

How can firms access bank finance for circular business model innovation?

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Abstract

Access to bank finance has emerged as a key challenge for firms engaged in circular business model innovation (circular BMI), both in practice and in the academic literature. Through interviews, focus groups and archival documents, we document the experience of firms accessing finance for circular BMI and assess bank willingness to lend to firms that engage in circular BMI. Our findings offer potential strategies for firms who look for external (bank) finance to realise circular BMI. Using a case study-based theory-refining approach, we identify three core strategies that firms can use to obtain bank finance for circular BMI. First, firms can signal future cash flow expectations by aiming to secure customer contracts and preorders. Second, relationship building with banks, suppliers and customers improves the banks' risk perception of firms. Third, firms can design standardised, long-lasting circular assets that can serve as bank collateral, especially once secondary markets develop, overcoming the difficulty of lending based on innovative, firm-specific assets.

KEYWORDS

bank finance, circular business model innovation, circular business models, circular economy, innovation finance

1 | INTRODUCTION

Business model innovation (BMI) allows firms to maintain their competitive advantage in the market place under changing circumstances (Chesbrough, 2010; Teece, 2010; Wirtz et al., 2016). Research into BMI is fuelled by an urgent need for companies to deal with worldwide environmental challenges by adjusting their operations in line with a circular economy, while at the same time capturing value for themselves (Hall & Wagner, 2012; Rauter et al., 2017; Vermunt et al., 2019). A circular economy represents a shift towards an economic system that is restorative and regenerative, calling for a 'superior design of materials, products, systems, and, within this, business models' (MacArthur, 2013). Firms engage in circular BMI to adjust their value propositions, operations and value capture strategies towards circular economic principles.

A crucial and well-known constraint of circular and sustainable innovation is the acquisition of (external) finance (Demirel & Danisman, 2019; Kirchherr et al., 2018; Polzin, 2017), especially for small and medium-sized enterprises (SMEs) and young firms (Demirel & Parris, 2015; Henry et al., 2020). Credit constraints arise primarily from informational opaqueness between the firm and its potential financiers, moral hazard issues and high transaction costs (e.g., Cosh et al., 2009; Myers & Majluf, 1984; Stiglitz & Weiss, 1981). A lack of collateral and of a financial track record, problems inherent to intangible R&D investments, aggravate these constraints (Brancati, 2015; Cincera & Santos, 2015; Mina et al., 2013). In addition, high technological risk (Linder & Williander, 2017), slower scalability and correspondingly long payback periods (Demirel et al., 2017; Kenney & Hargadon, 2012) render such businesses particularly unattractive for a range of financiers. Although access to external finance is recognised

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in the business model literature as an important challenge for sustainable/circular BMI, there has been no structured effort to analyse how to improve access to external finance for circular BMI.

In this paper, we ‘jumpstart’ our academic understanding of the relationship between circular BMI and finance (Aranda-Usón et al., 2019; Demirel & Danisman, 2019; Kirchherr et al., 2018). In particular, we focus on the role of banks in providing external finance for circular BMI, building on the innovation finance literature in this field (Brancati, 2015; Demirel & Parris, 2015) and noting the importance of bank funding for firms, in particular SMEs (de la Torre et al., 2010; European Commission, 2014; Giudici & Paleari, 2000). Our qualitative research approach allows us to collect fine-grained insights into bank loan decision making that are otherwise difficult to access. We study the current practice of bank finance for circular BMI to address the research question: *How can firms strategise to obtain bank finance for circular BMI?*

This paper contributes to the recent discussion in the circular business model literature (e.g., Ferasso et al., 2020; Vermunt et al., 2019) a fine-grained empirical understanding of how different business model components can facilitate access to bank finance for circular BMI. Most importantly, we show that access to bank lending for circular firms is not restricted to an evaluation of the ‘value capture’ part of a business model, but that value proposition and value delivery components, such as market offering, customers and resources, can also facilitate a positive bank lending decision for circular BMI. We formulate three key strategies for firms to access bank lending.

The remainder of this paper is structured as follows. The theoretical framework provides an overview of the BMI literature, with a focus on circular BMI, as well as a categorisation of lending technologies used by banks to evaluate business loans. Section 3 describes our case study methodology. In Section 4, we present our findings and elaborate on the role of business model components in the bank credit decision; our findings are discussed in Section 5.

2 | THEORETICAL BACKGROUND

2.1 | Circular BMI: Types and business model components

Firms commercialise new ideas and products through their business model but also innovate the business model itself to stay competitive in the market place (Chesbrough, 2010; Foss & Saebi, 2017). BMI that addresses environmental and social challenges is being addressed under two main headings: *sustainable* business models (e.g., Bocken et al., 2014; Schaltegger et al., 2016) and *circular* business models (see Ferasso et al., 2020, for a review; Murray et al., 2017). In this paper, and in line with the context of this special issue (Fraccascia et al., 2019), we focus on the subset of *circular* business models. A circular business model contrasts with a linear business model, in which value creation is based on a virgin material flow that is manufactured,

consumed and deposited as ‘waste’ (Perey et al., 2018). In a circular business model, ‘value creation is based on utilising economic value retained in products after use in the production of new offerings’ (Linder & Willander, 2017, p. 183). In its essence, a circular business model should allow a firm to decouple its operations from virgin resource consumption (Esposito et al., 2018). We distinguish three different product phases in which companies can innovate to move towards a circular business model: the pre-use, use and post-use phases (Achterberg et al., 2016; Bocken et al., 2016).

Particular attention has been given to the *components* of a business model that can be affected during the innovation process (Osterwalder et al., 2005; Teece, 2010). On the basis of existing classifications, we define three main business model parts and their subordinate business model components (Bocken et al., 2014; Wirtz et al., 2016). First, the value proposition describes the market offering of the company. Second, value creation and delivery include four business model components: strategy, resources, network (partners) and target customers. Third, the value capture component includes revenues and costs.

We systematically describe how business model components are organised in linear and (different types of) circular business models (see Table 1 for an overview). In the *preuse* or design and manufacturing phase, products are designed, developed and manufactured to increase longevity and/or ease of maintenance, repair, upgrades, refurbishment, remanufacturing or recycling in order to narrow resource loops (Achterberg et al., 2016; Bocken et al., 2016; Vermunt et al., 2019). This affects the *resources* used in the business model: materials are developed and/or sourced according to a set of criteria, such as renewables, bio-based, low resource intensiveness or full recyclability (Achterberg et al., 2016; Bocken et al., 2014; Lewandowski, 2016). The *market offering* of the firm will be affected by the objectives of reducing waste at a product's end of life and/or extending its lifespan through more durable design and altered resource uses that narrow, close or slow resource loops (Bocken et al., 2016). Target *customers* may be affected because they will be asked to take on different roles in relation to products (for example sharing instead of owning) and may need to become more engaged with the production process, the company behind it and the symbolic values that are embedded in both, such as frugality (Sijtsema et al., 2020). Creating a competitive advantage for the partners in the ecosystem (value chain *network*) proves challenging in general (Brown et al., 2020; Clarysse et al., 2014). *Costs* arise due to investments in the (re-)design of a circular product (R&D), as well as the cost of renewable or durable materials. *Revenues* may be affected if the customer base is changed or grown from scratch and depends on the pricing strategy.

When carrying out circular BMI during the *in-use* phase of a product, shifting from a ‘sales’ approach to a Product-Service System (PSS) is a common strategy (Kunz et al., 2018; Tukker, 2015). Circular BMI in relation to a PSS entails a shift from a value proposition based on offering a product towards offering the result or function of the product (Ceschin, 2013; Tukker, 2015; Vermunt et al., 2019). Services such as repair and maintenance, upgrades,

TABLE 1 Generic vs. circular business model innovation (in different phases) described at component level (framework based on Bocken et al., 2014; Linder & Williander, 2017; Wirtz et al., 2016)

Business model/ business model components (1–7)	Value creation and delivery			Value capture			
	Value proposition Market offering	Strategy	Resources	Network	Customers	Revenues	Costs
Generic (linear)	Product or service	Create company value added/serving a market	Tangible and intangible assets	Mostly unidirectional (selling), limited interaction	Linear relationship, selling point, limited after sales	For the firm (economic value), sales oriented	Materials, labor
Pre-use (narrowing resource loops through design and manufacturing)	Longevity, reparability, re-usability of product, high price, product category restriction	Serving a market, lowering resource dependency, solving resource depletion and facilitating resource recovery	Tangible assets, designed for longevity and/or modularity and/or recyclability	Mostly unidirectional (selling), long-term customer relationship, partner restrictions	Linear relationship, more focused customer segments	Higher prices, longer time between sales due to durable product/material, possible service revenue	Higher upfront costs for design and manufacture of durable materials/components/products
Use (slowing resource loops through services encouraging longevity and reuse)	Integrated product and service solution, product category restriction	Serving a market and increasing useful life of product and/or number of customers using the same product	Combination of intangible assets (services) with tangible assets (not necessarily sold or owned)	Bidirectional, partner restrictions, large customer network/ economies of scale for sharing platforms	Relationship over lifetime, more focused customer segments	Services, solutions, long-term regular cash flow from contracts and fees	Labour, high upfront investment for products, ICT investment for sharing platforms and/or monitoring
Post-use (closing loops by capturing by-products and 'waste')	Recycled materials, refurbished products, higher residual value, product category restriction	Serving a market and solving a waste problem	Tangible assets, recycling technologies	Bidirectional, partner restrictions	Closing the loop, possibly customer restrictions	Revenue from recapture of used materials/components/products	Lower costs due to use of recycled materials; higher costs due to collection and/or refurbishment/recycling

extensions or extended support are added to the value proposition to increase the product lifecycle. This ownership shift creates a financial incentive for the firm to invest in longevity and re-use of products and materials (Bocken et al., 2014; Tukker, 2004). It also entails tying up large amounts of capital, leading to a shift of financial risk from the customer to the firm (Linder & Williander, 2017; Vermunt et al., 2019). Increased contract length can lower this risk but may lead to a less attractive customer value proposition (Besch, 2005). Moreover, *cost* and *revenue* uncertainty are high compared to the investments required (Linder & Williander, 2017). Mont et al. (2006) note that the shift from a sales to a service model leads to higher expected profits but delays incoming *revenue*, creating an external finance need. This in turn affects *costs* (high upfront investment costs and a long payback period). Other circular BMI approaches during the *in-use* phase involve sharing platforms to enhance product productivity and lifetime extension through repairs or upgrades (Achterberg et al., 2016; Bocken et al., 2014; Lewandowski, 2016). Circular BMI during the *in-use* phase also affects the *value proposition* and *strategy*: it involves setting up an integrated product-service solution and increasing customer engagement/retention, as well as intensive use of specific partner *networks* to deliver such an integrated product-service offering.

Circular BMI in the *post-use* phase increases the added value of a product at the end of its lifecycle (Perey et al., 2018). Revenue is generated by recapturing and refurbishing products or components, recycling or second-hand sales (Achterberg et al., 2016; Bocken et al., 2014; Lewandowski, 2016). This process requires an accessible take-back programme (e.g., through sell/buyback agreements) and technological expertise. Some products may not be suitable for this type of business model, such as fast-moving consumer goods (Linder & Williander, 2017). BMI in the *post-use* phase may affect the *value proposition* and the *customer base* if the recovered products, components or materials lead to alternative, non-virgin material use (Perey et al., 2018). Recovering materials as input for a new value proposition requires building unique supplier and logistical *networks* (Vermunt et al., 2019). Furthermore, the *cost* structure depends less on material costs (since 'waste' is the input) and more on refurbishing and/or recycling costs, which can require high upfront investments in infrastructure (e.g., a refurbishing plant) or logistics (Perey et al., 2018). *Revenue* can be affected depending on whether the value proposition and the target customer are altered by the marketing of recycled material, components or products.

Circular BMI often takes place in several phases simultaneously (pre-, in- and post-use). Regardless of its locus, the economic viability of circular BMI depends on the ability of the focal firm to capture the value that is created (Frishammar & Parida, 2019). In a circular context, this comprises selling at a higher price and/or lower cost, or long-term engagement with customers and/or supply chain partners, through product-service systems (*in-use* phase) or buyback agreements (*in-use* and *post-use* phases), for example (Bocken et al., 2014; Frishammar & Parida, 2019; Lewandowski, 2016).

2.2 | Bank finance for circular BMI

Firms, especially SMEs and start-ups, rely on external sources of finance to fund investments in innovation (Berger & Udell, 1998). Bank credit represents the major share of external finance for SMEs in Europe and over 80% in the Netherlands (DNB, 2015; European Commission, 2014). Green and circular SMEs are no exception in this respect: 30% of SMEs engaging in circular innovation rely on debt (Demirel & Danisman, 2019).

The strategies of innovative circular firms are high risk; the majority of innovations fail due to existing externalities and high-carbon technology lock-in (Demirel & Danisman, 2019; Kirchherr et al., 2018; Polzin, 2017). High expenditures on wages and salaries, uncertainty about the outcome of the investment and intangible capital creation in the form of tacit knowledge of employees create financing constraints for innovative activities (Hall, 2010; Linder & Williander, 2017). Arguably, this uncertainty of return at the project level is particularly problematic for SMEs because they cannot build an innovation portfolio in the way that large firms can (Lee et al., 2015; Vermunt et al., 2019) and they lack historical cash flow data (Hall et al., 2016). Innovative green/circular firms invest in intangible (R&D) and tangible firm-specific assets (*resources*), whose context-specificity makes them difficult to use as collateral (Brancati, 2015; Cincera & Santos, 2015; Mina et al., 2013). Even when R&D investments are registered as patents, their salvage value is likely to be low if the firm goes bankrupt (Hall, 2010). In addition, slower scalability and correspondingly long payback periods give them a particular financing profile (Demirel et al., 2017; Kenney & Hargadon, 2012).

Banks employ different methodologies for extending credit, referred to as lending technologies (Berger & Black, 2011; Berger & Udell, 2006), to reduce credit/default risk (Angilella & Mazzù, 2015; Chaibi & Ftiti, 2015). We group different lending technologies into cash flow-based, asset-based and relationship-based lending technologies. In practice, lending technologies will often be combined (e.g., a relationship banker will ask for collateral and will want to see the firm's financial statements) but differences in the primary lending technique can affect credit decisions because each assesses different aspects of a firm's operations. We briefly describe each group of lending technologies below. Table 2 maps each business model component to its relevance for banks per lending technology.

2.2.1 | Cash flow-based lending

Banks deploy *financial statement analysis* when audited financial statements (*revenues* and *costs*) are available as a primary information source upon which funding decisions can be based. Cash flow-based lending (financial statement lending) for innovation is challenging for banks due to their lack of a track record (Hall & Lerner, 2010). When audited financial statements are not available, banks can still assess cash flows through *credit scoring*. Credit

TABLE 2 Theoretical relationship between business model components and lending technologies

Business model components	Value proposition		Value creation and delivery			Value capture	
	Market offering	Strategy	Resources	Network	Customers	Revenues	Costs
Cash flow-based	•				•	•	•
<ul style="list-style-type: none"> • Financial statement lending • Client contracts • Credit scoring 							
Asset-based	•		•			•	
<ul style="list-style-type: none"> • Fixed asset lending • Inventory • Personal assets • Leasing 							
Relationship-based	•	•	•	•	•	•	•

scoring uses automated procedures to screen an entrepreneur's personal financial information, together with the available data on the firm itself, to determine credibility; it is often used for (opaque) small businesses (Berger & Frame, 2007; Frame et al., 2001). Big data increases the potential of credit scoring (Mayer-Schönberger & Cukier, 2013). If past cash flows and/or credit scores are not available or insufficient for lending, banks can extend a loan based on secured future cash flows in the form of accounts receivable, in particular client contracts, which are a crucial part of circular PSS business models. Hence, both the *customer* of the business model and the terms of the client contract (the *value proposition*) affect a cash flow-based bank lending process.

2.2.2 | Asset-based lending

In asset-based lending, banks value the physical assets of an enterprise (owner) as a basis for the lending decision. *Fixed-asset lending* uses the physical assets of an enterprise that are not sold in the course of business, such as real estate, equipment or vehicles, as collateral for the loan (Berger & Udell, 2006). The asset is often uniquely identified and the size of the loan depends on its liquidation or market value, with repayment tied to its depreciation. In *leasing*, asset ownership is transferred to the bank for the duration of the loan, often with a buyback construction at the end of the contract (Chemmanur & Yan, 2000; Hendel & Lizzeri, 2002). With *asset-based lending*, working capital loans are provided on the basis of the current value of assets used in the course of business, such as inventory. All asset-based lending technologies focus on tangible *resources* in the business model, creating room for an enterprise to obtain finance even when the value capture of the enterprise (*revenues*) does not yet allow for this. However, the value of the asset depends on its ability to generate *revenues* outside the specific firm as well. Asset-based lending for innovative projects is difficult for banks because the context-specificity of assets leads to an uncertain market value (Lee et al., 2015; Mina et al., 2013).

2.2.3 | Relationship-based lending

In relationship-based lending, the lending decision is undertaken primarily on proprietary information known only to the bank and the borrower (Boot, 2000). The financier takes a long-term perspective in its lending decision, benefiting over time in multiple lending decisions from the information gathered (Petersen & Rajan, 1994). The loan is monitored through continued contact and observation of firm performance, adopting a holistic approach that encompasses all business model components. Relationship lending allows banks to provide additional services, similar to a venture capitalist or business angel, such as market intelligence and access to customers and other stakeholders crucial for the firm's sector expertise and success (Berger & Udell, 1998). Relationship lending is associated with small, opaque and/or innovative firms due to the use of 'soft' information, which is particularly valuable if hard information about track record, assets or cash flows are lacking (Brancati, 2015). Strong relationships between banks and firms increase banks' willingness to take risks/lend for innovation since potential default costs are spread out over a longer period of client earnings (Brancati, 2015; Jiménez & Saurina, 2004; Petersen & Rajan, 1994). In addition, relationships can lower the collateral requested by banks (Berger & Udell, 1995). It can be difficult for young, innovative firms to build up a strong banking relationship if they require major capital injections early in their existence.

While our literature review presents a rich empirical base regarding bank lending technologies and financing constraints faced by innovative firms, this literature does not comprehensively explain how firms engaged in circular BMI can strategise to access bank finance. We address this research gap in the current paper.

3 | METHODOLOGY

We employ a case study-based theory-refining approach to understand the decision making of banks regarding lending to firms engaged in circular BMI. Building on analytical frameworks from the BMI and

lending technologies literatures, we focus on the actual lending decision as the unit of analysis (Flyvbjerg, 2011; Yin, 2014). This fits well with the process-oriented nature of the underlying research question, the aim of building additional theory (Suddaby, 2006) and the limited accessibility for researchers of companies and financiers (especially on the lending decisions of banks) via instruments that are more quantitatively oriented (Bettis et al., 2015; Eisenhardt, 1989).

3.1 | Research context

The research reported here was conducted as part of two research projects executed between 2015 and 2017. The first project was commissioned by the Nederland Circulair! Consortium and financed by the Dutch Ministry of Infrastructure and Environment. This project analysed the financing barriers experienced by firms that were innovating towards business models for circularity, matching them with financiers to (potentially) provide finance. In collaboration with this project, four focus groups were carried out at banks to understand the challenges they experienced in financing circular BMI. The second project, financed by Stichting Management Studies, aimed to uncover enablers for circular BMI—including access to finance—on the basis of a qualitative analysis of 30 firms, ranging from start-ups to multinationals, all active in the Netherlands.

3.2 | Case selection

To unravel the mechanisms underlying a credit decision and thereby answer our research question, we used purposeful theoretical sampling (Eisenhardt, 1989; Sigelkow, 2007), including companies engaged in circular BMI as well as banks. The use of multiple cases allows us to ground the research empirically and to generate a sufficiently complex theory (Eisenhardt, 1989). To observe actual financing decisions in the companies, we applied an information-oriented selection (Flyvbjerg, 2011; Seawright & Gerring, 2008). We collected evidence from SMEs, start-ups and established firms, selected to represent the three different product phases in which circular BMI

can occur: *pre-use*, *in-use* and *post-use* (Achterberg & van Tilburg, 2016; Bocken et al., 2014; Evans et al., 2017). The firms operate in a variety of different sectors, such as consumer electronics, the built environment, chemicals/plastics, textiles and shared mobility (for a full classification of sectors per interviewed firm, see Table I1). With the exception of one water company, these firms deal with technical (as opposed to biological) cycles, at different levels of complexity.

We focused on banks in particular due to their important role in providing corporate finance (European Commission, 2014; Mina et al., 2013) and financing the transition to a more sustainable, long-term efficient economy (Campiglio, 2016). The Netherlands is a particularly interesting case study because it possesses one of the most developed bank-oriented financial sectors in the world (DNB, 2015). In addition, Dutch banks have expressed both individual and joint commitment to financing the circular economy (ABN AMRO, 2015; ING, 2015; MVO Nederland, 2016; Rabobank, 2015), which also made them accessible for academic purposes. We contacted representatives from all major banks active in business banking in the Netherlands. The four largest players in business banking agreed to cooperate with our study, representing a 61.4% of market share (DNB, 2015). Both sustainability-oriented banks and as generic commercial banks were included, increasing the transferability of our findings.

3.3 | Data collection

Data collection encompassed three distinctive elements to allow for data triangulation (see Figure 1 for an overview) (Gibbert et al., 2008; Patton, 2002 Yin, 2014). First, we used archival documents from all the organisations as well as additional stakeholders, such as think tanks and NGOs, to pinpoint the most relevant characteristics of circular business models and their financing challenges. From the banks, we obtained confidential archival documents, such as documentation about companies and credit assessment process documents.

Second, we conducted 36 interviews with company representatives (32) and bank employees (4). They lasted 1–2 h and were recorded and transcribed verbatim. Tables H1 and I1 contain a full

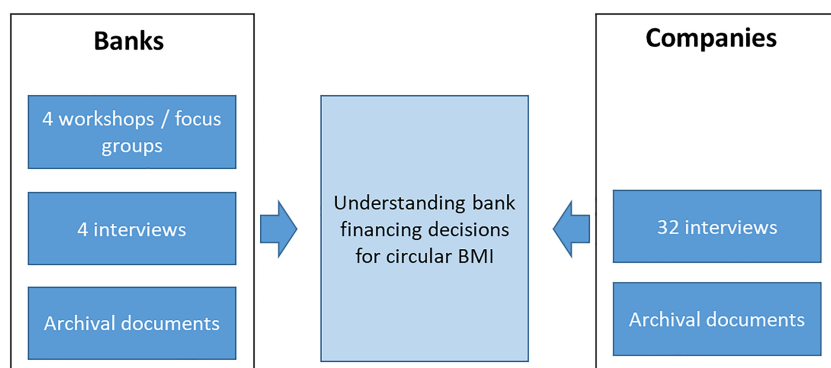


FIGURE 1 Overview of data collection sources [Colour figure can be viewed at wileyonlinelibrary.com]

(anonymised) list of interviewees from banks and firms. For each firm, an interview took place that focused on the circular business activities they had or were developing, including questions about whether they experienced a financing need and whether they applied for bank credit. If so, we asked follow-up questions about the amount, the bank that financed them and why they were financed. If they did not receive credit, we asked why the bank rejected their application or what prerequisites they were asked for in order to obtain credit in the future. If they did not apply for bank credit, we asked about their experience with other types of finance requested and/or received. In this way, we collected evidence about financing challenges and solutions for firms that implement circular business models in the pre-use (7), in-use (13) or post-use (10) phases, including evidence on real loan applications where relevant. At least two researchers were present at each interview; one person from the author team was accompanied by a trained researcher from the project teams, interviewing according to a clear interview protocol.

For each bank, representatives involved in firm credit decisions were interviewed. These included experienced bankers with sustainability, commercial and legal backgrounds, such as loan officers and sector managers, as well as legal department, risk management and front office (commercial) staff. The interviews addressed concrete challenges and opportunities that bank employees encountered in credit decision processes with firms engaged in circular BMI.

Third, the author team organised four focus groups, one with each participating bank (Geissler & Zinkhan, 1998; Greenbaum, 1998). These lasted 2–4 hours and included a representative sample from each bank's credit committee (6–20 participants). During the focus group, the challenges and opportunities of financing specific firms engaged in circular BMI were discussed. The focus groups were recorded and transcribed verbatim. Transcripts were sent to participants to verify accuracy (Vuori & Huy, 2016). We asked questions regarding their experience with credit applications at their bank related to circular BMI and their credit decision-making process (lending technologies) in general.

To prepare for each focus group, together with our bank contact person, we selected two representative companies that had recently been looking for credit to finance a circular BMI. During the focus group, we used these two representative cases to ask each bank to explain their credit decision making. We elaborated on the challenges, opportunities and (potential) solutions of financing these enterprises. Finally, we aimed to understand what lending technologies each bank used to extend credit (cash flow, assets, relationships).

Characteristic shortcomings of focus group-based research—such as participants publicly agreeing to views of the group despite private disagreement, and limited data validity due to the formation of a consensus view in group interaction—have in past research been mitigated by creating a private space/atmosphere for open exchanges and by encouraging the discussion of different views (Geissler & Zinkhan, 1998; Greenbaum, 1998). The focus group methodology increased the willingness of banks to participate in our research because they perceived it to be a learning experience.

Through a combination of insights from archival documents, interviews and focus groups with representatives from the banks involved in the credit decision, feedback was obtained on banks' ability and willingness to finance certain circular companies, which we related to their BMI (Moran-Ellis et al., 2006).

3.4 | Data analysis

Corresponding to the theory-refining approach, data analysis followed an abductive procedure (Dougherty, 2002; Mantere, 2008). We started with BMI components and bank lending techniques as an initial frame of reference (Suddaby, 2006) and made new linkages between the main theoretical concepts (theory building) by detecting patterns and matching them with the data. These steps involved a constant back and forth between theory and the collected data to ensure the internal validity of our study. To ensure reliability of analysis, a case study database was developed using NVivo, which allowed us to integrate the different data sources (archival documents, interview and focus group transcripts) and corresponding perspectives (Gibbert et al., 2008; Jick, 1979; Moran-Ellis et al., 2006).

Three researchers carried out the data analysis. At each focus group or interview, at least one researcher was absent to add an 'unbiased' view, ensuring inter-coder reliability and construct validity (Gibbert et al., 2008; Yin, 2014). We reflected our findings to a group of finance sector experts to verify and extend them (Finance working group, 2016). The findings from banks were anonymised during the process (Banks A–D are reported). We were able to include both sustainability-oriented and classic commercial banks in our analysis, which improved external validity. Although our findings are context-dependent (Flyvbjerg, 2011), the research contributes to a broader understanding of how firms can access bank finance for circular BMI.

Archival documents and interview and workshop transcripts were screened as bottom-up codes for central topics, such as factors in the decision-making process, to derive implications about the ways in which lending technologies are deployed and to derive differences in generic business models vs. innovative circular business models. The coding procedure¹ of archival documents, interviews and focus groups resulted in 1155 coded segments. We developed bottom-up codes from the insights on shifting to a circular business model, potential financing challenges and credit allocation processes at banks, and specific lending technologies or approaches that are consolidated under top-down codes (circular BMI/lending technologies) from our theoretical framework. This process of coding and revisiting our initial frame of reference developed over several rounds (Dougherty, 2002). The overlap between circular BMI codes and lending technology codes allowed us to establish an empirical link in a matrix structure (the main

¹The coding scheme is available from the authors upon request.

TABLE 3 Summary of empirical findings explaining the relationship between circular BMI and lending technologies

Lending technologies		Cash-flow based				
		Past	Future	Asset-based	Relationship-based	
Value proposition	Market offering	-	Terms of client contract affect security of incoming cash flows, expected higher profits through better value management	Standardized/modular product improves value of collateral	Circularity screening due to bank values	
	Value delivery	Strategy	-	Gradual transition from linear to circular, existing (linear) cash flows secure circular cash flows	Developing long-term marketable products improves collateral value	Finance existing bank clients who carry out CBMI as part of business
Value capture	Resources	Tangible	-	-	Long-term asset values depend on market value, specificity, moveability and competitors	-
		Intangible	-	Commitment of entrepreneur needed to secure cash flows	-	Expertise, quality and 'fit' of entrepreneur is screened
	Customers	-	Signed and creditworthy customer contracts signal robust future cash flows	Targeting larger (B2B) customers lowers dispersion, creates scale and eases collateral collection	Having committed, pre-ordering customers indicates demand	
	Network	Joint ventures with large supply chain partners provide robust balance sheet	-	-	Buyback constructions with product supplier lowers risk for a bank.	Embeddedness in networks improves CBMI relevance and support by bank
Value capture	Revenues	Historical cash flow data available for CBMI within existing firms or JV's	Optimized contract terms and customer portfolio, and logic of business case signal robust cash flows	Size and diversity of contract portfolio i.r.t. asset value and expected 'stick rate' signal revenues	Existing, large clients are more likely to get a CBMI loan due to additional revenue expectations	
	Costs	-	Often high upfront investment costs; expectations of future cash flows determine bank loan willingness	Lower depreciation and repair costs and 'just-in-time' stock make financing more attractive	-	

findings are shown in Table 3; key quotes within this matrix are reported in Tables A1 to F1.

4 | FINDINGS

To answer our research question in a systematic way, we report how bank finance for circular BMI is affected per business model component and for each lending technology. A matrix summary of all findings (BM components for each lending technology) is reported in Table 3. The circular BMI components and their financing challenges

are illustrated with quotes from firms and banks (Tables A1–F1). The quotes refer to documents as well as workshop participants and interviewees from banks and circular BMI firms and are listed (anonymously) in Tables H1 and I1.

4.1 | Value proposition

The *value proposition (or market offering)* plays an important role in bank finance for circular BMI, regardless of the lending technologies used. At the sustainability-oriented bank, lending is oriented

specifically at circular and sustainable businesses; therefore, the value proposition is screened carefully to confirm that the business activity matches the bank's values. Mainstream banks instead want to develop capacity with their account managers to understand and recognise the value proposition of circular BMI; they expect a circular business to become profitable in the long term due to increasing environmental challenges and consequent changes in regulation, prices and customer demand.

The value proposition embodied in circular BMI affects the lending decision through expectations of higher levels of value creation and capture, based on the logic that circular business models lead to optimal value/resource management. Both banks and firms express their belief that the quality and longevity of circular product design and manufacturing (*pre-use* phase) will increase the value of a business over the product's lifetime. The value proposition needs to be adjusted due to this increased lifespan, enabling engagement with the product throughout its lifecycle: in a product-service model or through a buyback construction with supply chain partners or end users. The benefit of the increased value of the product can be shared between the producer and the consumer to make both the market offering and the revenue model competitive. However, we also note that bank interest in the value proposition does not automatically translate into a positive lending decision. Banks state that proof of market potential (*customers*) for this market offering is needed.

The conditions of the client contracts that are offered in a product-service model (*in-use* phase) comprise a crucial aspect of the assessment of the value proposition of firms. These conditions embody the market offering to the client in terms of the services, costs and flexibility of opting out of the product after a certain time. Contract conditions, in particular duration and opt-out clauses, affect the perceived riskiness of future cash flows (*future revenues*). Banks are used to lending on the basis of contracts with the same duration as the economic lifetime of the underlying asset, offering secure future cash flows. In circular BMI, however, assets are expected to produce cash flows in multiple, consecutive client contracts. While future cash flows are likely to be higher than for linear products due to the longer useful life, such consecutive contracts yet to be signed. The ratio between the first, signed contract and the upfront investment in the underlying asset is therefore crucial for the lending decision. Similarly, when the market offering includes a buyback construction (with the firm/producer, in the *post-use* phase), the expected future value of the asset at the end of its first use needs to be assessed and compared with the buyback price, so as not to pose a high future risk.

Besides the contract structure, the product characteristics of the market offering can affect access to bank finance. Products offered to the market that have a long lifetime *and* are standardised or modular (e.g., in terms of size, colour and material) are more marketable, including in a second or third round of use. For asset-based lending in particular, product characteristics embedded in the marketing offering play an important role.

4.2 | Value creation and delivery

4.2.1 | Strategy

Banks seem to be more willing to finance circular BMI when existing, established clients strategise to shift gradually from linear business to circular business because it gives them access to established cash flows from the existing business that de-risk their loans for circular BMI. By contrast, bank interviewees mention that circular initiatives set up by start-ups are unlikely to get financed, and neither are initiatives of established businesses that are not existing clients of the bank. Phased transition from a linear to a circular business model (e.g., by using or combining existing/proven production processes) is therefore a lending-enhancing strategy available only to established firms with an existing bank relationship or those aiming to obtain a bank relationship. However, we do find some evidence of start-up firms that strategise to access bank loans by drawing upon proven production processes to deliver an innovative circular product, thus lowering perceived risks.

4.2.2 | Resources

The most important *tangible* resources for a bank loan are a firm's assets, such as real estate, machines or the assets/inventory that are brought to market (e.g., washing machines or smartphones). The importance for banks of the underlying asset is mentioned for firms carrying out product-service BMI (*in-use* phase) in particular, since their assets remain on the firms' balance sheets. Our findings suggest that using tangible 'circular' assets as a basis for a lending decision leads to several challenges. First, circular assets are often innovative, which leads to a lack of historical data signalling their long-term value, making it difficult for banks to lend on the basis of past cash flows. Some firms find that active online second-hand product markets can increase expected future asset value by providing actual market values. This is only possible for products that have existed for a while.

Second, the underlying assets in circular BMI often suffer from the following characteristics that lower their ability to serve as collateral:

- a. Specificity—an elevator tailor-made for a building cannot be re-used at the product level.
- b. Illiquidity—a carpet glued in a building, for example, makes re-use difficult.
- c. Dispersion—washing machines situated at individual consumer homes make collateral collection costly.
- d. Low capital goods—smartphones or clothing are goods with inherently low collateral value.
- e. Longevity—there is a maturity mismatch because banks prefer loan durations of 5–7 years whereas firms with long-lived assets need financing for up to 20 years.

Since these characteristics affect the suitability of assets as collateral, adjusting these characteristics in the product design phase can help firms to obtain a bank loan. One electronics firm designed its lighting solutions so that they can be easily removed from a building. Removable, standardised carpet tiles have a higher residual value than tailor-made glued carpets. An elevator producer created a materials passport so that at the end of an elevator's lifetime it can be valued at a material level. Dispersion could be addressed by terminating the underlying service in case the customer is not fulfilling their payment obligation, illustrated by washing machines and smartphones.

Third, *availability of parties who could take over the assets as a (part of another) running business* was mentioned as a financing issue in relation to tangible resources. The underlying assets are worth more to a bank if they can be sold to other players in the same field (competitors or producers) that are willing to buy them. Selling a client portfolio to a competitor retains more value than selling underlying assets separately, because client contracts can be continued.

Intangible resources, that is, *the quality and commitment of the entrepreneur*, are an important factor for both relationship-based and (future) cash flow-based lending. One bank mentioned that it puts a lot of effort into judging the quality of the entrepreneur by looking at their skills and relevant experience and judging whether the team is effective. The bank also judges whether the entrepreneur 'fits' with the business they intend to carry out.

4.2.3 | Customers

The customers targeted by circular firms affect a bank's lending decisions in two ways. First, having *signed customer contracts* is an important signal for (future) cash flow-based lending. Both enterprises and banks recognise signed customer contracts (both B2B and B2C) as a positive factor in obtaining a bank loan. A firm that upcycles used car tyres (*post-use* phase) secured order confirmations from clients who had tested their product, which helped them obtain a bank loan to build a factory. Similarly, a plastics re-use firm (*post-use* phase), mentioned that the reluctance of clients to place orders before having the production facility in place was a key reason for their failure to obtain a bank loan to finance their factory. At a B2C level, customers can also affect access to bank finance *when customers display willingness to pre-order* their product, such as through a reward crowdfunding campaign. Customer commitment to pay in advance for a circular smartphone through reward crowdfunding positively affected the bank lending decision, as a signal of market demand.

It is not only important that a firm can show it has customers; banks indicate that they also screen for the *credit quality of customers* who have committed to buying/leasing a product. Banks assess the robustness of this future cash flow; if customers do not pay, a loan may default. However, screening the credit quality of clients can be costly, and banks indicate that it either needs to be done in an automated way or is only viable for large deals/clients. Banks also express a preference for B2B customers in general, stemming from the fact that these often represent longer contractual periods and larger

volumes; the collection of collateral in case of default is also easier. However, development of the credit scoring intelligence of B2C clients could be a potential business development undertaken by banks that improves firm and bank screening procedures for contracts and lending, respectively.

4.2.4 | Networks

Networks and partnerships play a role in obtaining bank credit in several ways. First, we find that *partnerships/collaboration in the supply chain*, in particular with larger firms, lower the risks for banks. Shared ownership of underlying resources organised in the supply chain, such as through a joint venture, enables the inclusion of a larger balance sheet in risk assessment, which lowers risk. The commitment of partners helps to secure supplies and bring to market a successful innovative product. Since circular business models in particular require supply chain collaboration to deliver on the promise of a circular value proposition, dedicated networks increase the chances of success. Relatedly, *buyback constructions with a supplier* can increase the underlying asset value for the bank, facilitating asset-based lending. In the case of one enterprise (washing machine leasing), this suggestion in one of the bank focus groups was later implemented to facilitate a successful debt crowdfunding campaign. Third, evidence of *embeddedness* of a firm within a (local) community or network lowers the perceived risk of default. A firm that is well embedded in a community is less likely to suffer from withdrawal of funds, customers and (local government) support. This was mentioned as a crucial factor in the credit decision-making process of a relationship-based bank in our sample.

4.3 | Value capture

4.3.1 | Revenues

Proof of ability to generate *revenues* is deemed crucial by all banks and enterprises for a positive credit decision. The absence of robust historical revenue data, as included in standard financial models, is recognised as a key challenge for financing circular BMI. In addition, circular BMI towards a product-service model (*in-use* phase) creates delayed revenues, extending the financing gap. Two main ways to overcome lack of past revenue data for circular BMI emerged from our data. First, BMI within a larger firm benefits from an *existing track record from other business lines*, which can facilitate a bank loan for circular BMI. Sometimes, the bank has an incentive to nurture or start a long-term relationship with an established firm that carries out circular BMI.

The reliability of (future) revenues can also be improved by *structuring client contracts to optimise future cash flows*. A longer duration of contracts and a costly opt-out clause can lower the risk for banks that cash flows will not materialise. Moreover, improved data on the percentage of customers that terminate their contract in each time

period (the 'stick rate' of customers) can improve the reliability of future cash flows. Confirmed or expected orders from clients are viewed as proof of future cash flows, particularly if a customer is large and creditworthy.

We found that many banks—and large firms that fund circular BMI internally—are more willing to fund a certain type of circular BMI when they believe in the *'logic' of the business case and its potential to create revenue*; it increases their willingness to take risks. We observe this in particular in the shift from a for-sales to a product-service business model (*in-use* phase): there is a general agreement that a product-service model allows firms to capture more value from a circular (long-lasting) product than a sales model is able to capture from a linear product.

The expected revenue captured from the first client is important; this is 'secure' revenue that has already been contracted. Since circular assets often do not yet have secondary markets (and therefore residual values), the revenue-generating capacity of assets depends on the asset value that is recovered within an existing contract, including the 'stick rate' of the client.

Costs

Finally, costs affect the credit decision when *high upfront investment* costs for circular BMI lead to large loan sizes in relation to expected revenue, increasing the duration and perceived riskiness of the loan (for infrastructural investments like factories to make products from circular materials and product-service models alike). The high upfront investment cost of shifting from a for-sales to a product-service business proposition is seen as an important funding constraint, even though banks agree that this model is attractive in the long term (steady cash flows from lasting customer relationships based on durable products). Circular BMI in the *post-use* phase (processing of products, components and materials for re-use) often requires large infrastructural investments, particularly to carry out large-scale processing in factories. Banks focus on market, technological and operational risks and demand proof of market feasibility and scalability.

Firms perceive the longer lifetime of assets to be financially attractive due to the lower yearly *depreciation costs* of assets. However, for banks, the willingness to spread out depreciation over a longer time period depends on the residual value that financiers are willing to account for, and this often depends on the duration and flexibility of contracts. In general, firms that finance their innovation internally show a higher willingness to depreciate assets over a long period than banks do. Firms also mention that *lower repair costs* due to smart, modular and/or durable design and proactive repair and maintenance make the business case for a product-service model financially attractive.

Finally, *just-in-time asset holding* lowers financing costs for product-service BMI (*in-use* phase), because it prevents asset-heavy balance sheets. Bank employees suggest that a preferred strategy from a financing perspective is to only hold (and finance) those assets on the balance sheet that are already contracted out to clients (and thus delivering revenues straight away).

5 | DISCUSSION AND CONCLUSION

Obtaining (bank) finance for circular BMI carried out by firms is of strategic importance for individual companies and is identified as a key challenge for a transition towards a circular economy by both academics and practitioners (Ferasso et al., 2020; MVO Nederland, 2016; Vermunt et al., 2019). By improving our understanding of the ways in which firms can obtain bank finance for circular BMI, this paper addresses a key barrier to the transition to a new industrial era based on a circular economy (Esposito et al., 2018). We also show how setting up a circular business model can be made less risky (Ferasso et al., 2020) in order to facilitate bank finance.

Our research highlights that finance for circular BMI is a key challenge, according to both banks and firms. By combining a lending technology (Berger & Udell, 2006) and business model component perspective (Wirtz et al., 2016), we use a qualitative empirical approach to show that successful bank finance for circular BMI can be facilitated through three strategies.

5.1 | Strategy 1: Proving future cash flows by securing consumer commitment

Banks prefer to extend finance on the basis of robust historical cash flow data (Hall et al., 2016), which we confirm to be generally lacking in the case of circular BMI. Furthermore, the delay of incoming cash flows in the shift from a for-sales to a product-service model (*in-use* phase) is seen by banks to be problematic in the short term (Aranda-Usón et al., 2019). Established firms are able to gradually develop a circular market offering alongside their established business (Frishammar & Parida, 2019), allowing them to show historical cash flow data based on existing *revenues*. We also see smaller firms that build strong *networks* in their value chain, spanning the pre-, in- and post-use phases, by, for example, setting up joint ventures with established firms to 'piggyback' onto their balance sheet.

However, in most cases of circular BMI, historical cash flows are lacking. The key strategy that firms undertake (and banks look for) is 'proof' of *future* cash flows, primarily in the form of contracts and pre-orders from *customers* (both B2C and B2B). Signed contracts and (pre-)orders from *customers* are seen by banks as useful signals of future cash flows (*revenues*): banks assess the size, quality, expected growth and 'stick rate' of customer contracts in relation to the financing need. The relevance of signed client contracts for financing circular BMI in the *in-use* phase confirms earlier findings in the product-service-system literature (Linder & Williander, 2017); our evidence shows that this also holds for circular BMI in the *pre-use* and *post-use* phases, including in a B2B context. The banks in our study offer two specific suggestions to firms to improve their future cash flow data: First, lengthening contractual terms (adjusting the *market offering* in the *in-use* phase) to make cash flows more secure for financiers; and second, requesting increased commitment from customers (Besch, 2005) and increasing (insight into) the quality of their

customers by, for example, by tracking their credit scores, payment data and stick rates. Both suggestions increase the value of consumer commitments, providing a robust signal for future revenues and value capture.

5.2 | Strategy 2: Relationship building in the value chain with banks, suppliers and customers

The second key strategy for firms engaged in circular BMI is relationship building with suppliers, banks and consumers. The importance of relationship building, collaborations and networks along the value chain for successfully delivering a circular value proposition has been described in the circular business model literature (Brown et al., 2020; Ferasso et al., 2020; Veleva & Bodkin, 2018) but it has not yet been recognised as a facilitator of access to (bank) finance. This is an important contribution because relationships (*networks*) enable finance both directly and indirectly.

Access to finance can be facilitated directly through relationship building with banks (for lending) and customers (for crowdfunding). Indirectly, strong *networks* in the value chain are a risk reduction strategy for circular businesses, a previously underexplored topic (Ferasso et al., 2020). Value chain *networks* increase the likelihood of the successful delivery of a circular *market offering*, and risks are shared between actors in the supply chain. In this way, banks increase their trust in the ability of a firm to deliver on its circular promises. This is the case for firms innovating in the *pre-*, *in-* and *post-use* phases alike.

We find several different approaches to relationship building for finance. First, during the *in-use* phase, firms can build up a *consumer* community to lower market risk for banks, through a crowdfunding campaign, by offering free services or by building a network among early adaptors (Veleva & Bodkin, 2018). In particular, a successful (reward or financial) crowdfunding campaign can provide a strong signal to a bank regarding market appetite, and allows for risk sharing with other financiers. Second, firms can collaborate with key suppliers through, for example, joint ventures or buyback guarantees (across phases). This helps firms to deliver their *market offering* and lowers execution risk from the perspective of banks because risks are shared in the supply chain. Third, identifying market players/competitors that could potentially take over the business in case of default may also help obtain a bank loan since a going business/concern is worth more than its liquidation value. While the literature on collaboration among circular businesses highlights the importance of supplier relationships for creating new circular business opportunities (Brown et al., 2020), our evidence that firm-supplier and firm-consumer relationships can facilitate bank finance for circular BMI is novel, offering new strategies for firm managers aiming to secure external finance. While these strategies may also work for regular (non-circular) innovations, they are particularly well suited to circular BMI, which embodies a 'supply chain promise' and requires long-term relationships with customers to deliver services, buybacks and guarantees.

5.3 | Strategy 3: Designing long-lasting, standardised circular assets as collateral for banks

A final strategy is to standardise the circular asset at a product, component or material level to increase its long-term market value (Vermunt et al., 2019), which can be captured through product-service models, buyback guarantees or sales on secondary markets. This strategy originates in the *pre-use* phase of product design to slow resource loops in the *in-use* and *post-use* phases. In this way, the increased, durable value embedded in the (tangible) *resources* of a circular firm can be used to secure a (partly) collateralised bank loan. We conclude that, from the perspective of serving as collateral for a bank loan, circular assets provide both an opportunity and a risk, in contrast to established, linear assets (Perey et al., 2018). Circular assets are designed to be long-lasting at a product, component and/or material level, which potentially makes them valuable as collateral for a bank loan, as in more established (leasing) markets for cars and printers. We find some evidence of secondary market value for standardised, long-lasting circular assets that are already established. At the same time, (innovative) circular assets are often firm- and context-specific (Brown et al., 2020), with no proven secondary market value, which lowers their suitability as collateral from a bank's perspective. This signals two opportunities that may facilitate asset-based lending for circular BMI. First, if circular assets are designed in such a way that products, modules and materials are increasingly standardised and transparent (i.e. using a materials passport), this broadens opportunities for re-use, increasing long-term asset values (Kirchherr et al., 2018) and therefore potential to serve as collateral. Second, the development of asset-based bank lending for circular BMI may simply take time: it can gradually be facilitated by the development of a track record and secondary markets for circular assets (components and materials), as well as government regulation that stipulates re-use instead of waste (Kunz et al., 2018), increasing the value of used assets (Nußholz et al., 2019).

5.4 | Beyond value capture: Deploying business model components to facilitate bank finance

Intuitively, one might try to address financing barriers through the value capture (revenues and costs) components of a business model. However, the three strategies identified here reveal that a focus on value capture alone will not do the job. Usually, historical cash flows (in particular *revenues*) are lacking, so value capture cannot be 'proven'. Therefore, other business model components, such as market offering, customers, resources and networks, can be strategically deployed to convince banks to provide loans for circular BMI. Our evidence shows the richness of approaches that can be taken by firms to realise a positive lending decision, building on these business model components.

Across strategies 1 and 2, *customers* play a key role because they are asked to display increased commitment to a firm's circular product or service (compared to one-off sales). This confirms the existing literature on circular business that stipulates an increasingly active role for

customers in a circular economy (Fischer & Pascucci, 2017; Sijtsema et al., 2020). Customers can help circular firms to access bank loans by committing to longer contractual periods, by being early adaptors and by providing financial resources through (reward or financial) crowdfunding. Building up a dedicated customer community is therefore a crucial strategy for circular firms to obtain finance, affirming the importance of understanding how to improve consumer awareness and attitudes towards circular products and services (Ghisellini et al., 2016; Hazen et al., 2017).

The *market offering*—both product and service—plays an important role across strategies 1 and 3 because product and contract conditions can be designed to lower banks' perceived risk of the firm. Circular product and service design can affect risk perception and therefore access to financing, and can thus be added as an additional product/service design objective. In particular, product design strategies (*pre-use* phase) targeted at 'slowing resource loops' (Bocken et al., 2016) fit well with an asset-based bank lending strategy, since these design strategies aim for long-lasting products. For example, design for 'reliability and durability' and 'standardization and compatibility' (Bocken et al., 2016, p. 311) are design strategies to slow resource loops that would directly improve a product's suitability as collateral. Furthermore, contract/service terms also affect the financeability of a circular business model from the perspective of a bank. In PSS models (*in-use* phase) in particular, the terms of the contract formalises the relationship and risk sharing between the producer and customer (Reim et al., 2015), and should establish incentives to reduce risky behaviour and preferably aim for long contract durations. This, again, requires commitment on the side of the *customer*, which can be challenging (Besch, 2005). However, the more risk/commitment taken up by the customer, the more attractive it is for a bank to finance the producing firm.

5.5 | Conclusion

Our study contributes to the emerging realm of empirical studies on circular business models in the strategic management literature that identify access to external finance as a key barrier for circular BMI (Aranda-Usón et al., 2019; Demirel & Danisman, 2019; Vermunt et al., 2019). On the basis of our analysis at the business model component level, we provide three concrete financing strategies for circular BMI: (1) Signalling future cash flows through customer contracts and pre-orders to reduce uncertainty surrounding innovative circular business models (Frishammar & Parida, 2019; Linder & Williander, 2017); (2) Building relationships with banks, suppliers and customers to construct a financeable value proposition and delivery, affirming prior literature on value chain cooperation (Brown et al., 2020; Veleva & Bodkin, 2018); and (3) enabling asset-based lending for circular BMI through standardisation/modularity (Kirchherr et al., 2018) and the creation of secondary markets to allow for better pricing of the residual value of circular assets for banks.

These strategies show that in order to design a financeable circular business model, firms need to think carefully about their *market*

offering (i.e. contract and asset design), they need to engage their *customers* beyond their traditional passive role and they need to build strong *networks* with their value chain and financiers. These strategies can counter the high investment risk that banks (and other financiers) face, increasing firms' chances of accessing financial resources.

While our study is carried out in the Dutch context, our findings are generalisable to other developed countries where circular BMI takes place, although some caution is advised. The uptake of a circular economy has spread to policymakers and firms in developed nations worldwide (Murray et al., 2017) but the structure and role of the banking sector can differ substantially by country. The Netherlands has a highly developed bank-based financial system (DNB, 2015), whereas Anglo-Saxon countries rely more on equity finance. The lending technologies that banks rely on will also affect the applicability of the three strategies in other contexts: for example, in Germany, many smaller banks exist that engage in relationship banking (favouring strategy 2) whereas, worldwide, technology and the integration of markets are driving bank lending towards being increasingly transaction-based (Rajan, 2006), favouring strategies 1 and 3.

On the basis of our findings, policymakers can support the attractiveness of financing circular CMI by, for example, the implementation of regulations that stimulate the re-use of materials; this would improve the risk perception of a circular market offering and would make circular assets more valuable as collateral. For example, Kunz et al. (2018) present a study outlining Extended Producer Responsibility, in which producers become responsible for the collection and recycling of waste related to their own products. Furthermore, policymakers could require certain levels of standardisation, modularity and compatibility for the products and components in industries, increasing their potential as bank collateral.

As a follow-up to our qualitative empirical study, a key direction that future research might take is to build a database of successful and unsuccessful credit applications by firms for circular BMI, including the reasons for each outcome. This would allow for monitoring (over time) of the financing constraints (and strategies) of circular BMI. Another important research goal would be to understand how the development of waste regulation and secondary markets may drive the long-term market value of circular assets to enable bank finance. Furthermore, it would be worthwhile to track innovative financing arrangements established within the supply chains of circular products, keeping an eye out for best practices that can be upscaled across circular industries. At a higher conceptual level, this work provides insights into decision making and uncertainty in the context of sustainable corporate finance, a research field that can be extended after this study.

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APPENDIX A

TABLE A1 Importance of the value proposition (market offering) BM component per lending technology

Lending technology	Cash flows (future)	Assets	Relationships
Value proposition (market offering)	Terms of client contracts (duration, opt-out clause), in product-service BMI affect perceived risk level of future cash flows.	Level of standardization/modularity of market offering and underlying product affects its marketability in multiple rounds of use (and therefore lowers risk as collateral).	Value proposition is assessed on circularity/sustainability due to values and expected profitability.
Key quotes	'From a financial point of view this is a hard one. For example, a wind turbine. At least you want an offtake time of 5–10 years. Here it [the contract duration] is only 3 months. Your robustness of your cash flow is very low. [...] A newcomer could take all your customers, which makes it hard to finance.'—Head of Commercial Banking, Bank B3, workshop	'You can take the building apart in components or sell it in parts. Every part has a different residual value. Instead of a residual value of 0 or 1 (it is rented out or not) there is now a whole array of value propositions which makes the risk for the bank smaller.'—Director Sustainable Banking, Bank D1, interview	'Through conversations with many stakeholders we saw that the sustainability of a building is becoming a more dominant factor in its rentability. Investing in this is a future-based strategy to make sure our portfolio is robust.'—Director Sustainable Banking, Bank D1, interview

TABLE B1 Importance of the strategy BM component per lending technology

Lending technology	Cash flows	Assets	Relationships
Strategy	Through gradual transition of firms from linear to circular, cash flows can be secured by existing (linear) cash flows from existing business units.	Strategizing to develop products that can be brought to market for many years affects its marketability in multiple rounds of use (and therefore lowers risk as collateral).	Phased transition by established firms, from linear to circular, in line with their existing strategy with an existing bank relationship is lending enhancing
Key quotes	'You believe in the solution. [...] It was a strategic decision of the client to stay in the same industry. [...] You are not too concerned about assets or contracts. You look at the debtor and what is happening.' Sector banker public banking, Bank D4, workshop	'The most circular product is one that you do not adjust, which can be used for very long in its current form. [...] In the pay-per-use construction the residual value increases if you take a <i>white</i> desk. We want to stimulate that because we can circulate it more easily. So, you can design products in such a way that they are timeless.' Office Furniture firm, CEO AA1	'Who is our client and what is their relationship with our bank: existing or new, and why are they shifting banks?' Bank D, credit documents 'Many of our clients [...] are making a phased transition to a circular business model. In particular the good clients who we have known for ages, who now realize they want to become circular, we are right in the in-between phase at the moment.' Senior Sustainable Business Strategist, Bank A1, workshop

TABLE C1 Importance of the tangible and intangible resources BM component per lending technology

Lending technology	Assets	Cash flow (future)	Relationships
(Tangible and intangible) resources	[Tangible] The higher expected residual value of assets used in circular BMI in contrast to linear BMI can lower depreciation costs for firms and increase duration of cash flows. (1) Assets underlying in BMI are often novel, leading to a lack of historical data on their long-term/residual value. Banks do not easily include the long-term value as a security in a bank loan because of the uncertainty that this value will be captured (no second-hand contracts and no secondary markets). Long-lived assets need longer loan durations, which is a challenge for banks. (2) Assets are often costly to collect and therefore not deemed suitable as collateral. (3) The availability of other market players that can take over the assets as part of a running business affects the riskiness of using these assets as collateral (and the value that banks are able to place on them). As an alternative route, firms can lease key business assets (vehicles, equipment) from banks to alleviate financing constraints.	[Intangible] Commitment of the entrepreneur to the business is needed to secure future cash flows.	[Intangible] The expertise, quality, 'fit' and track record of the entrepreneur and, if relevant, the team.
Key quotes	<p>'When, in closed supply chains, the residual value of products increases, the basis for a loan improves' Circular Economy Guide, bank D</p> <p>'[...] banks get stuck on financing these kinds of models. It is about a fixed asset with a period of minimum of 20 years. They are allergic for that, because it needs to fit with a period of 5–7 years and it needs to be mobile to serve as collateral. These are the tensions.' Sales manager elevator firm, AC1</p> <p>'[...] what on earth do we do with 10,000 washing machines? [...] We cannot go selling them one by one and store them somewhere. So, the residual value for a bank is much lower, since we are not specialized in selling 10,000 washing machines. Is there a market for the residual value?' Head of Commercial Banking, Bank B3, workshop</p> <p>'[...] All that is fixed to a building, loses directly its value. In a lease construction you need collateral, thus residual value. 'Flooring as a service' obviously has no residual value. [...] The bank helped us and calculated based on residual value of resources.' Director</p>	<p>'There is a client, but if the contracts are withdrawn, someone needs to take care that a new client is found for the machine, that payments come in every month, that someone carries out this whole operation. So, people say: what if you stop, that risk is too large. Then the washing machines are standing there and if no-one will collect the fees, how will I ever get my loan back?' Founder washing service provider, Z1</p>	<p>'If there is one factor that would be most important to lend or not to lend, it is the quality of the entrepreneur or the combination of people who are running a business. [...] If the entrepreneur does not understand what he is doing, there is no way we are going to finance him.' Managing Director, Bank B4, workshop</p> <p>'[...] Not everyone has a team in which everyone has over 30 years of experience and two Harvard MBAs, which played a role in succeeding to attract a bank loan.'— CEO Car Tyre upcycler, K1</p>

TABLE C1 (Continued)

Lending technology	Assets	Cash flow (future)	Relationships
	sustainability, office furniture firm AE1 'That is exactly the core risk of the re-marketing, the ability to bring the asset to the market again, which is unknown and new. A bank is not going to take that risk.' Director Sustainable Finance, Bank C1, workshop		
Lending technology	Cash flow (future)	Relationships	
Intangible resources	Commitment of the entrepreneur to the business is needed to secure future cash flows.	The expertise, quality, 'fit' and track record of the entrepreneur and, if relevant, the team.	
Key quotes	'There is a client, but if the contracts are withdrawn, someone needs to take care that a new client is found for the machine, that payments come in every month, that someone carries out this whole operation. So, people say: what if you stop, that risk is too large. Then the washing machines are standing there and if no-one will collect the fees, how will I ever get my loan back?' Founder washing service provider, Z1	'If there is one factor that would be most important to lend or not to lend, it is the quality of the entrepreneur or the combination of people who are running a business. [...] If the entrepreneur does not understand what he is doing, there is no way we are going to finance him.' Managing Director, Bank B4, workshop '[...] Not everyone has a team in which everyone has over 30 years of experience and two Harvard MBAs, which played a role in succeeding to attract a bank loan.'—CEO Car Tyre upcycler, K1	

TABLE D1 Importance of customer BM component per lending technology

Lending technology	Cash flow (future)	Assets	Relationships
Customers	(1) Having signed contracts with customers. (2) The creditworthiness of clients targeted in a business model affects the perceived robustness of future cash flows.	Targeting B2B customers can lead to larger volumes thus less dispersion, easing collection of collateral in case of default.	Having committed, pre-ordering customers indicates market demand
Key quotes	'The bankability of circular business models in many cases requires the acceptance of 'contractual comfort' instead of the right of legal ownership over assets in case things go wrong. Secondly, it requires a more cash flow based approach to finance rather than an approach based on collateral values.' Bank C, documentation '[...] one of our challenges is to get clients to commit for future procurement. [...] Without market demand we cannot scale. [...] But without scale, clients will not commit. And without committed clients we cannot attract funding for building the factory.' CEO Plastics recovery, H1	'A carpet producer creates value from returning materials. But this is not value for the financier. For Fairphones/ Iphones: if you receive enough back from the market you get 50-100 Euro per phone. As long as you get enough volume (10.000's) you can send them to the refurbisher. With those volumes that is possible. With carpet that is not the case.' Vice president large & key accounts A19, bank A workshop	'[...] we had many test reports from large clients that tested our product who stated that 'if that factory will be built, we want to become a client'. [...] this helped to mitigate market risk.' Car Tyre upcycler, CEO K1 '[...] the commitment from pre-paying customers was mentioned as a factor in the positive lending decision'. Fairphone, resource efficiency manager G1

TABLE E1 Importance of the networks BM component per lending technology

Lending technology	Cash flow (past)	Assets	Relationships
Network	Joint venture (shared balance sheet) with established supply chain partners can lower risk for the bank.	Buyback constructions with the supplier of the product brought to market can increase asset values (lower risk) for a bank.	(1) Embeddedness of a firm in networks indicate business proposition relevance to others (2) involve relevant parties (in and outside the bank) at early stage of loan request.
Key quotes	<p>'[...] we set up a joint venture with an existing party, who had a balance sheet' CEO, Car Tyre Upcycler, K1</p> <p>'Define the extended credit base: all other parties whose financial health is a prerequisite for repayment of our loan. These need to be included in the analysis.' Bank D, internal credit document</p>	'I think there is an elementary role for Miele [washing machine producer] in the financing, it is key that there is a buyback obligation from Miele against a certain price. That would improve the financeability [of a washing machine provider] substantially.' Relationship manager corporate banking, Bank A18, workshop	<p>'I think what we did especially well—and this is quite extraordinary, especially at banks—is that we involved all people internally in the bank (about 30) in a very early stage.' CEO, Car Tyre Upcycler K1</p> <p>'Projects or institutions which are important to the community or local government may be supported if they run into financial problems thus lowering the probability of default.' Bank B, credit policy document</p>

TABLE F1 Importance of the revenues BM component per lending technology

Lending technology	Cash-flow (past)	Cash-flow (future)	Assets	Relationships
Revenue	Banks prefer to have historical cash flow data but this is often not available for BMI. Joint ventures with supply chain partners and BMI with (in) existing firms alleviate this challenge.	(1) Optimizing contract terms and customer portfolio signal robust and predictable cash flows. 2) Belief in the revenue-generating capacity of a particular type of BMI.	Lack of secondary markets makes BMI residual values insecure. It is important what part of the asset value is recovered within an existing contract, and expected 'stick rate' of the assets after the contract ends.	Banks are more willing to invest in BMI for an existing client or a large potential client than non-clients and/or small firms because it is more likely to create additional business/revenues.
Key quote	'The process of the bank is filling in the model by historical facts. For new business models there is no historical data. For those data you have to look into the future (or into the entrepreneur).' Sustainable Business Manager, Bank A2, interview	'In the first conversation with the bank they told me, you do not exist for two years, period. I came back after two years, but then I did not have a track record in cash flows. After two years of track record of cash flows, I again returned, and then was told: 'Sure you now have this track record, but you have no secured cash flows for the future.' Founder Washing Service Provider, Z1	'Residual value is fictive, after five years there is no market. [...]. Two things are important: (1) strong clients and (2) do I get the assets back in the first place? We say: 'they bet on the stick rate'—after five years these assets are still in there.' Office Lighting, Head of financial sourcing, in workshop Bank D	'We will never finance an individual firm that arranges all its banking business elsewhere. [...] And the smaller the firm the stronger is that rule. If it is, for example, Apple, we might see what we can do.' Director Sustainable Banking, Bank D1, interview

TABLE G1 Importance of the costs BM component per lending technology

Lending technology	Cash flow (future)	Assets
Costs	(1) BMI takes time to prove itself, which makes it costly and difficult to finance upfront. (2) In a product-service business model, growth will entail high upfront investment costs. Long-term costs are expected to be more stable due to efficient maintenance. (3) Lower financing costs can be reached by pre-financing only assets that are <i>actually</i> set out to customers.	Lower depreciation and repair costs in a product-service model make financing of this type of BMI more attractive.
Key quote	<i>'Why would Bundles buy in 200 washing machines? Why not buy in stock-based, directly from Miele.[...] It creates a more focused and smaller financing need. Now you would finance 200 machines and already pay interest to the bank while you do not yet have 200 contracts signed.'</i> Assistent Accountmanager A15, bank A, workshop	<i>'We think there is a much healthier model with the leasing construction especially with a device which is so easy to repair. [...] When you would take 100 phones back from Unilever because they had the leasing contract, and 50 of those have a scratched screen, we need to change those, and for [our first smartphone] that would take 30 minutes. For [our second model] only 10 seconds, so that decreases the repair costs.'</i> Consumer Electronics, Resource Efficiency Manager G1

TABLE H1 List of interviewees/workshop participants at banks (face-to-face) (49)

Code	Role	Date	Interviewers	Workshop/interview
A1	Senior sustainable business strategist	Dec 2015	3	Interview
		Sep 2016	2	Workshop
A2	Sustainable business manager	Dec 2015	3	Interview
A3	Account manager	Sep 2016	2	Workshop
A4	Account manager	Sep 2016	2	Workshop
A5	Innovation manager	Sep 2016	2	Workshop
A6	Innovation manager	Sep 2016	2	Workshop
A7	Asset manager	Sep 2016	2	Workshop
A8	Account manager	Sep 2016	2	Workshop
A9	Financial specialist	Sep 2016	2	Workshop
A10	Marketing manager	Sep 2016	2	Workshop
A11	Account manager	Sep 2016	2	Workshop
A12	Account manager	Sep 2016	2	Workshop
A13	Sustainability program manager	Sep 2016	2	Workshop
A14	Credit analyst	Sep 2016	2	Workshop
A15	Assistant account manager	Sep 2016	2	Workshop
A16	Young professional trainee	Sep 2016	2	Workshop
A17	Economist	Sep 2016	2	Workshop
A18	Relationship manager corporate banking	Sep 2016	2	Workshop
A19	Vice president large & key accounts	Sep 2016	2	Workshop
B1	Manager innovation lab	Jan 2016	2	Interview
		Feb 2016	2	Workshop
B2	Intern innovation lab	Jan 2016	2	Interview
		Feb 2016	2	Workshop

(Continues)

TABLE H1 (Continued)

Code	Role	Date	Interviewers	Workshop/interview
B3	Head of commercial banking	Feb 2016	2	Workshop
B4	Managing director	Feb 2016	2	Workshop
B5	Sector manager business banking	Feb 2016	4	Workshop
B6	Senior relationship manager SME banking	Feb 2016	4	Workshop
B7	Senior relationship manager SME banking	Feb 2016	4	Workshop
B8	Relationship manager SME banking	Feb 2016	4	Workshop
B9	Director operations, investment management	Feb 2016	4	Workshop
B10	Corporate Communication & Strategy Intern	Feb 2016	4	Workshop
B11	Controller investment management	Feb 2016	4	Workshop
C1	Director sustainable finance	Jan 2016	2	Interview
		Aug 2017	2	Workshop
C2	Director sustainable lending	Jan 2016	2	Interview
C3	Manager sustainable finance	Aug 2017	2	Workshop
C4	Senior risk manager	Aug 2017	2	Workshop
C5	Sector banker	Aug 2017	2	Workshop
D1	Director sustainable banking	Jan 2016	2	Interview
		Jun 2016	3	Workshop
D2	Head of sustainability corporate banking	Jan 2016	2	Interview
		Jun 2016	3	Workshop
D3	Sector banker industry	Jun 2016	3	Workshop
D4	Sector banker public banking	Jun 2016	3	Workshop
D5	Senior procurement consultant	Jun 2016	3	Workshop
D6	Director corporate lending	Jun 2016	3	Workshop
D7	Director Strategy & Business Development	Jun 2016	3	Workshop
D8	Procurement consultant	Jun 2016	3	Workshop
D9	Sector banker industry	Jun 2016	3	Workshop
D10	Head Real Estate Risk & Portfolio Management	Jun 2016	3	Workshop
D11	Sector banker construction	Jun 2016	3	Workshop
D12	Product manager maintenance corporate buildings	Jun 2016	3	Workshop
D13	Innovation manager	Jun 2016	3	Workshop
D14	Risk management	Jun 2016	3	Workshop

TABLE I1 List of face-to-face interviewees at firms (30 firms, 41 interviewees)

Code	Sector/type of firm interviewed	Role of employee interviewed	Date	# Interviewers
E1	Bed producer	Product development	Nov 2016	2
E2	Bed producer	Procurement	Nov 2016	2
F1	Chemical products	Manager circular economy	Oct 2016	2
G1	Consumer electronics	Resource efficiency manager	Nov 2016	2
H1	Plastics recovery	CEO	Dec 2017	2
I1	Building materials	Sustainability manager	Dec 2017	2
J1	Building materials	Public affairs	Oct 2016	2
K1	Car Tyre upcycler	CEO	Nov 2016	2
L1	Carpets	Sustainable development	Nov 2016	2
M1	Waste recovery	Directeur	Jan 2017	2
N1	Electronics recovery	Founder	Aug 2016	2
O1	Waste	CEO	Oct 2016	2
P1	Electronics	Sustainability manager	Dec 2016	2
P2	Electronics	Sustainability manager	Dec 2016	2
P3	Electronics	Business controller solutions financing	Jan 2017	2
Q1	Consumer electronics	Founder	Sep 2016	2
Q2	Consumer electronics	Founder	Sep 2016	2
R	Office furniture	General Directeur	Nov 2016	2
S1	Electronics	CEO	Nov 2016	3
S2	Electronics	Global head sustainability	Nov 2016	3
S3	Electronics	Director sustainability	Nov 2016	3
T1	Furniture	Founder	Jan 2017	2
U1	Car sharing	Business development manager	Mar 2017	2
V1	Sharing platform	Founder/CEO	Dec 2016	2
W1	Clothing resale platform	Founder/CEO	Oct 2016	2
X1	Car sharing firm	Country manager	Dec 2016	2
Y1	Bicycle renting	Sustainable business manager	Dec 2016	2
Z1	Washing service provider	Founder/CEO	Dec 2016	2
AA1	Office furniture	CEO	Feb 2017	2
AA2	Office furniture	Product design	Feb 2017	2
AA3	Office furniture	MVO	Feb 2017	2
AB1	Office furniture	Manager circularity	Nov 2016	2
AC1	Elevator firm	Sales manager	Mar 2017	2
AE1	Office furniture	Director sustainability	Jan 2017	2
AF1	Electronics	Head of financial sourcing ^a	Jun 2016	3
AF2	Electronics	Director sustainability	Feb 2017	2
AF3	Electronics	Head of Global Public & Government Affairs	Feb 2017	2
AG1	Building sector	Managing director	Mar 2017	2
AG2	Building sector	Marketing & sales	Mar 2017	2
AH1	Packaging	CEO	Aug 2016	2
AI1	Water sector	Strategic advisor	Nov 2016	2

^aThe head of financial sourcing of this firm (AF1) was not interviewed separately but participated in one of the bank workshops. We added him to the interview list to clarify that his input derived not from a bank, but from a firm. The firm was also interviewed at a later stage (employees AF2 + 3).