sustainability and ecological mindfulness. These endeavors underscore Ericsson's unwavering commitment to aligning ecosystems, highlighting advancements in technology alongside a strong emphasis on sustainability, ultimately paving the path to a more interconnected and circular future (Ericsson, 2022).*

Practices category 4: Circular business transformation and scaling attempts

Circular business transformation, which is a dynamic and evolving process, requires fundamental changes within an organization to enhance its core operations, adapt to shifting market demands, and embrace new opportunities. On this transformative journey, industrial firms are managing change, cultivating a sustainable culture, and reorganizing the organizational structure for effective implementation of the CBM. Moreover, in this phase, scaling plays a pivotal role. Scaling, in this context, refers to the process of growing and expanding a business or its operation for the purpose of adopting circular practices and principles in an organization and its broader ecosystem. Here, "the main focus is on increase in size… accompanied by a larger-than-proportional increase in the performance" (Palmié et al., 2023). The entire process encompasses a range of different approaches that firms adopt to successfully navigate the complexities of the CE. These insights are illuminated through industrial examples from Swedish industrial firms, showing how these firms can successfully reshape their operations and strengthen their dedication to sustainability and circularity.

Revising and transforming organizational operations

In the pursuit of successful CBM implementation, industrial firms are extending their focus beyond technical competence and operational excellence to emphasize the critical role of internal organizational development. In this phase, industrial firm's direct employee conduct to harmonize with the organization's CBM approach and aims. They are providing guidance so that employee behavior aligns with the organization's CBM strategy and objectives (Anthony et al., 2014). In the literature, this practice has been recognized as cultural control, rewards and compensation, and administrative control – three important mechanisms of management control (Svensson & Funck, 2019). Through this practice, industrial firms not only facilitate informed decision making but also ensure that employee behaviors are in harmony with CBM principles. Apart from these mechanisms, industrial firms are initiating change programs and introducing organizational structure-related changes to make CBM implementation effective. In this section, we highlight a range of activities that Swedish industrial firms are undertaking in relation to these three mechanisms to facilitate CBM transformation.

To implement CBM successfully, industrial firms are ***cultivating a sustainability culture***. Managing change is a paramount task, necessitating a clear vision and strategy that articulates the industrial firm's commitment to circularity. Industrial firms are communicating this vision regularly and compellingly to all internal employees. Furthermore, they are establishing open channels of communication to ensure that the entire organization understands the shift (von Kolpinski et al., 2023). In their internal documentation on environmental policies and practices, they are emphasizing crucial reference points and using eye-catching posters throughout the workplace to reinforce the firm's sustainability objectives (Svensson & Funck, 2019). Industrial firms are fostering a culture of sustainability and innovation through tangible actions and not just words. Firms are offering comprehensive training programs that empower employees with the knowledge and skills needed to actively contribute to CBMs (Svensson & Funck, 2019). They are giving thought to adjusting compensation and reward structures to recognize and incentivize sustainable practices and innovative solutions (von Kolpinski et al., 2023). Both financial and non-financial rewards have increasingly been used without strict linkage to any specific projects. For instance, employees are receiving recognition based on the amount of collected waste and on the conscious usage of energy and water. Firms are encouraging regular employee education sessions to keep all informed of the latest circular principles and practices (Svensson & Funck, 2019).

Swedish industrial firms are also ***initiating change programs***. There are based on BM reconfigurations in the context of the CE (Hofmann & Jaeger Erben, 2020). Industrial firms are considering CBM adjustment-related change programs when aiming to make gradual and incremental changes to their existing business models. Here, the purpose is to enhance sustainability and circularity without radically altering their core operations. This approach is suitable when the firm's current resources, networks, and product/service offerings remain relevant, but there is a desire to improve efficiency, reduce waste, and increase environmental consciousness within the existing framework (Hofmann & Jaeger Erben, 2020; Okorie et al., 2021). The next change program of consequence is CBM adaptation. Industrial firms adopt this change management program when they recognize the need to continuously align their business operations (for instance, repurposing by-products and shifting from raw to recycled materials) with the evolving demands and expectations of the social environment (Hofmann & Jaeger

Erben, 2020; Okorie et al., 2021). Lastly, the CBM innovation change management program is being adopted when an industrial firm recognizes the imperative of a profound shift in its business model to effectively address emerging sustainability challenges and opportunities, essentially redefining its role within the CE. This transformation introduces novelty to the firm, giving rise to entirely new value creation processes. These directions are aligned with a forward-looking perspective that urges firms to proactively respond to the evolving landscape of sustainability and circularity (Hofmann & Jaeger Erben, 2020; Okorie et al., 2021).

To effectively implement a CBM, industrial firms are ***introducing reorganization to address silo thinking***. This involves the introduction of new roles and departments that explicitly prioritize sustainability and circularity. By creating positions such as sustainability managers and environmental awareness cells, firms are establishing dedicated teams with the explicit mission of driving the circular agenda. By incorporating sustainability into the organizational hierarchy, these firms are conveying a powerful message about their unwavering commitment to circularity (Awan & Sroufe, 2022; Hofmann & Jaeger‐Erben, 2020). This proactive approach not only enhances the successful implementation of CBMs but also positions these firms to thrive in an evolving business landscape where sustainability emerges as a fundamental value. Since the transition to a CBM is a radical organizational change, it may demand frequent changes in teams and the style of business operations (Hofmann & Jaeger Erben, 2020). Therefore, industrial firms are embracing an open, flexible, and less rigid organizational structure. This adaptability enables firms to stay agile and responsive to the dynamic nature of sustainability. Moreover, to avoid a unidimensional silo mentality, cross-functional and cross-disciplinary communication must be promoted to trigger mutual learning processes so that the emergent cognitive diversity is effectively channeled. (Awan & Sroufe, 2022; Hofmann & Jaeger-Erben, 2020).

> ***Industrial examples: Revising and transforming organization operational practices at Scania and Volvo***
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> *Scania, a manufacturer of commercial vehicles and engines, has embarked on a remarkable journey towards circularity and sustainability. Its vision and strategy, aptly named "Sustainability in Every Drop" demonstrate a resolute commitment to reducing its environmental footprint while shaping the future*

> *of sustainable transportation. Scania ensures that its sustainability objectives permeate throughout the organization through consistent and transparent communication, coupled with robust internal documentation of environmental policies. This commitment is reinforced by Scania's dedication to nurturing a culture of sustainability and innovation. It invests significantly in employee education and training, keeping its workforce abreast of the latest sustainable practices and circular principles. Furthermore, Scania has instituted compensation and reward structures that recognize and incentivize sustainability-driven behaviors among its employees (Scania, 2022).*
>
> *Volvo Group actively promotes cross-functional and cross-disciplinary collaboration. Departments that once operated in isolation have now forged close partnerships to achieve shared sustainability objectives. For instance, its engineering, design, and procurement teams work closely to develop more sustainable and recyclable vehicle components. They have transitioned from conventional, hierarchical structures to more agile, team-based approaches. This shift enables quicker decision-making processes and fosters collaboration across departments (Volvo Group, 2021).*

Utilizing multiple scaling approaches

Scaling, when viewed as a practice within the context of implementing a CBM, extends beyond simple expansion of sales. It involves careful arrangement of resources and processes to transform a novel CBM into a pervasive and impactful solution. At its core, scaling as a practice calls for the development of competencies to manage complexity and foster adaptability. Swedish industrial firms are adopting scaling as a business practice to increase the reach and volume of their circular offerings. Moreover, implementing scaling approaches successfully provide firms with economies of scale and long-term viability, which are necessary for successful CBM implementation. Scaling helps industrial firms to connect the dots between the promise held out by the idea of a CBM and the actuality of making it work sustainably (Bertucci Ramos et al., 2022). In this section, we will delve into three scaling logics, employing industrial examples from Swedish industrial firms.

Using the ***scale-up approach***, industrial firms are strengthening their existing circular endeavors. For example, an industrial firm has already committed to recycling components from its products. Today, they are not simply continuing with these efforts but are significantly expanding their scope. In practical terms, this means broadening the recycling program to encompass a wider array of products or increasing coverage of circular practices throughout their manufacturing processes (Sandberg & Hultberg, 2021). By scaling up, these industrial firms are amplifying the impact of their established circular initiatives. **The scale-out approach** involves the diffusion of proven circular practices across various segments of an industrial firm through policy or regulatory changes. For example, an industrial firm that has excelled in reducing waste in one of its production facilities through innovative material utilization is not stopping at this achievement. Instead, the industrial firm is making the same waste reduction techniques mandatory for their other manufacturing units. In essence, the firm is striving for an organization-wide shift towards circularity, ensuring that the successes of one unit influence and inspire improvements across the entire organization (Sandberg & Hultberg, 2021).

On the other hand, industrial firms committed to the ***scale-deep approach*** are taking circularity to the core of its operations. This approach goes beyond surface-level practices and seeks to make circularity a fundamental aspect of the organizational values, beliefs, and culture. For example, an automotive manufacturer is not content with just recycling components; it is committed to fundamentally redesigning its vehicles for disassembly and reuse. This deep embedding of circularity in product development demonstrates a profound commitment to making circularity an integral part of the corporate culture and long-term strategy. Here, the emphasis is on a comprehensive transformation, encompassing business models, supply chain strategies, and product design, all viewed through a circular lens (Sandberg & Hultberg, 2021).

> ***Industrial examples: Utilizing several scaling practices at Sandvik Group, Tetra Pak, and SKF***
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> *Sandvik Group is implementing the scale-up strategy. It has significantly increased its efforts in recycling and reusing materials, especially in its metalworking operations. By expanding its use of recycled metals into more products, it is not only reducing waste but also conserving natural resources. This demonstrates its commitment to circularity by doing more of what it is already doing within their core (Sandvik, 2022).*

> *Tetra Pak is practicing the scale-out strategy. After successfully introducing a circular initiative to reduce packaging waste in one product line, the firm is now adopting this as standard procedure and extending this practice to various other product categories. It has taken the successful recycling and material reduction methods applied to one sector and is replicating them across its diverse portfolio of packaging solutions, embracing circularity more broadly within the organization (Tetra Pak, 2022).*
>
> *SKF is committed to enhancing sustainability in its supply chain through the scale-deep approach. SKF requires its suppliers to provide plans for improving energy efficiency and reducing CO2e emissions per tonne of output. To facilitate this, SKF has developed a tool that enables product designers and procurement teams to estimate the carbon footprint of various steel supplier options. This tool helps SKF address the growing demand from customers to reduce embedded CO2e emissions in the products they purchase. Throughout 2022, SKF actively worked on informing and involving its direct material suppliers in alignment with the company's ambitious objective of net zero by 2050. This engagement with suppliers is an ongoing process that will extend into 2023. SKF's proactive approach to supplier engagement reflects its commitment to achieving sustainability goals, not only within its own operations but also throughout its supply chain. By promoting energy efficiency and reducing emissions at every level of production, SKF is contributing to a more sustainable and environmentally responsible future (SKF Group, 2022a).*

Discussion – where does Swedish industry stand? 5

This report for Swedish Entrepreneurship Forum has sought to illuminate where Swedish industry stands regarding CBMs. We address this question by describing the barriers that Swedish industrial firms face in making the transition to CBMs, and by following with a description of CBM practices – in other words, what Swedish industrial firms do when design and scaling CBMs. These questions are critical for at least two reasons. First, in a world where environmental problems are becoming increasingly severe, CBMs represent a way to improve resource efficiency by slowing, closing, or generating resource loops. Thus, it is a key source of competitive advantage for Swedish industrial firms. Second, if companies can successfully scale CBMs, it will deliver *environmental value* in the form of positive externalities. This type of value is not captured by industrial firms, but rather indirectly by society in the transition to a potentially more circular and sustainable future. So, against the backdrop where CBMs have become the dominant framework for thinking about how to mitigate climate change and get to net zero in practice (Bocken & Ritala, 2021), we need to know where Swedish manufacturing industry stands. What has been done so far, and what remains to be done?

There is a need for society, and for industry, to move from the linear economy paradigm where products, once consumed, lose their value, and are discarded as waste (Bigliardi & Filippelli, 2021). This is what the Ellen McArthur Foundation (2015) has called the take-make-dispose model. The alternative to this is the CE paradigm, which seeks to decouple growth and resource consumption and, thus, maintain products, components, and materials at their highest possible value. This shift has profound implications for industrial firms because it changes value creation, the design of products, the structure of individual firms, their value chains and value networks, and it calls for new policies and institutional changes (Aarika-Stenroos et al., 2023). Our report is geared principally to the current situation facing Swedish industrial firms – both the circumstances within industrial firms and the barriers and practices that require broader collaboration with ecosystem partners. However, we outline some ideas for policy interventions as well.

Where does Swedish industry stand regarding CBMs? Are we good or bad, leading or lagging? Sweden has historically been seen by many as a front runner in sustainability. It is therefore somewhat paradoxical to witness many, powerful barriers to introducing CBMs. Indeed, the CBM practices that Swedish industrial firms engage in are early phase, experimental, and somewhat premature. For example, few if any Swedish industrial firms appear to have radically improved their resource efficiency or successfully scaled a CBM to the extent that it has replaced a more traditional or conventional business model.

Why then are CBM practices in Swedish industry not more mature? We can think of several different reasons. First, this report is underpinned by an analysis of the literature on CBM in Sweden – mainly academic literature but some grey literature as well. While this adds rigor, not all that industry does is seen in the literature. So, we are open to the possibility that Swedish industry has progressed further than our analysis indicates. In fact, much could be going on in Swedish industry that is beyond our purview. Second, not all CBM initiatives use that term. Some of it is published under the labels of sustainable business models, green business models, product-service systems, and similar terms. This parallel literature has not been part of our analysis. Third, and perhaps most likely, CBMs are complex and unwieldy. As will be revealed in the discussion of barriers and practices below, developing and successfully scaling a CBM is a lengthy and complex process. Implementing CBMs requires more than just a strong commitment from industrial firms; it demands systemic or industrial-level changes. In this transformation, it is crucial to recognize that success is not solely dependent on the industrial firm but on the active involvement and alignment of all ecosystem partners. It requires a collective effort where stakeholders collaboratively adapt and evolve, making CBMs a truly transformative and sustainable initiative. This is highly complex, and it takes time. CBMs appear unwieldy in the sense that it is not always straightforward what to do and how to do it. Frequently, there is incomplete information and contradictory or changing requirements; there is no single "best solution" for how to develop and scale a CBM. It requires trial and error and an experimental approach. So great complexity and extreme unwieldiness may help to explain why Swedish industry has not come farther along the CBM path.

That said, what can and should Swedish industrial firms do to mitigate or overcome the barriers, and what can they do to build on and improve their practices?

5.1 What can Swedish industrial firms do to mitigate or overcome the barriers?

The barriers hindering the adoption of CBMs by Swedish industrial firms are meticulously outlined in section 3, rendering a recap redundant. Nevertheless, three overarching observations merit renewed attention. First, it is evident that these barriers loom large and hold substantial influence, making them resistant to facile mitigation. This is fundamentally rooted in the fact that CBMs require a significant infusion of novel activities, and it is these very innovations that give rise to these barriers. Second, and on a more optimistic note, it is notable that the majority, if not all, of these barriers fall within the sphere of influence of industrial firms and their collaborative partners. In essence, these challenges are not insurmountable, and firms hold the key to addressing them. Lastly, it is crucial to recognize that many of these barriers are intricately intertwined, forming an interdependent web. This means that a siloed approach to tackling them is inherently limited. To mitigate or overcome the barriers, we propose the following logic.

- Many of the barriers to CBM lie in the realm of capability, meaning that they can be mitigated by building capability or competence in the specific area of that barrier. For example, industrial companies can improve co-creation with customers, develop their service delivery organization over time, and learn to design better revenue models and new revenue streams. In fact, this logic seems to apply to all barriers except those erected with hefty up-front investment costs.

- As blunt as it may sound, CBMs come with significant up-front investment costs. Industrial companies may need to digest this fact and allocate more funding to create new offerings, delivery processes, and revenue models as part of a dedicated effort to implement a CBM.

- A holistic perspective in addressing CBM barriers needs to be adopted. Barriers that relate to one component in a CBM can cause problems in another. So, a firm-specific and careful analysis must be made. For example, an underdeveloped external partner network is a barrier to value delivery. It will undercut firm value creation because new products not only need to be created but also must be delivered.

- Many of the barriers call for an awareness of what the CBM literature has called "a fallacy of the wrong level" (Frishammar & Parida, 2021). It is easy for an industrial company to think of a CBM as "ours" in the singular sense whereas in fact they should think about it as "ours" in the plural sense of the word. Here, some barriers are at the firm level of analysis, such as the failure to use emerging technologies, the failure to conceive risk management strategies, or significant up-front investment costs. Others are clearly at the ecosystem level of analysis, such as not thoroughly involving customers in co-creation, or underdeveloped external partners. An industrial company must ensure they address each CBM barrier on the correct level.

- A particular challenge for Swedish industrial firms is that CBMs may be designed domestically but must be scaled internationally. This makes scaling inherently slow, but it is nevertheless important to account for the international dimension early in the design phase. International dealer networks, local service networks, and technology providers must be involved to ensure customized offers to global markets. Needless to say, Swedish industrial companies are highly export-oriented, when it comes to growth and revenue generation.

5.2 What can Swedish industrial firms do to improve CBM practices?

Like barriers, practices lie in the realm of capability in the sense that practices, over time, develop into routines and capabilities. But there is no perfect 1:1 match with all practices corresponding to a specific barrier. Rather, combined and over time, practices will allow an industrial firm to improve its CBM. A general observation is that most practices seem early or premature, meaning that most practices are early stage and characterized by pilot testing rather than a successful large-scale CBM rollout. Another point to note is that all practices strive for improved resource efficiency along the CBM logic but, based on the literature analysis, it is hard to say what the exact results are. There are few, if any, studies that quantify the environmental effects of CBMs. Swedish industrial firms seem far away from the more ambitious versions of resource efficiency, such as the circular flow logics of closing the loop. To improve current practices, we offer the following advice.

- Because CBMs are early stage, practices should be viewed as experimental. A key response is to learn from early failures, revise the practice, and move forward. This firm type of "agile working approach" (Sjödin et al., 2020) is highly beneficial for Swedish industrial firms.

- Scaling a CBM diverges significantly from a traditional product scale-up; it often involves building one customer relationship at a time. This is especially pronounced when introducing new revenue models that require deep co-creation of value with each customer. Consequently, the process inherently unfolds at a deliberate pace, demanding both time and patience. The extensive co-creation of value with each industrial customer can create bottlenecks to rapid scaling across diverse customer bases. However, it is precisely through this personalized co-creation that CBMs establish strong customer relationships, paving the way for more extensive scaling as the model matures.

- A crucial decision in developing practices is the make-or-buy option – that is to say, determining what an industrial company should itself do versus agreeing with ecosystem partners what they can contribute. "Make", in this case, calls for internal development. Some practices seem to have a clear center of gravity, such as those in category 2 (organizational competency building). Some others have a clear "buy" slant to them, such as ecosystem creation and orchestration practices in category 3. An industrial firm would need to reach a clear verdict on which CBM practices should be carried out in-house and which can be contributed by others. This is particularly important because CBMs often require collaboration outside existing value chains and with various, new actors. Understanding alignment structure, governance principles, and role distribution is, therefore, critical in developing mature practice.

- Many activities that make up practices, such as managing resource flows and resource strategies to slow, close, or narrow the loop, are often beyond the limited prior experience of industrial firms. Developing proficiency in these practices takes time and requires deliberate resource allocation.

- Digitalization seems an important enabler of circularity and, by extension, CBMs – this is underscored by category 2, organizational competency building, and is largely consistent with the so-called "twin-transition" logic. The synergy between digital and environmental transitions has been a focal point, emphasizing a collective capacity to reinforce each other. This dynamic relationship is especially significant when considering the European Green Deal, where digital technologies play a pivotal role in achieving environmental objectives. The concept of a "twin transition" aligns with this vision of framing two parallel movements: the "green transition" and the "digital transition". This approach seeks to combat the pressing climate crisis, advancing the goals of the Paris Agreement and the sustainable development goals of the UN. The use of digital technologies is integral to fostering a more inclusive and equitable future. Successfully managing these "twin transitions" is the linchpin for establishing a sustainable, just, and competitive future. A second concept emerges alongside this: the pivotal role of digitalization as an enabler of circularity and, by extension, CBMs (Tabares & Parida, 2023). In sum, these two concepts highlight the interconnectedness of digital and environmental transitions, emphasizing their capacity to enhance one another and underlining their indispensable role in steering us towards a sustainable and competitive future.

5.3 Beyond CBM barriers and practices: additional observations regarding CBMs in Swedish industrial firms

Our analysis of where Swedish industrial firms stand regarding CBMs has resulted in some additional observations that go beyond CBM barriers and practices. The most noteworthy of these observations are:

- The transition to a CBM changes an industrial firm internally. This goes without saying. But, when an industrial firm changes the ways it creates, delivers, and captures value, it will have profound implications for its organization, culture, and production technologies. This would appear to be a key reason why the transition to CBMs is slow moving and remains in the pilot/experimental phases.

- There is no such thing as a perfectly circular business model. A CBM is not either/or, 0 or 1. Across industrial firms, a CBM seems to be a question of circularness. Many Swedish industrial companies make deliberate use of resource strategies but fail to entirely close the loop. Instead, they gradually improve their resource efficiency and move along the continuum to becoming more circular in the way they do business.

- When Swedish industrial firms engage in CBM transformation, their old business model often co-exist in parallel with the new one. For example, they may continue with conventional product sales along with offering CBMs in the form of advanced service contracts. Therefore, they end up operating multiple business models.

- The transformation from a linear business model to a CBM seem to happen by imitation/mimicry rather than innovation. In practice, this means that Swedish industrial firms imitate rather than innovate from scratch (Frishammar & Parida, 2019). When imitating, the transformation often goes across CBM components and requires changes to two or more of them (value creation, value capture, and value delivery).

- There is frequently an endowment effect where a particular focal industrial firm overvalues its own resources and capabilities and underplays those of its partners (Frishammar & Parida, 2021). This seems particularly unfortunate given that a CBM often requires collaboration across firm boundaries.

5.4 What can policy do that Swedish industrial firms cannot do themselves?

To deliver on CBMs, our position is that Swedish industrial firms can do a lot without policy interventions. Indeed, they are strongly incentivized to do so for reasons of competitive advantage. The challenge to change largely linear business models into CBMs is – and should be – in their own hands. Broader policy initiatives, such as Sweden's climate act and climate policy framework, along with initiatives such as the EU circular economy action plan, already steer industrial firms in a more circular direction. That said, Swedish industrial firms account for large greenhouse gas emissions and negative externalities, which make the policy discussion relevant. Our analysis of CBMs in Swedish industrial firms does not lend itself to proposing specific policy mixes. However, to mitigate barriers and speed up practices and capabilities for CBMs, we identify three policy initiatives that are worthy of consideration.

- First, policy makers can use *economic transfers* to strengthen CBM development. This could include "in block" public support via R&D programs directly to industry, perhaps in combination with funding for industrial research. These economic instruments primarily influence the development and diffusion of CBMs from the supply side. Such programs could be organized under already existing initiatives from, for example, Vinnova, the Swedish Governmental Agency for Innovation Systems. Programs aimed in this direction could help "decode" and implement EU and domestic policy frameworks on sustainability.

- Second, economic transfers can be combined with so-called "soft instruments" (Borrás & Edquist, 2012) to stimulate partnerships that share costs, benefits, and risks. Here, an idea could be to use funds for so-called "network management" – that is to say, provide coordination of the emergent ecosystems of collaborating firms which are experimenting with CBMs.

- Third, our analysis reveals a noteworthy trend. Rather than undertaking radical transformation initiatives, many industrial firms adopt a strategy of "mimicry" as their gateway to CBMs. While this might seem counter-intuitive for a process rooted in innovation, it is nonetheless evident that business model imitation plays a substantial role (Frishammar & Parida, 2019). Numerous industrial firms opt for a strategy of benchmarking or studying instances of circular, sustainable, and innovative business models, either in their own industry or beyond. Notable examples such as the Rolls-Royce power-by-the-hour model is frequently cited. In this context, industry network actors (e.g., automation region, IUC) are pivotal in facilitating knowledge exchange between firms and industries. So, government-backed initiatives supporting knowledge-sharing events and workshops can help greatly in expediting the adoption of CBMs.

- In the realm of CBMs, global industrial collaboration is a promising avenue, yet it brings forth intricate challenges in the form of regulatory disparities, certification complexities, and standardization issues (highlighted in the 3.2. subsection under difficulty in developing external partner networks). To reduce these hurdles, embracing CE standardization and certification processes can be beneficial policy intervention. National and international CE standardization can streamline CBM implementation by harmonizing these requirements, simplifying compliance, and fostering cross-border industrial collaboration. For example, Swedish OEMs struggle to introduce second-life battery business models (CBM). As when old batteries need to be transported between international borders, they face high complex and unfavorable regulations related to recycled materials. Thus, we encourage policy makers to cooperate with industrial institutions, like Swedish Institute for Standards, to introduce CE specific standardization and certification, as this holds promise to positive influence CBM adaption.

Conclusions 6

In summary, the Swedish industrial landscape stands at a pivotal juncture in its journey towards CBMs. Despite the strong commitment to environmental sustainability, barriers to CBMs in the Swedish industrial context are formidable, primarily driven by the complexity and time-consuming nature of CBMs, which demand capabilities in areas such as co-creation, service delivery, and innovative revenue models. The majority of CBM practices undertaken by Swedish industrial firms remain in the early, experimental phase, with limited quantifiable evidence of significantly improved resource efficiency. The slow scaling process, often one customer at a time, underscores the need for patience and consideration of the international dimension.

While the transition to CBMs profoundly impacts industrial firms internally, it is imperative to note that there is no one-size-fits-all circular business model. Many companies progress incrementally along the circular continuum. Importantly, they often operate multiple business models concurrently, integrating the old with the new. This transformation often involves imitation of successful CBMs by other firms, necessitating changes in multiple components of CBMs. Yet, the endowment effect frequently causes firms to undervalue their partners' resources and capabilities. As for policy implications, Swedish industrial firms are already incentivized to move towards CBMs due to the potential competitive advantage. Furthermore, broader policies such as Sweden's climate framework and the EU's circular economy action plan are steering them in a more circular direction. However, targeted policy initiatives, such as economic transfers to support research and development and fostering partnerships to share costs and risks in CBM experimentation, can accelerate CBM development. These initiatives could decode complex sustainability policy frameworks and encourage the emergence of collaborative ecosystems in the pursuit of a more circular and sustainable industrial future. This paradoxical path towards CBMs signifies the intricate nature of the transition and the essential role of both industry and policy in shaping a more sustainable and circular industrial landscape in Sweden.

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In a world that is increasingly asking for more environmentally friendly and sustainable products and services, circular business models can offer firms a competitive advantage. However, shifting production towards greater circularity is a complex task, requiring that firms and ecosystems embrace not only technological, but also organizational and business model innovation. In *Circular business models - Where does Swedish industry stand?* authors Johan Frishammar and Vinit Parida offer advice on how firms can effectively and successfully move towards circularity.

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