



Kaunas University of Technology

School of Economics and Business

Conceptual Model for the Digital Transformation of Incumbent SMEs' Business Models

Master's Final Degree Project

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Summary

Digital technologies, increasing competitive pressure from digital entrants and the deconstruction of value chains, and changing customer behavior drive the Digital Transformation (DT) of Business Models (BMs). Incumbent companies are forced to actively engage in Business Model Innovation (BMI) in order to sustain their competitive advantage. This is particularly relevant for small and medium enterprises (SMEs) who play an important structural role in many countries. In comparison to large companies, they lag behind regarding the DT of their BMs and the adoption of digital BMs.

Despite the increasing amount of studies dealing with the DT of BMs, two major research gaps exist, first with regard to incumbent SMEs, and second with regard to the relationship between strategic management and the DT of BMs. Last, but not least, there seems to be a lack of empirically validated practical models and frameworks for the DT of BMs, in particular for SMEs. Therefore, the **research aim** is to develop a conceptual model for the DT of incumbent SMEs' BMs.

Taking the high degree of fragmentation and construct unclarity in this research field into account, the **theoretical findings** include the identification of key drivers and a definition of the DT of the BM based on prior research. Furthermore, digital BMs are conceptualized and recent typologies and taxonomies are reviewed. Extant studies dealing with the DT of incumbent SMEs' BMs are analyzed. Together with a comparative analysis of models and frameworks for transforming BMs into digital BMs, they form the basis for the key theoretical contribution, that is a conceptual model for the DT of incumbent SMEs.

A **qualitative research methodology** is developed to analyze the applicability of the proposed conceptual model. Following a multiple case study approach, the building systems sector in Germany was selected as research context. Data was mainly collected through conducting semi-structured interviews and analyzed through a qualitative content analysis.

The **empirical findings** suggest that the conceptual model is applicable both for SMEs exploiting their existing BM and for those exploring a new digital BM. The additional contextual element of strategic leadership was identified in all cases and added to the conceptual model. Although some steps seem to be of higher relevance to incumbent SMEs pursuing a new digital BM, the conceptual model can also provide guidance at an early stage of the BMs' DT, for instance with regard to the strategic management of the DT of the BM. Based on the differences which were observed between the case companies, recommendations for the DT of the BM were derived depending on the degree of digital BMI and organizational focus.

The **final result** is a theoretically and empirically validated conceptual model for the DT of incumbent SMEs' BMs that extends prior research at the intersection of DT, BM and strategic management.

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Santrauka

Skaitmeninės technologijos, jų pasėkoje augantis konkurencinis rinkos spaudimas, vertės grandinių rekonstrukcija ir kintanti klientų elgsena skatina skaitmeninę verslo modelių transformaciją. Rinkoje įsitvirtinusių įmonių, siekdamas išlaikyti konkurencinį pranašumą, yra priverstos inovuoti, transformuojant savo verslo modelius. Tai ypač aktualu mažoms ir vidutinėms įmonėms, kurios vaidina svarbų struktūrinį vaidmenį daugelyje pasaulio šalių, taip pat ir Europos Sąjungoje. Palyginus su didelėmis įmonėmis, pastarosios atsilieka, kalbant tiek apie verslo modelių transformaciją, tiek ir apie skaitmeninių verslo modelių vystymą.

Nepaisant to, kad daugėja tyrimų, susijusių su skaitmenine verslo modelių transformacija, egzistuoja dvi didelės mokslinių tyrimų kryptys: pirma, tyrimai susiję su įsitvirtinusių mažų ir vidutinių įmonių problematika, ir, antra, tyrimai susiję su strateginio valdymo ir verslo modelių skaitmeninės transformacijos tarpusavio sąsajomis. Susidaro išpūdis, kad mokslinėje literatūroje stokojama empiriškai ištirtų sąsajų tarp verslo modelių ir skaitmeninės transformacijos sistemų bei sprendimų, ypač mažų ir vidutinių įmonių atveju. Todėl šio **tyrimo tikslas** - sukurti koncepcinį jau įsitvirtinusių mažų ir vidutinių įmonių verslo modelių skaitmeninės transformacijos modelį, apibendrinantį mokslinius tyrimus skaitmeninės transformacijos, verslo modelių ir strateginio valdymo sankirtoje.

Atsižvelgiant į didelį šios mokslinių tyrimų srities fragmentiškumą ir menką konstruktyvų ištyrimą, **teorinės išvados** visų pirma grindžiamos pagrindinių skaitmeninės transformacijos veiksmų identifikavimu bei verslo modelių skaitmeninės transformacijos apibrėžimu, kas užtikrina kuriamų naujų mokslo žinių sąsajas su ankstesniais mokslo tyrimais. Be to, teorinės analizės metu konceptualizuojami skaitmeniniai verslo modeliai bei apžvelgiamos naujausios jų tipologijos ir tendencijos. Toliau nuosekliai analizuojami ankstesni moksliniai tyrimai, kuriuose nagrinėjama įsitvirtinusių mažų ir vidutinių įmonių verslo modelių skaitmeninė transformacija. Kartu su verslo modelių skaitmeninės transformacijos ir sistemų lyginamąja analize, visa tai tampa pagrindu esminiam teoriniam šio darbo indėliui, t. y. koncepciniam įsitvirtinusių mažų ir vidutinių įmonių skaitmeninės transformacijos modeliui.

Siūlomo koncepcinio modelio pritaikomumui analizuoti parengta **kokybinio tyrimo metodika**. Taikant daugkartinio atvejo tyrimo metodą, tyrimo kontekstu pasirinktas Vokietijos pastatų sistemų sektorius. Duomenys surinkti atliekant pusiau struktūruotus interviu, o išanalizuoti taikant kokybinę turinio analizę.

Empirinio tyrimo išvados rodo, kad sudarytas koncepcinis modelis taikytinas mažose ir vidutinėse įmonėse, tiek transformuojant esamus verslo modelius, tiek ieškant naujų skaitmeninių verslo

modelių alternatyvų. Išanalizavus pasirinktus atvejus, taip pat nustatytas papildomas kontekstinis strateginės lyderystės elementas, kuris tyrimo pabaigoje taip pat įtraukiamas į koncepcinį modelį. Nors gali atrodyti, kad kai kurie modelio žingsniai aktualesni įsitvirtinusioms mažoms ir vidutinėms įmonėms, siekiančioms išvystyti naują skaitmeninį verslo modelį, visgi parengtas koncepcinis modelis taip pat sėkmingai taikytinas ankstyvajame verslo modelio skaitmeninės transformacijos etape, pavyzdžiui, kalbant apie strateginį verslo modelio skaitmeninės transformacijos valdymą. Remiantis skirtumais, kurie buvo pastebėti tarp ištirtų atvejų, priklausomai nuo skaitmeninių verslo modelio inovacijų laipsnio ir organizacinės orientacijos, skirtingo tipo įmonėms buvo parengtos verslo modelių skaitmeninės transformacijos rekomendacijos.

Galutinis darbo rezultatas – teoriškai argumentuotas ir empiriškai patikrintas koncepcinis įsitvirtinusių mažų ir vidutinių įmonių verslo modelių skaitmeninės transformacijos modelis, praplečiantis ankstesnius mokslinius tyrimus skaitmeninės transformacijos, verslo modelių ir strateginio valdymo sąsajų pagrindu.

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List of Abbreviations and Terms

Abbreviations:

AI – Artificial Intelligence;

B2B – Business-to-Business;

B2C – Business-to-Consumer;

BM – Business Model;

BMI – Business Model Innovation;

C2C – Consumer-to-Consumer;

CEO – Chief Executive Officer;

CTO – Chief Technology Officer;

DACH – Germany, Austria and Switzerland;

DESI – Digital Economy and Society Index;

DSR – Design Science Research;

DT – Digital Transformation;

EDI – Electronic Data Interchange;

ERP – Enterprise Resource Planning;

IC – Intellectual Capital;

ICT – Information and Communications Technology;

IoT – Internet of Things;

IS – Information Systems;

OECD – Organization for Economic Cooperation and Development;

OEM – Original Equipment Manufacturer;

PESTEL – Political, Economic, Sociological, Technological, Environmental and Legal

RBV – Resourced-based View;

SaaS – Software-as-a-Service;

SME – Small and Medium Enterprise;

SWOT – Strengths, Weaknesses, Opportunities and Threats;

VISOR – Value Proposition, Interface, Service Platform, Organizing Model and Revenue Model.

Terms:

Business Model – Describes the architecture of how a company creates, delivers and captures value (Teece, 2010).

Business Model Innovation – Deliberately making novel, non-trivial changes to key elements or to the architecture of the business model (Foss & Saebi, 2017).

Conceptual Model – A theoretically and empirically validated model of an approach that addresses both theorists and practitioners and conceptualizes and visualizes the context and relevant process steps related to a particular phenomenon.

Digitization – Converting analog into digital information (Verhoef et al., 2021).

Digitalization – Applying digital technologies to existing business processes to make them more efficient or to create higher customer value (Verhoef et al., 2021).

Digital Business Model – Describes the architecture of how a company operating in a digital ecosystem creates, delivers and captures value by digitalizing business processes, introducing digital products or services and applying data analytics on a digital platform it owns or complements (based on Teece (2010) and Ahmad et al. (2020)).

Digital Transformation (DT) of the Business Model (BM) – The DT of a company's BM is driven by digital technologies, increasing competitive pressure from digital entrants and the deconstruction of value chains, and changing customer behavior. Guided by the top management, fundamental changes to the company's existing BM or the adoption of a new BM result in the emergence of a digital BM which provides a source of sustained competitive advantage for the company.

Introduction

Digital technologies, changes in the competitive landscape and altered customer behavior drive the Digital Transformation (DT) of industries and companies, resulting in the emergence of digital Business Models (BMs) (Verhoef et al., 2021). Incumbent companies are forced to actively engage in Business Model Innovation (BMI) in order to sustain their competitive advantage in this new environment (Foss & Saebi, 2017).

Relevance:

The number of scientific publications dealing with both DT and BM increased steeply from 2015 onwards, reflecting the growing importance for society and economy alike and interest from the research community. However, there is a high degree of concept unclarity and fragmentation in the field of digital BMs and at the intersection of DT, BM and strategic management research. In particular, the link between DT and strategic management to this day remains under-researched (Rêgo et al. 2021). Another research gap exists with regard to small and medium enterprises (SMEs). While numerous studies have dealt with the BMs and BMI of large firms', limited research deals with the specific context of SMEs (Filser et al., 2021; Miller et al., 2021). Research on the DT of SMEs is mainly focused on models for evaluating digital readiness and maturity (Klohs & Sandkuhl, 2020). Similarly, research on the DT of SMEs' BMs is only emerging (Andersen et al., 2021). Last, but not least, there seems to be a lack of empirically validated practical models and frameworks, in particular for SMEs, who face the need to digitally transform their BM.

Problem Analysis:

Taking a look at the composition of the most valuable companies worldwide according to market valuation in the past 20 years, it is striking to notice how it changed. While tech companies such as Microsoft, Cisco, Intel and Nokia, and big oil corporates dominated in the late 1990s, in 2019, seven out of the top ten (Microsoft, Amazon, Apple, Alphabet, Facebook, Alibaba and Tencent, by order of market capitalization) companies were companies which have a digital BM in place (Desjardins, 2019). Nokia provides an example of an incumbent company whose linear pipeline BM was disrupted by the digital platform BM of a new entrant in its industry (Apple) (Linge, 2017; van Alstyne et al., 2016). The case of Nokia and Apple shows that the emergence of digital BMs poses a challenge, even threat, to incumbents regardless of their size. Best cases of successful transformations described in scientific or business literature mostly refer to start-ups or larger digital incumbents, alluding to what the Organization for Economic Cooperation and Development (OECD) (2021) refers to as a digital gap between established small and medium enterprises (SMEs) and other companies.

SMEs play an important structural role in many countries and contribute to the prosperity and stability of the global economy by creating jobs. Therefore, organizations such as the OECD urge policymakers to support the DT activities of this group of companies. Worldwide, SMEs provide more than two-thirds of employment (International Labour Organization, 2021). Around 90% of all businesses are SMEs (World Bank, 2021). In the EU, 99% of all businesses belong to the group of SMEs (European Commission, 2021a). Idiosyncratic characteristics such as agility and less hierarchy on the one hand and resource constraints and lack of capabilities on the other hand (Miller et al., 2021; Rosenbusch et al., 2011) influence SMEs' abilities to engage in digital BMI. Even within the group of SMEs, there is a high degree of heterogeneity. Company size (Heider et al., 2021) and ownership (Soluk & Kammerlander, 2021), for instance, have been found to play a role in the context of BMI and DT.

The EU has recognized the necessity to speed up the DT of SMEs' businesses in its "Digital Decade" program targeting the improvement of environmental factors such as building up the population's digital skills and specifically crafting instruments for SMEs, for example so-called digital innovation hubs (European Commission, 2021b, 2021c). The European Commission has also introduced the Digital Economy and Society Index (DESI) to measure digital performance and competitiveness across the EU. Among the member states of the EU, Germany does not belong to the high-performing countries regarding DT, only ranking 19th out of 27 states regarding the integration of digital technologies into businesses and e-commerce. The DESI furthermore recognizes the aforementioned digital gap between large companies and SMEs (European Commission, 2021a). In order to remain competitive, German companies – in particular incumbent SMEs – have to improve in this regard. All this leads to the question *how incumbent SMEs can digitally transform their BMs*.

Object of research: DT of incumbent SMEs' BMs

Research aim: To develop a conceptual model for the DT of incumbent SMEs' BMs

Research objectives:

1. To analyze the relevance of the DT of incumbent SMEs' BMs from a scientific, economic and political point of view and to establish an understanding of the DT of BMs and digital BMs based on prior research.
2. To propose a conceptual model for the DT of incumbent SMEs' BMs based on a review of extant studies in the context of SMEs and a comparative analysis of models and frameworks for the DT of BMs.
3. To develop a research methodology for validating the proposed conceptual model in incumbent SMEs from the building systems sector in Germany.
4. To empirically validate the conceptual model and provide recommendations for the DT of the BM of incumbent SMEs depending on the degree of digital BMI and organizational focus.

Research methodology and structure of the thesis:

This thesis is based on a qualitative research design. The problem analysis in chapter 1 illustrates the relevance of the research object and aim. In chapter 2, theoretical foundations of the key concepts are provided. The review of extant studies on the DT of incumbent SMEs' BMs and the comparative analysis of models and frameworks for the DT of BMs first lead to the identification of a research gap. Second, the results from the analysis are used to propose a conceptual model for the DT of incumbent SMEs' BMs.

All this provides the necessary theoretical grounding to apply a multiple case study method to validate the proposed conceptual model among German SMEs in the building systems sector. An interview guideline was prepared based on the theoretical findings and following the structure of the conceptual model. Data was collected through the conduction of four semi-structured interviews and through desk research to acquire secondary data. The software MAXQDA was used to perform a qualitative content analysis.

Based on the results of this analysis, recommendations for incumbent SMEs who want to digitally transform their BM are derived along two identified dimensions, the degree of digital BMI and organizational focus. The conceptual model is empirically validated. Theoretical and managerial implications, as well as limitations and avenues for future research are discussed. The conclusions reflect on the research objectives and the most important findings.

1. Problem Analysis of the Digital Transformation of SMEs' Business Models

Digital technologies are at the core of the digital economy, a term which has first been coined in the mid-1990s with the rise of the internet (Armstrong, 2020). They have had a profound influence on the world's society in the past twenty years and have the potential to positively as well as negatively impact the future (United Nations, 2021). Today, the digital economy can be understood as “that part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services” (Bukht & Heeks, 2017, p. 13).

Emerging digital technologies such as artificial intelligence (AI), blockchain or the Internet of Things are among the major drivers of Digital Transformation (DT), next to changes in the competitive landscape and altered consumer behavior. DT impacts the company's societal and business environment and has major implications for its organizational structures. Ultimately, DT results in the emergence of digital Business Models (BMs) (Vaska et al., 2021; Verhoef et al., 2021). This forces companies with existing BMs to engage in Business Model Innovation (BMI) to retain their competitive advantage (Foss & Saebi, 2017; Verhoef et al., 2021). Recently, DT of companies and industries has been accelerated by environmental factors such as COVID-19 (Almeida et al., 2020) and climate change, with the United Nations' Environmental Program identifying digital technologies as being key to achieving the Sustainable Development Goals by 2030 (UNEP, 2021).

1.1. Scientific and Business Relevance of the DT of Incumbents' BMs

The growing importance of DT and subsequent changes to the BMs of companies are also reflected in the increasing number of publications in this field (Vaska et al., 2021). An analysis of publications in the Scopus database containing the terms “digital transformation” and “business model” in their title, abstract or keywords depicted in Fig. 1 shows the development of publications in the subject areas of business and economics between 2003 and 2021.

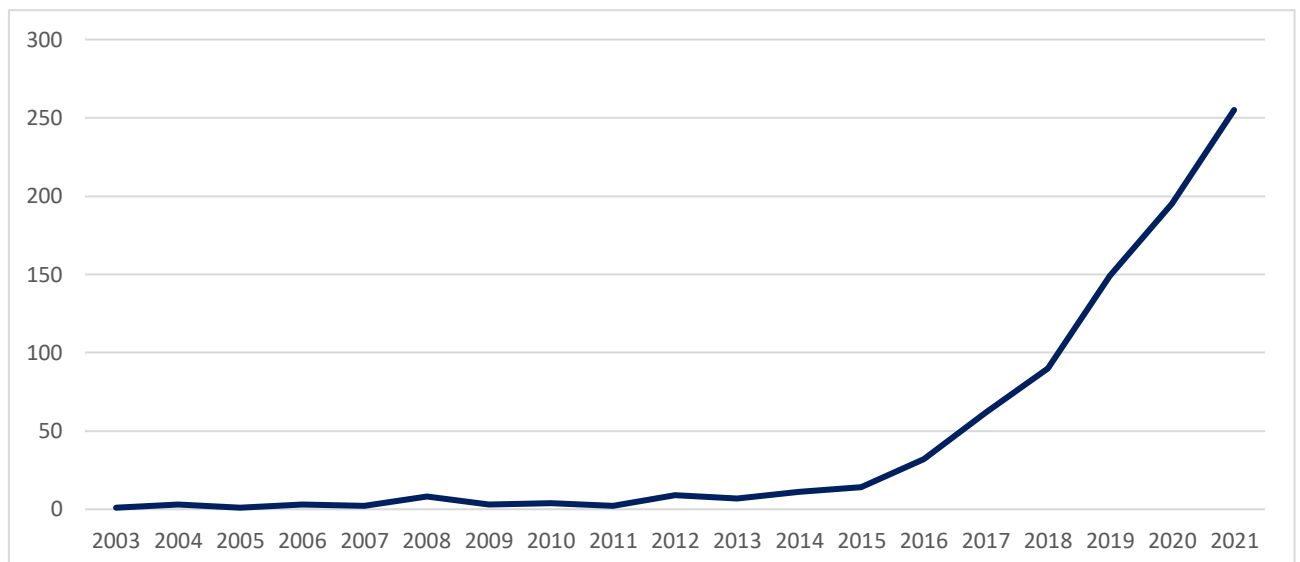


Fig. 1. Annual publications at the intersection of DT and BM research
(retrieved from Scopus database in January 2022)

While there were only a handful of publications per year before 2011, from 2012 research interest increased considerably. In 2021 alone, there were 255 publications, the highest amount so far. The majority of these publications, nearly 40%, were in the subject area of business, management and

accounting, reflecting that the relevance of this topic stems from practical business problems. Research streams as different as marketing, strategic management and information systems (IS) have dealt with DT in the past (Verhoef et al., 2021) while BMs first became of interest to researchers with the emergence of the Internet and the business opportunities arising from it. Research in this field has been influenced by e-commerce as well as strategic, technology and innovation management research (Zott et al., 2011).

The growing importance of digital business models and their potential to disrupt entire industries in the past ten to 20 years also becomes apparent when taking a look at the composition of the most valuable companies by market capitalization in the world. In the late 1990s, the top ten included tech companies such as Microsoft, Cisco, Intel and Nokia, as well as big oil corporates such as Exxon and bp. In 2014, Microsoft was surpassed by Apple, only ranking fourth after Exxon and Alphabet (Google). This was also the last year an oil company was part of the top ten of market capitalizations. In 2019, seven out of the top ten companies (Microsoft, Amazon, Apple, Alphabet, Facebook, Alibaba and Tencent, by order of market capitalization) had a digital BM in place (Desjardins, 2019).

DT and the consequent necessity to change the firm's BM result in both challenges and opportunities for incumbents. Regardless of company size, the challenges connected to the DT of incumbents are multifold. Externally driven challenges include shifting market boundaries and changing roles of stakeholders, for instance, increased vertical integration by suppliers or the growing importance of customer co-creation (Verhoef et al., 2021). In addition, new entrants (to an industry) which disrupt traditional industries require incumbents to reconsider their current BM, as experienced by Nokia when Apple introduced the iPhone in 2007 (Linge, 2017).

In fact, on closer examination of Apple's digital BM compared to Nokia's BM, it becomes apparent that Apple conceived its phone to be more than just a product. They designed the iPhone's architecture in such a way that only minor value for the user was derived from a linear pipeline BM transforming inputs into outputs. The main reason consumers were attracted to the iPhone was the digital platform BM Apple had in place, at the core of which lay the App Store which connects producers of apps with consumers. The example of Nokia's shrinking in the face of platform companies such as Apple and Google illustrates how platforms disrupt traditional BMs and almost always become the dominating BM in the industries they enter (van Alstyne et al., 2016).

An empirical qualitative longitudinal study of the global advertising industry by Cozzolino et al. (2021) examining how incumbent producers react to new entrants' platforms paints a slightly different picture than the Nokia-Apple example. They found that incumbents in that specific context pivoted between cooperation and competition in the face of new entrants' digital platforms and went through three phases of co-existence with their disruptors. This implies that the emergence of digital platforms does not necessarily lead to the downfall of incumbents, but is rather dependent on the specific context and incumbents' behavior and natural advantages, for example, customer intimacy.

Favoretto et al. (2021) have identified several internal challenges of DT for manufacturing firms based on a systematic literature review which might apply to many non-digital incumbent firms regardless of the industry they operate in. Often, technological issues such as insufficient IT infrastructures and data security must be overcome before facing DT of the BM. In addition, the lack of strategic organizational commitment, that is a digital strategy, leadership and culture which support DT, poses a challenge to incumbent manufacturers. In order to offer a digitally enhanced value

proposition to customers, firms must not only identify meaningful customer needs but also change the value creation processes to be able to make use of digital technologies to provide a solution to these needs. High initial investments versus uncertain returns could impact value capture of the focal company. Concerning value delivery, the sales approach might have to be adapted to support a digital value proposition. A lack of capabilities and partnerships, in particular concerning data analytics, ecosystems and value co-creation, further impedes the DT of manufacturing companies' BMs.

In the face of DT, incumbent firms have to act as ambidextrous organizations and will have to make trade-offs between exploitation – supporting today's business – and exploration – investing into tomorrow's opportunities. Moving beyond the resource-based view (RBV) (Barney, 1991) which attributes advantages in the form of a resource base to incumbents, in the digital economy, companies also need to access shared and external resources. Opportunities can be found in new products, services and BMs which are enabled by digital technologies, such as leveraging platforms with limited internal resources as in the case of Airbnb or Netflix (Oberländer et al., 2021). However, these examples also implicate that success stories can often be found in the context of start-ups or larger digital incumbents, alluding to what the OECD (2021) refers to as a digital gap between established small and medium enterprises (SMEs) and other companies.

1.2. Idiosyncratic Characteristics influencing the DT of Incumbent SMEs' BMs

The Organization for Economic Cooperation and Development (OECD) (2021) regards the successful DT of SMEs as highly relevant because this group of companies plays an important structural role in many countries and contributes to the prosperity and stability of the worldwide economy by creating jobs. The OECD further acknowledges that policymakers have to increase SMEs' abilities to prepare for DT and to act on opportunities that result from it. 99% of the EU's businesses belong to the group of SMEs which according to the European Commission's (2021a) definition comprises all companies with an employee headcount lower than 250 and an annual turnover lower than € 50 million or a balance sheet total lower than € 43 million. Worldwide, SMEs provide more than two-thirds of employment (International Labour Organization, 2021). Around 90% of all businesses are SMEs (World Bank, 2021).

A survey conducted among SMEs from France, Germany, Poland, Spain and the United Kingdom showed that more than 50% of them know of the need to adopt digital technologies if they want to remain competitive. Despite this fact, only one-third of them reported DT to be a strategic priority. They identified a lack of digital infrastructures, IT security concerns, employees' insufficient digital skills and a lack of qualified potential workforce as key challenges (Abel-Koch et al., 2019). Findings from another survey that questioned 2,000 SME executives from 19 countries in the April of 2020, shortly after the outbreak of the COVID-19 pandemic, underline that SMEs are partly unprepared for DT. Less than 40% of them reported having sufficient data to make decisions based on data analytics. Regarding competitiveness, two-thirds of the participants stated that larger companies have an advantage because of their superior data analytics capabilities (Conway & Codkind, 2021).

Incumbent SMEs in particular are different from large firms on the one hand and (small) new entrants on the other hand. In comparison to larger companies, SMEs are often attributed with characteristics such as agility or less hierarchy which might be a competitive advantage when reacting to environmental changes. Because of resource constraints, engaging in innovation activities with uncertain outcomes can be financially risky for them at the same time, however (Rosenbusch et al.,

2011). In addition, SMEs face difficulties regarding internal and external knowledge capabilities and economies of scale which are limited by smaller market and product portfolio sizes. Factors influencing the heterogeneity of organizations within the context of SMEs are, among others, age (young versus mature), size (small versus medium), financial performance and ownership (family-owned vs. public) (Miller et al., 2021). Overall, it has been found that a company's attributes and its context influence the business model and the ability to innovate it (Foss & Saebi, 2017), leading to the need to take a differentiated look at the DT of incumbent SMEs' BMs.

Several studies have supported the notion that the heterogeneity of SMEs influences their (digital) BMI activities and success. For instance, Heider et al. (2021) conducted a quantitative study on 285 German SMEs and investigated the impact of dynamic capabilities on BMI and the factors which moderate this relationship. They found that small company size has a moderating influence on the relationship between dynamic capabilities and BMI, indicating that small-sized companies have to approach the DT of their BM in a different way than medium-sized companies. Medium-sized firms are encouraged to engage with outside stakeholders to improve their BMI while small firms should concentrate on reconfiguring their resources. The ownership structure of SMEs also plays a role. In their qualitative study of 15 family-owned Mittelstand¹ companies from Germany, Austria and Switzerland (DACH), Soluk and Kammerlander (2021) identified three major barriers impeding the DT of the BM of such companies, namely reluctance among owners which led to limited managerial attention, a lack of common understanding within the firm and employee resistance because of individuals' fears of how the DT of the BM might affect their role in the company.

Nevertheless, SMEs might profit from adopting digital technologies in their BMs which are expected to help them overcome issues connected to their size and subsequent limitation of achieving economies of scale. Data analytics could be used in the context of machine-to-machine communication, enabling SMEs to gather more market information and better understand customer needs. This could result in a higher degree of product differentiation and decreased operating costs along the supply chain. Digital platforms could result in a broadening or even internationalization of SMEs' customer bases (OECD, 2021).

1.3. Political Ambitions to Accelerate the DT of SMEs' BMs

Policymakers acknowledge the DT challenges of SMEs and have ambitions to speed up the DT of SMEs. For instance, the European Commission's call to make the following years until 2030 Europe's "Digital Decade" includes several ambitions which address the DT challenges faced by SMEs:

- build up digital skillset among the European population,
- improve digital infrastructures to make them more resilient and performant and
- accelerate DT of businesses (European Commission, 2021c).

In fact, "three out of four companies should use cloud computing services, big data and Artificial Intelligence [and] more than 90% SMEs should reach at least basic level of digital intensity [by 2030]" (European Commission, 2021c). In order to counter the slow adoption of digital technologies among SMEs in particular, the EU plans to launch so-called Digital Innovation Hubs which are

¹ Although the German Mittelstand also comprises of companies which are larger than SMEs, many German SMEs are part of this group of companies which is defined by the unity of ownership and management. In a Mittelstand company, "up to two natural persons or their family members hold (directly or indirectly) at least 50% of the shares in a company [and] these natural persons are members of the management" (Institut für Mittelstandsforschung, 2022b).

supposed to support SMEs in matters such as experimenting with new technologies, training employees and finding investment by providing an innovation ecosystem and networking opportunities. In total, € 1.5 billion shall be invested by the EU and member states alike to fund more than 200 hubs, with the aim to ensure that they are available to every firm. It is planned that each of them will specialize in applications and sectors which are most relevant to the region they are operating in (European Commission, 2021b).

Under the Horizon 2020 project, the EU also funded the development of a self-help platform for incumbent SMEs as well as start-ups to enable them to successfully implement BMI activities, regardless of the digital context. Led by researchers from TU Delft, more than 1500 SMEs from 13 EU countries were surveyed on BMI. The researchers found that only 37% of the companies surveyed innovated their BMI, but the vast majority recognized the importance of BMI. The aim was also to find out what the SMEs’ needs are in relation to BMI and to design the platform accordingly in a user-oriented way. Four years of research resulted in the so-called “Business Makeover” platform (Business Makeover, 2022a). On the platform, companies can select a goal and sub-goal (for instance “I want to test my business” / “I want to test whether my business is futureproof”) and are then guided to appropriate tools which can help them in answering these questions (Business Makeover, 2022b).

The European Commission (2021d) has introduced the Digital Economy and Society Index (DESI) to measure digital performance and competitiveness across the EU. The DESI considers four dimensions in its evaluation which are in line with the “Digital Decade” goals: Human capital (improvement of the digital skillset among the EU population), connectivity (expansion of digital infrastructures, in particular very high capacity network connectivity), integration of digital technology (acceleration of the DT of businesses, especially SMEs) and digital public services (online availability of key public services) (see Fig. 2).

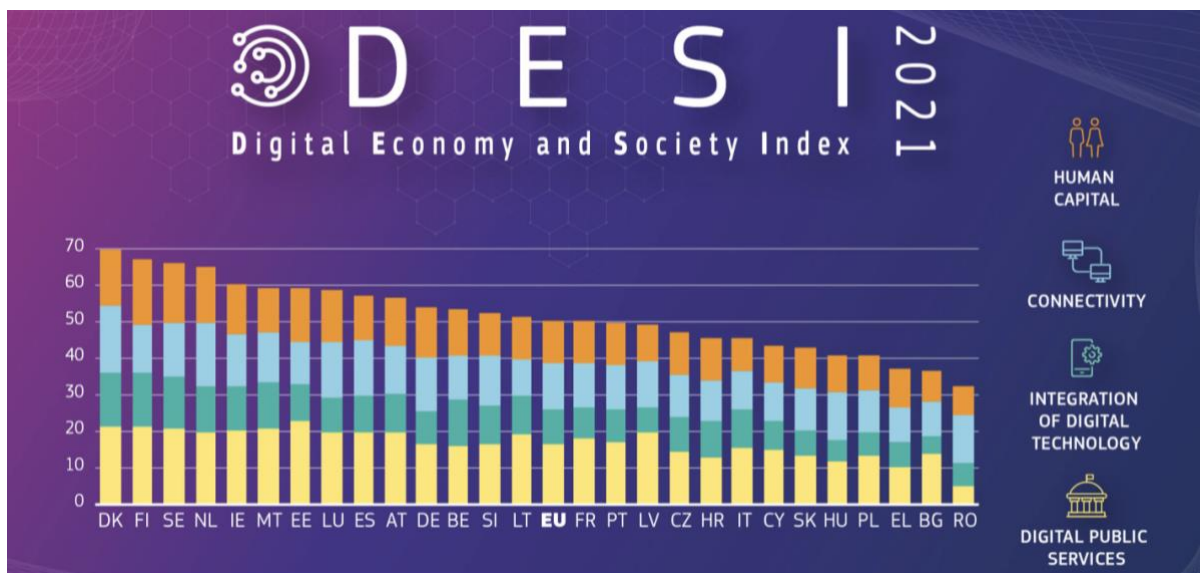


Fig. 2. Digital Economy and Society Index 2021 (European Commission, 2021a)

Among the member states of the EU, Germany does not belong to the high-performing countries regarding digital transformation although it is the fourth-largest economy in the world according to its GDP (IMF, 2022). In 2021, Germany ranked 11th among the 27 member states in total, but only 19th regarding the integration of digital technologies into businesses and e-commerce, which was even one rank lower than in 2020 (European Commission, 2020, 2021d). In order to remain competitive,

Germany has to improve in this regard. As the comparison of the member states in Fig. 2 shows, the Northern countries and the Netherlands are leading overall and can be regarded as the benchmark for successful DT.

Integration of digital technologies is also relevant to the particular context of SMEs. In 2020, only 60% of all SMEs in the EU had at least a basic level of digital intensity. Digital intensity is measured by counting how many out of twelve selected digital technologies are used by companies, the basic level requiring the use of at least four technologies. Again, SMEs' in Denmark and Finland were leading in digital intensity, coming close to the EU target of 90% with 88% while German SMEs only ranked 14th at slightly above 60%. The DESI also recognized a gap between large companies and SMEs not only regarding advanced technologies such as cloud, AI and big data but even basic digital solutions such as implementing an Enterprise Resource Planning (ERP) system, confirming the aforementioned digital gap. In addition, while 76% of all large companies employed internal Information and Communications Technology (ICT) specialists, small and medium-sized companies lagged behind at 14% and 42%, respectively (European Commission, 2021d).

Considering German SMEs, which shall provide the research context for the empirical part of the study, there are some characteristics that should be taken into account next to the general idiosyncrasies of incumbent SMEs. Traditionally, strong ties with customers, suppliers and other stakeholders as well as a high degree of specialization are typical for incumbent SMEs in Germany (Heider et al., 2021). These characteristics influence the type of activities they embark on in their DT journey. Independent from the industrial sector, German SMEs invest more often in IT structures or digital customer relationships than in digital products (Zimmermann, 2021), implicating that the DT of some elements of the BM is further developed than that of others.

All in all, research regarding the DT of BMs is only emerging. The growing scientific relevance is mirrored by the increasing transformation of industries' BMs, creating both opportunities and challenges for all companies regardless of their size. However, incumbent SMEs face a digital gap compared to large companies. Idiosyncratic characteristics such as size or ownership influence their ability to engage in BMI. Because of their important structural role in many countries' economies, there is political interest to not only drive the DT of SMEs' BMs on a global, but also on the European level. To help institutions such as the EU design instruments which fit the needs of SMEs and identify pathways to success for SMEs' owners and managers in the pursuit of ambitious political goals, more scientific research is required. Within the EU, German SMEs lag behind regarding the integration of digital technologies in their businesses in general and DT of their BM in particular. Conducting research in the context of German SMEs can provide new insights into the challenges and necessities underlying the DT of incumbent SMEs' BMs and can help to secure the future competitiveness of all incumbent SMEs.

2. Theoretical Solutions for the DT of Incumbent SMEs' BMs

2.1. Theoretical Foundations of the DT of BMs

The following sub-chapters aim to clarify the concept of DT, provide clear definitions for both BM and BMI and finally elaborate on the key drivers and definition of the DT of the BM.

2.1.1. Definition of DT

Due to the multidisciplinary nature of DT (Verhoef et al., 2021), it is necessary to clarify the concept of DT. Table 1 displays selected extant definitions of DT.

Table 1. Selected extant definitions of DT

Author(s) (Year)	Context	Definition of DT
Remane et al. (2017)	Theoretical study	“Fundamental alterations in existing and the creation of new business models [...] in response to the diffusion of digital technologies such as cloud computing, mobile Internet, social media, and big data.”
Schallmo et al. (2017)	Literature review	„The DT framework includes the networking of actors such as businesses and customers across all value-added chain segments, and the application of new technologies. As such, DT requires skills that involve the extraction and exchange of data as well as the analysis and conversion of that data into actionable information. This information should be used to calculate and evaluate options, in order to enable decisions and/or initiate activities. In order to increase the performance and reach of a company, DT involves companies, business models, processes, relationships, products, etc..“
Vial (2019)	Literature review of 282 publications from IS research	“a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies”
Warner & Wäger (2019)	Qualitative study of seven large German incumbents	“Digital transformation is an ongoing process of strategic renewal that uses advances in digital technologies to build capabilities that refresh or replace an organization’s business model, collaborative approach, and culture.”
Verhoef et al. (2021)	Literature review of 84 papers from different research streams	“a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm”

Comparing the different definitions of DT, all of them explicitly mention digital (or in Schallmo et al.’s (2017) case “new”) technologies as facilitators (Schallmo et al., 2017; Verhoef et al., 2021; Vial, 2019; Warner & Wäger, 2019) or triggers (Remane et al., 2017) of DT. While some definitions have a narrower scope as to the target of transformation, namely the company’s BM (Remane et al., 2017; Verhoef et al., 2021), others also mention companies, processes, relationships and products (Schallmo et al., 2017) or an organization’s collaborative approach and culture (Warner & Wäger, 2019). The most encompassing and abstract definition is offered by Vial (2019) who speaks of an “entity” and thus broadens the scope of DT beyond the company level. Furthermore, DT is described as a process by Vial (2019) and linked to the strategic management of the firm by Warner and Wäger (2019). Last but not least, the ultimate goal of DT is associated with increasing the company’s performance and reach (Schallmo et al., 2017), improving the object of transformation itself (Vial, 2019) and value creation and appropriation (Verhoef et al., 2021). Consequently, at this point, it can be said that DT can be understood on multiple levels of aggregation within industries and companies and that its definition in the context of BMs needs to be refined, although it is recurrently mentioned in conjunction with BMs.

2.1.2. Definition of BM and BMI and its Relationship to Strategy

As the focus of this thesis is the DT of BMs, resulting in the emergence of a digital BM, it is not the objective to provide a thorough review of the research which has previously been conducted on BMs and BMI. However, it is necessary to define both concepts before offering a definition for the DT of the BM which is appropriate for this thesis. In addition, both concepts will be conceptualized regarding the field of strategic management, because the problem analysis has already indicated that there is an inter-linkage between strategy and the DT of the BM.

Business Model (BM)

Similar to DT, the BM concept has lacked clarity for a long time (Foss & Saebi, 2018). Tools such as the BM Canvas by Osterwalder and Pigneur (2010) were born in practice to map different components of a BM, although the theoretical substantiation of these components is unclear (Foss & Saebi, 2018). Teece's (2010) definition of a BM is the most widely accepted one among scholars investigating the DT of BMs (Favoretto et al., 2021; Vaska et al., 2021; Verhoef et al., 2021) and shall thus also be used in this thesis:

„All businesses, either explicitly or implicitly employ a particular business model. A business model describes the design or architecture of the value creation, delivery and capture mechanisms employed” (Teece, 2010, p. 191).

Foss and Saebi (2018) further highlighted the notion of an *architecture* and stated that a BM is not only a set of elements that describes what is being done in the process of value creation, delivery and capture but that it rather displays *how* this being achieved through the relationships and underlying activities between the elements. These relationships are not necessarily represented by the models commonly used in practice, for instance, the St. Gallen Magic Triangle by Gassmann et al. (2014) and the aforementioned BM Canvas, which are also utilized by SMEs (van Tonder et al., 2021). Nevertheless, in order to provide a more granular understanding of the elements typically associated with value creation, delivery and capture, Table 2 connects Teece's (2010) definition with the elements proposed by two popular BM tools.

Table 2. Typical elements of a BM

Teece (2010)	Gassmann et al. (2014)	Osterwalder & Pigneur (2010)
Value creation	How is the value proposition created? – Value chain	Key resources
		Key activities
		Key partners
	What do you offer to the customer? – Value proposition	Value propositions
Value delivery	Who is your target customer (segment)? – Customer	Customer segments
		Customer channels
		Customer relationships
Value capture	How is revenue created? – Revenue model	Cost structure
		Revenue streams

Another important aspect is the context dependency of BMs. They can only be evaluated considering the particular business environment (Teece, 2010). When it comes to appropriating value from technologies, a BM can also be regarded as a key requirement for successful technology exploitation. In this sense, a mediocre technology combined with a superior BM can be more valuable than a high-end technology exploited by an average BM (Chesbrough, 2010). This role of the BM as a source of value appropriation leads to the distinction between strategy and the BM.

Although some authors such as Chesbrough and Rosenbloom (2002) included strategy as a function of the BM, this work adopts the perspective of Teece (2018) and DaSilva and Trkman (2014) in which strategy is not the same as the BM. On the one hand, strategy precedes the BM by shaping dynamic capabilities which determine the BM of the future. The dynamic capabilities framework was first introduced into strategic management by Teece et al. (1997) with the aim to explain how companies can create and capture value when facing rapid industry-wide technological changes. “Dynamic capabilities, which are underpinned by organizational routines and managerial skills, are the firm’s ability to integrate, build, and reconfigure internal competences to address, or in some cases to bring about, changes in the business environment” (Teece, 2018, p. 40). On the other hand, digital technologies can enable radically new BMs to which strategy must respond (Teece, 2018).

Business Model Innovation (BMI)

Overall, BMI research is more recent than BM research, introducing the additional component of innovation to the BM concept. BMI has been described as both a process and an outcome (Andreini et al., 2021). In an extensive literature review, BMI is defined as “designed, novel, and non-trivial changes to the key elements of a firm’s business model and/or the architecture linking these elements” (Foss & Saebi, 2017, p. 216). Thus, BMI takes place in a deliberate manner and is initiated by the top management, has an innovative character, and goes beyond minor adaptations such as qualifying a new supplier or extending the product portfolio. While any innovation can be classified to be either exploitative (refining or extending existing solutions) or explorative (experimenting with fundamentally new alternatives) (March, 1991), Foss and Saebi (2017) offered a more nuanced typology of BMI based on the novelty (new to the firm or new to the industry) and scope (modular or architectural), identifying four types of BMI ranging from evolutionary to complex BMI.

The ability to engage in BMI, that is to design and implement a new BM, depends on the dynamic capabilities of the firm (Teece, 2018). In the context of BM design, Teece (2018) defined three types of specific dynamic capabilities that combined with strategy are of great importance to create a BM which is a source of competitive advantage for the firm. The stronger these capabilities across the board, the more likely a company is to not only recognize opportunities but also to push for an even more radical shift in the BM and organizational structure and culture:

- Sensing capabilities: Ability to identify opportunities
- Seizing capabilities: Ability to define and refine BM and to allocate resources
- Transforming capabilities: Ability to realign structure and culture

BMIs can also be understood as a specific type of innovation in the context of innovation management (Tidd & Bessant, 2020). Frankenberger et al. (2013) analyzed the innovation processes and 14 cases of past BMI projects of six multinational companies of various industries. They found that the BMI process follows similar patterns as other innovation processes and consists of two meta-phases: “design”, which is first analyzing the ecosystem, second generating new ideas and third building a new BM, and “realization” which is focused on the commercialization of the developed BM.

Furthermore, the process of BMI is linear only to some extent as the process of BMI in practice is rather iterative and contains feedback loops between the different stages. For instance, changes in the ecosystem might require companies to repeatedly switch between the first and the second stage.

2.1.3. Key Drivers and Definition of DT of the BM

Digital technologies can be regarded as one of the key drivers of DT and enablers of digital BMs (Favoretto et al., 2021; Klos et al., 2021; Vaska et al., 2021; Verhoef et al., 2021). As defined by Yoo et al. (2012), digital technologies can be characterized by reprogrammability, meaning that form and function are independent of each other and that (software) functions can be added even when the (physical) form is already in use, for instance via a software update. In addition, digital technologies rely on data homogenization, which enables the discrete representation of data, error-free data transmission and fast and inexpensive communication – not only within, but also between companies or other actors.

Second, companies who make use of these attributes of digital technologies actively change the *competitive landscape* of many industries and further drive the DT of BMs. Traditional industries such as the retail or music industry have become dominated by digital entrants (who have become digital incumbents) such as Amazon, Alibaba or Spotify. Today, even markets that seem unrelated to the core business of these digital giants face potential disruption from them. For instance, Amazon is developing into a potential competitor in the financial sector (Verhoef et al., 2021). In addition, competition is becoming increasingly global (Teece & Linden, 2017). Globalization as well as the open and inexpensive exchange of information within and between organizations further drive the deconstruction of incumbents' vertically integrated value chains. This happens through disconnecting information from physical flows as well as outsourcing activities of the value chain. The value chain becomes a layered stack where companies within a layer form distinct capabilities and compete with each other. In contrast to vertical integration, some companies pursue horizontal strategies to apply these distinct capabilities in previously unconnected businesses. Different layers require different BMs and incumbents holding too tightly to existing BMs may become vulnerable to disintermediation and disruption (Stern, 2013).

Last but not least, *customer behavior* along the whole customer journey has changed. Customers are choosing online sales outlets over offline stores and as a result, customer expectations are shifting towards more digital solutions and interaction (Verhoef et al., 2021). Creating a superior customer experience becomes even more important because customer value is created primarily during the consumption of the product (El Sawy & Pereira, 2013).

In the context of DT of BMs, the terms digitization and digitalization are used interchangeably by many scholars (Caputo et al., 2021; Schallmo et al., 2017). This lack of a common distinction also applies to the concepts of digitalization and DT (Vaska et al., 2021). Verhoef et al. (2021) have identified three phases of DT linking these three concepts based on a literature review of multiple research streams dealing with this topic. According to their findings, *digitization* represents the first and least complex phase of DT. Digitization refers to the conversion of analog into digital information, for instance of documentation processes, and typically does not impact activities related to the focal firm's value creation. In the second phase, *digitalization* takes place. During digitalization, digital technologies are applied to change existing business processes with the aim either to increase profitability through cost reductions or to enhance the customer experience. It is

important to note the emphasis on existing processes which truly distinguishes digitalization from DT. Last, at a higher level, *DT* changes the company's societal and business environment (Vaska et al., 2021) and at the company level has major implications for its organizational structures beyond the adaptations following digitalization. Ultimately, DT results in "a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm" (Verhoef et al., 2021, p. 889), thus requiring incumbent firms to engage in BMI with the aim to adopt a digital BM to retain their competitive advantage (Foss & Saebi, 2017; Verhoef et al., 2021).

Taking into consideration the findings from chapters 2.1.1 and 2.1.2, it is suggested to alter this definition. In particular, the focus on a "new" digital BM seems too narrow and pays heed to neither the nuances of innovativeness as described by other DT definitions focusing on the company's BM (for instance Remane et al. (2017) and Warner and Wäger (2019) mentioning both the existing and a potential new BM) nor to the understanding of BMI as proposed by Foss and Saebi (2017). Furthermore, the aforementioned key drivers seem to substantiate the necessity for the DT of the BM. Therefore, this thesis assumes the following understanding of the DT of the BM:

The DT of a company's BM is driven by digital technologies, increasing competitive pressure from digital entrants and the deconstruction of value chains, and changing customer behavior. Guided by the top management, fundamental changes to the company's existing BM or the adoption of a new BM result in the emergence of a digital BM which provides a source of sustained competitive advantage for the company.

2.2. Theoretical Foundations of Digital BMs

As described in the previous chapter, the emergence of a digital BM is one major outcome of a company's DT of its BM. First, this chapter deals with defining what a digital BM is and which key components characterize it. Second, extant classifications and typologies are presented in order to provide insight into the potential range of digital BM opportunities which companies might unlock.

2.2.1. Definition, Characteristics and Key Components of Digital BMs

The lack of construct clarity which was associated with BM research for a long time still exists in the context of digital BMs and BMI (Ahmad et al., 2020; Trischler & Li-Ying, 2022). The definition by Veit et al. (2014) emphasizes the important role of digital technologies which also becomes apparent in the relationship between DT and BMI and states that a BM is digital if those technologies "trigger fundamental changes in the way business is carried out and revenues are generated" (Veit et al., 2014, p. 48). However, they remain vague as to which key components and characteristics make a digital BM different from a non-digital one.

Table 3 lists key components and characteristics of digital BMs identified in a recent literature review of 20 papers on digital BMs by Ahmad et al. (2020) *in addition* to the previously discussed traditional definition of a BM. Because the authors used slightly different wording from the one in this thesis (for instance "digitized" instead of "digitalized" processes), some key components have been renamed to fit the construct definitions proposed in this thesis. Each key component will be explained in more detail in the following.

Table 3. Key components and characteristics of digital BMs (based on Ahmad et al. (2020))

Key component	Characteristics of digital BMs
Digitalized Business Processes	Digitalized business processes increase overall efficiency and reduce transaction costs for information collection, communication and activity control
Digital Products	Value shifts from physical to digital products which create data Data can be utilized in digital BMs
Digital Services	Offering digital services enables highly scalable digital BMs
Data Analytics	Capability to gather, analyze and interpret data leads to acceleration of DT, creation of added value and new ways of customer engagement
Digital Platform	An accessible digital platform serves as a basis for ecosystem collaboration and enables basic functionalities for digital products and services and their implementation
Digital Ecosystem	Operation in a digital ecosystem can enable strong and complementary partnerships between different actors

Digitalized Business Processes

Digitalizing business processes results in several improvements for the focal firm. On the one hand, by optimizing and automating processes connected to value creation, companies can increase efficiency and positively influence the quality of their products and services. On the other hand, transaction costs that occur during information collection, communication and activity control externally, as well as internally, can be reduced (Ahmad et al., 2020). Closely connected with this development is the dematerialization of processes (Caputo et al., 2021).

Digital Products

Firms employing digital BMs tend to rely less on physical elements (Caputo et al., 2021). Introducing digital products shifts the locus of value creation from the company's production to the usage of the product (Remane et al., 2017). Digital products create data, by for instance integrating smart capabilities such as connected sensors into physical products, which can further be utilized to create added value for customers via digital services. They can also take the form of purely digital products which means that they are stored, delivered and used in an electronic form as is the case for software. In addition, digital products paired with data analytics can enable different forms of value capture such as consumption-based pricing (Ahmad et al., 2020; Bock & Wiener, 2017).

Digital Services

Generally speaking, the DT of traditional, manufacturing-based BMs is often associated with an orientation towards digital services (Paiola & Gebauer, 2020). Digital services may either be offered as a complement to a digital product or as a stand-alone pure service solution. Because they can be reproduced at zero marginal cost, they are highly scalable (Remane et al., 2017).

Data Analytics

Data can be seen as a key resource resulting from the DT of BMs. It can be both externally and internally sourced and can be used to increase revenue or decrease cost as well as for innovation purposes (Sathanathan et al., 2017). Companies do not only need to acquire the capability to collect data, but also to analyze and interpret it in order to gain valuable insights. Internal data resulting from the company's IT systems can be used to increase efficiency while analyzing customer or social media data can help to improve existing or to create novel customer experiences (Bock & Wiener, 2017).

Digital Platform

Digital BMs are characterized by an increasing reliance on digital platforms (Remane et al., 2017) which serve as a basis for ecosystem collaboration between actors and complementors (Ahmad et al., 2020). Research on digital platforms is theoretically grounded in non-digital platforms (de Reuver et al., 2018). According to Gawer and Cusumano (2014) who differentiated between internal (company) and external (industry) platforms, an industry platform is a product, service or technology developed by one or more firms that is open to outside firms in the business ecosystem to develop complements. This type of platform favors the emergence of network effects which can be direct (same-side) or indirect (cross-side). Direct positive network effects are created when an increase in the number of users improves the value of the platform. Indirect positive network effects occur when an increase in the number of complementors results in a higher value of the platform. From a technical viewpoint, a digital platform can be described as “an extensible codebase to which complementary third-party modules can be added” (de Reuver et al., 2018, p. 127). The sociotechnical view emphasizes the relationship between technical elements such as hard- and software and organizational processes and standards (de Reuver et al., 2018). Apart from enabling partners to provide complementary digital products and services (Ahmad et al., 2020), digital platforms allow companies to interact more closely with their customers (Sathananthan et al., 2017). Customers can be integrated inbound, by allowing them to perform simple business processes on their own via a digital standard interface, and outbound, by using data analytics to pro-actively improve customers’ operations (Bock & Wiener, 2017).

Digital Ecosystem

DT increasingly dissolves boundaries between organizations (Garzella et al., 2021). The digital platform and its complements form a digital ecosystem consisting of multiple heterogeneous actors (Yoo et al., 2012), including customers, suppliers, producers of complementary digital products and services, logistics providers, financiers and many more (Ahmad et al., 2020). Digital BMs relying on platforms thus require firms to integrate into such a digital ecosystem (Remane et al., 2017). The digital ecosystem heavily influences the value of a digital platform as other actors can provide complementary digital products and services which ultimately create the value-add for a customer, therefore it can be of interest to the platform owner to enable innovation activities outside the boundaries of the firm (Yoo et al., 2012). Thus, the digital ecosystem also has to act as an infrastructure that fosters cooperation and knowledge sharing (Ahmad et al., 2020).

Fig. 3 displays a conceptualization of the digital BM within the digital ecosystem. Two cases are presented: A company employing a digital BM that is the owner of a digital platform and a company pursuing a digital BM that complements the digital platform of another actor in the ecosystem. While the focal firm’s integration of digitalized business processes, digital products or digital services, and data analytics is necessary to transform the existing into a digital BM, it does not have to be the owner of a digital platform. The distinction between digital products and services is made to include cases in which the product cannot be digitally transformed (for instance food), but the value proposition as a whole including services can (also see Allmendinger and Lombreglia (2005)).

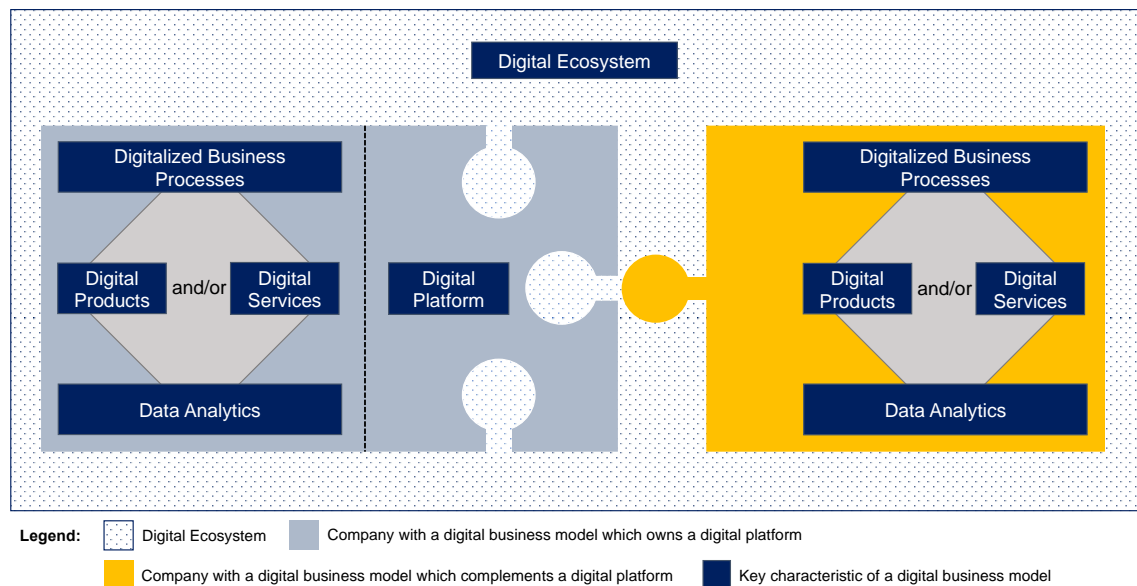


Fig. 3. Conceptualization of a digital BM

2.2.2. Classification and Typologies of Digital BMs

One of the first attempts to create a typology of digital BMs was by Timmers (1998) who identified eleven internet-based BMs (e-shop, e-procurement, e-auction, e-mall, 3rd party marketplace, virtual communities, value-chain service providers, value-chain integrators, collaboration platforms and information brokers) and tried to classify them along two dimensions, degree of innovation (low to high) and extent of integration (single-function BMs to fully integrated functionality).

Independent from the industrial context, in principle, traditional pipeline-based BMs can be differentiated from platform-based digital BMs. In pipeline BMs, value is created along a linear value chain. Companies make use of resources, which need to be valuable, rare, inimitable and specific to the organization in order to provide a basis for a sustained competitive advantage (Barney, 1991), and firm-controlled capabilities to transform inputs into goods that the customer buys. In contrast, ownership over resources becomes less important when it comes to platform-based digital business models. Competitive advantage for the platform owner is primarily created through the network of platform participants, the interaction between them and the exchange of information (Rohn et al., 2021).

Digital BMs can be further classified into innovation platform BMs and transaction platform or marketplace BMs. In digital BMs based on innovation platforms, the platform is the foundation that allows other firms to develop new complementary products and services. Popular examples of this are operations systems such as Apple iOS, Microsoft Windows and Google Android. In the case of digital BMs based on transaction platforms, the platform provides a marketplace for direct exchange of existing products and services and interaction, like Airbnb, LinkedIn and Google Play do. Recently, more and more hybrid platforms which both serve as an innovation and a transaction platform have risen (Cusumano et al., 2019).

Taxonomies based on empirical research and typologies based on theoretical research can help to provide an overview of the full range of opportunities presenting itself to companies when it comes to choosing a digital BM. Recent typologies and taxonomies are presented in Table 4.

Table 4. Selected typologies and taxonomies of digital BMs

Author(s) (Year)	Context	Object of classification	Findings
Täuscher and Laudien (2018)	Mixed methods study evaluating 100 randomly selected marketplaces, the majority of which are entrepreneurial and Consumer-to-Consumer (C2C)	Platform- based transaction BMs	Six distinguishable types of transaction BMs are identified (efficient product transactions, digital product community, product aficionados, on-demand offline services, online services, peer-to-peer offline services).
Weinstein (2020)	Theoretical study listing 20 BMs for the “Now economy” based on company examples	Pipeline- and platform- based BMs	20 different BMs are identified, not all of them purely digital (access, bricks-and-clicks, community of users, crowdsourcing, experience, free, freemium, long tail, marketspace, multi-sided markets, on- demand, open, pay for value, platform participant, pure-play, shaper, Software-as-a-Service (SaaS), subscription, unbundling).
Drewel et al. (2021)	Qualitative study testing catalog of platform patterns with SMEs to conceptualize digital platforms.	Platform- based BMs	The 37 identified platform patterns are based on the principles of real digital platforms. They can be used for platform ideation, development and characterization.
Mancha and Gordon (2021)	Theoretical study identifying different types of digital platform BMIs, validation through classifying 20 digital platform BMs and five mini cases	Platform- based transaction and innovation BMs	Five types of digital platform BMIs are identified. Transaction platform BMs enable “expanded offering”, “marketplace” and “expanded market” BMI, innovation platform BMs can be utilized for “complement co-innovation” or “industry co- innovation” BMI.

The mixed methods study by Täuscher and Laudien (2018) resulted in a taxonomy of six distinct transaction platform BMs which can mainly be distinguished by the platform participants (B2C or C2C or both) and the value proposition, for instance offering a large variety of physical products in a BM for efficient product transactions or on-demand offline services in a BM connecting businesses with customers. Since the study was conducted with entrepreneurial firms and across a wide range of industries and geographies, it is questionable if the results are applicable to SMEs.

Weinstein (2020) simply listed 20 different BMs for the so-called “Now economy”, a 24/7 always open economy. Although his list is comprehensive and includes company examples for each of the BMs he mentions, it is unstructured and does not primarily focus on digital BMs, but also encompasses traditional pipeline BMs and revenue models. Next to platform-based digital BMs such as “marketspace” (a digital marketplace) and “platform participant” (creating user applications for users of a platform), the author presented pipeline BMs which can be enhanced by adding a digital value proposition. For instance, he named “bricks-and-clicks” (retail and online store) and revenue models such as “freemium” or “subscription”. The list is based on theoretical research and not further validated.

The catalog of 37 platform patterns proposed by Drewel et al. (2021) is practitioner-oriented and seems to be similar to the St. Gallen Business Model Navigator (Gassmann et al., 2014). The platform patterns are structured according to six design fields of digital platforms the authors identified: value unit, participant acquisition, anatomy of transaction, platform infrastructure, monetarization and further ecosystem participants. The catalog has been tested through multiple workshops with participants from SMEs, research institutions, and industry associations in the field of product

engineering. It was found that working with patterns created superior results in the ideation of digital platforms than working without the patterns.

Mancha and Gordon (2021) proposed a classification of three types of transactions and two types of innovation platform-based BMs. Transaction platform BMs can expand the value proposition for the customer by improving or offering new activities (*expanded offering*), they can facilitate value exchanges in the company's industry (*marketplace*) and they can extend the company's reach into new market segments and geographies (*expanded market*). Digital BMs based on innovation platforms, can enable the hoisting of third-party innovations that complement the value proposition on the company's level (*complement co-innovation*) or even industry-wide (*industry co-innovation*).

All in all, none of the studies manages to give a complete overview of the spectrum of digital BMs. Together, the selected studies propose a wide range of opportunities for digital BMI. However, the digital BM options which are available to the focal firm are highly context-specific, for instance depending on the company's characteristics or the type of customers it serves. Therefore, a typology without taking these factors into account seems to be of little help in practice.

2.3. Extant Research on the DT of Incumbent SMEs' BMs

BM research has tended to focus on large firms' BMs in the past, neglecting to consider the relevance and context specificity of SMEs (Filser et al., 2021; Miller et al., 2021). Research on the DT of SMEs is mainly focused on models for evaluating digital readiness and maturity (Klohs & Sandkuhl, 2020). Similarly, research on SMEs' digital BMI is only emerging (Andersen et al., 2021). In the following, a review of recent studies dealing with the DT of SMEs' BMs will be conducted. Because of the aforementioned construct unclarity, construct wordings introduced by the authors of the studies have partly been homogenized to fit the wording of this thesis while making sure to not lose the meaning originally intended by the authors, for instance replacing "digitalization" defined as "combining different technologies [...] to create radically new products, services and BMs" (Rachinger et al., 2019, p. 1144) by "DT". Studies were selected employing a keyword search and based on their relevance to the DT of SMEs' BMs, considering the use of digital technologies in BMI activities in particular. Therefore, studies introducing new concepts such as boundary management (Garzella et al., 2021) or investigating the impact of the COVID-19 pandemic on the DT of SMEs' BMs (Priyono et al., 2020) are taken into account.

2.3.1. DT of Incumbent SMEs' BMs

Following the prior definition of DT of the BM and the identification of its key drivers, previous studies investigating the DT of incumbent SMEs' BMs (see Table 5) can help to validate the theoretical background and to refine the understanding in this specific context.

In their mixed methods study, Bouwman et al. (2018) found that internal motives related to innovation and strategy as well as external technology turbulence drive firms to utilize digital technologies to innovate their BMs, in this case social media and big data. BMI through social media or big data is positively associated with firm performance.

Table 5. Selected extant studies on the DT of incumbent SMEs' BMs

Author(s) (Year)	Context	Object of research	Key findings
Bouwman et al. (2018)	Mixed methods study with SMEs utilizing social media and/or big data for BMI (quantitative study on 338 European SMEs; four in-depth case studies)	Examines the impact of digital technologies on BM experimentation and innovation and how this influences firm innovativeness and performance	Innovation and strategy are internal drivers of digital BMI. External technology turbulence also drives digital BMI. Utilizing digital technologies for BMI is positively associated with firm performance.
Bouwman et al. (2019)	Quantitative study on 321 European SMEs which use digital technologies to drive BMI	Examines the impact of BMI practices enabled by digital technologies on firms' performance	Both allocating resources towards BM experimentation and engaging in BMI strategy implementation affect firm performance positively.
Müller (2019)	Qualitative study based on 43 in-depth expert interviews with representatives from German manufacturing SMEs	Examines characteristics of BMs triggered by Industry 4.0	Key resources and value proposition are most affected by Industry 4.0. Industry 4.0 providers' BMs are influenced to a higher degree than users' BMs.
Rachinger et al. (2019)	Qualitative study based on twelve case studies (half of them SMEs) in the automotive and media industries in Austria and Hungary	Examines the impact of DT on different dimensions of the companies' BMs and how they cope with it in terms of their dynamic capabilities	The DT of the BM is triggered internally and externally. All aspects of the BM are influenced, although there are differences regarding elements of the BM between the two industries. The type of value proposition influences the DT of the BM.
Gebauer et al. (2020)	Qualitative study based on two case studies conducted with SMEs in the German region of Brandenburg	Examines two alternative BMI pathways triggered by digital technologies (e-commerce & introduction of ERP system to production)	The company pursuing growth started the DT of their BM by focusing on value delivery aspects, the company wanting to improve profitability targeted value creation aspects of the BM.
Matarazzo et al. (2021)	Qualitative study based on case studies conducted with six Italian SMEs which are active in food, fashion and furniture	Examines the impact of DT on consumer value creation and the relationship between dynamic capabilities and DT	Digital technologies enable BMI by providing means to understand customer needs and improve value creation and delivery. The transformation is initiated by the executive level and implemented by managers.
Soluk and Kammerlander (2021)	Qualitative study based on a multiple case study with 15 family-owned Mittelstand manufacturing firms from DACH	Examines DT processes, the necessary dynamic capabilities and the main barriers and enablers	Process digitalization and product and service digitalization precede the DT of the BM. It is internally driven by the availability of digital talents who can implement digital initiatives. Emerging digital technologies and competitive pressure are external triggers. The outcome is two-fold: a digital BM and new dynamic capabilities.
Paiola et al. (2022)	Qualitative study based on two longitudinal case studies of Italian SMEs engaged in service-oriented BMI driven by IoT	Investigates the process of developing an IoT-based service-oriented BM and managing the new and extant BM in parallel	Digital BMI is an incremental process during which resources are deployed based on trial-and-error learning. The authors identify three main phases of the process, i.e. inception, experimentation and replication.

In a quantitative study on European SMEs which use digital technologies for BMI, Bouwman et al. (2019) found that allocating resources towards BM experimentation and engaging in BMI strategy implementation affects firm performance positively. In addition, their results imply that multiple combinations of input factors led to the desired outcome, suggesting that there are many possibilities to drive digital BMI. The authors suggested conducting further research with the aim to deduct a framework for optimal digital BMI.

Müller's (2019) qualitative study investigated the impact of Industry 4.0 on the BMs of German SMEs from different manufacturing-intensive industries (mechanical and plant engineering, electrical engineering, and automotive suppliers). The context of industry 4.0 can be regarded as specific to Germany as well as to manufacturing companies and is fueled by particular digital technologies, namely cyber-physical systems, the Internet of Things (IoT) and cloud computing. Due to the fact that most case companies are only starting BMI activities, the results are rather exploratory in nature but open up another perspective. Based on the BM Canvas by Osterwalder & Pigneur (2010), the main outcome concerns the role of the companies within Industry 4.0. Most SMEs in the study sample categorize themselves as users and estimate a smaller impact on their BMs. Industry 4.0 providers expect more changes to their future BM, indicating that they might be better positioned to reap the full benefits of digitally transforming their BM.

Although Rachinger et al.'s (2019) study does not only consider SMEs but also large companies, it is interesting nevertheless, as it comparatively analyzes cases from the Austrian and Hungarian automotive and media industries, thus allowing to drawing conclusions regarding different industrial settings (manufacturing Business-to-Business (B2B) (automotive) vs. B2C (media)). Both industries reported external drivers, for instance, digital technologies, competitive pressure and the shortening of technology lifecycles among others, as well as internal drivers such as sensing capabilities and process optimization in advance of the DT of the BM. As to the outcome, both industries reported changes to the BM with the potential to increase revenue and increase the competitive advantage. Compared to the automotive industry where the effect on the optimization of value creation in the context of Industry 4.0 was perceived to be strongest, representatives from the media industry also reported an influence on the value proposition and value capture mechanisms. Customer demand has been found to be another factor influencing the degree of DT. This supports the context dependency of BMs and BMI (Teece, 2018).

Following research by Heikkilä et al. (2018), Gebauer et al. (2020) studied two SMEs situated in the German region of Brandenburg, examining two alternative BMI paths triggered by digital technologies. In the original study based on qualitative research with 11 European SMEs, Heikkilä et al. (2018) analyzed the relationship between strategy and BMI pathways independent from the digital context, using the BM Canvas as a conceptualization tool, and found that the focus of BMI depends on the main strategic goal. For companies pursuing growth, focusing on the value delivery aspects of the BM was more important, for companies striving for an increase in profitability, the starting point was value creation. Although the overall study design limits generalizability, Gebauer et al. (2020) confirmed these findings in their study. Furthermore, they found that the DT of the BM can be regarded as an iterative process during which the different elements of the BM need to be aligned at each step. According to the authors, investigating the BMI process triggered by digital technologies in different companies could provide further valuable insights.

Matarazzo et al. (2021) conducted case studies with six Italian SMEs which are active in food, fashion and furniture. They found that digital technologies such as social media, big data or Augmented Reality can help companies to innovate the consumer value creation aspect of their BM. Digital technologies play a role in advance of BMI, enabling SMEs to better understand customer needs or to engage in co-creation activities. By generating new solutions for omnichannel distribution, value delivery is enhanced as well. Regarding dynamic capabilities, sensing and learning are important prerequisites for BMI, often initiated by the SME's owner or Chief Executive Officer (CEO). Integrating and coordinating capabilities follow and are often driven by managers in the firm.

Soluk and Kammerlander's (2021) qualitative study dealt with the overall DT processes of family-owned Mittelstand firms from the manufacturing industry in the DACH region. Although most of the companies that were investigated were larger in size than typical SMEs, the study yielded interesting insights regarding antecedents and outcomes of the DT of the BM which might also be applicable to SMEs. Following the two stages of process digitalization and product and service digitalization and thereby supporting the findings of Verhoef et al. (2021) that digitalization precedes the DT of the BM, the holistic DT of the BM is internally driven by digital talents who can implement digital initiatives. Externally, competitive pressure and radical changes in the market act as triggers.

Finally, Paiola et al. (2022) conducted a longitudinal case study on two Italian medium-sized companies in the packaging machine industry. Both firms have started to implement new BMs centered around remote monitoring enabled by IoT technologies, in one case the digital solution is customized for each customer while in the other case a digital platform has been introduced. The authors found that digital BMI is an incremental process during which resources are deployed based on trial-and-error learning and identified three main phases of the process: inception, experimentation and replication. Leveraging existing resources to identify and utilize synergies between the old and the new BM as well as preparing for scalability were found to be success factors in the transformation of the two incumbents.

In summary, not all findings from these studies can be generalized as some of them were qualitative in nature and rather specific in terms of context. However, they partly confirm the previously established understanding of DT of the BM. Externally, the emergence of digital technologies, the shortening of technology lifecycles and an increase in competitive pressure drive incumbent SMEs to engage in BMI. Internally, dynamic capabilities such as sensing and learning are important for SMEs in advance of digital BMI. Furthermore, having a strategy in place for the DT of the BM, top management dedication and the availability of digital talents are important enablers. Prior digitalization activities precede the more holistic DT of the BM. In incumbent SMEs, digital BMI tends to take place in an incremental and staged rather than in a radical manner. Regarding the outcome, engaging in digital BMI activities positively impacts firm performance. Digital technologies have the potential to alter and/or improve the entirety but also single elements of SMEs' BMs. The design of the resulting digital BM depends on the industry context as well as the company's strategy, core value proposition and its perceived or targeted role in the digital ecosystem. Calls for further research include the need to establish a framework for optimal digital BMI of SMEs.

2.3.2. Barriers and Challenges of the DT of Incumbent SMEs' BMs

The barriers and challenges incumbent SMEs experience during the DT of their BMs are partly the same as for large companies, partly specific due to their characteristics. In addition to the classic

issues incumbent SMEs face touched upon in the problem analysis, such as resource slack, barriers and challenges exist with respect to the DT of BMs which have been identified by the extant studies presented in chapter 2.3.1 (see Table 6). Research findings suggest that they are dependent on the company's industry (Rachinger et al., 2019) as well as on the advancement of the DT of the BM (Paiola et al., 2022; Soluk & Kammerlander, 2021), which is in line with the previously established understanding of SMEs' heterogeneity.

Table 6. Barriers and challenges of the DT of incumbent SMEs' BMs

Category	Sub-category	Barriers and challenges	References
Organizational	Insufficient digital knowledge	Training employees Recruiting new employees	(Gebauer et al., 2020; Müller, 2019; Rachinger et al., 2019)
	Managing change	Overcoming paternalism Developing and communicating a digital strategy Overcoming employee resistance Establishing a new mindset around digital BM	(Paiola et al., 2022; Soluk & Kammerlander, 2021)
Technological	Shorter technological cycles	Making the right choice at the right time Designing flexible digital BMs	(Paiola et al., 2022; Rachinger et al., 2019)
	Managing digital infrastructure	Coping with data security and privacy concerns Managing digital interfaces	(Müller, 2019; Rachinger et al., 2019)
Value network-related	Balancing complexity and control	Aligning internal processes and partner structures Keeping control of key resources and capabilities	(Paiola et al., 2022; Rachinger et al., 2019)
	Changing role of customers	Customers demanding individualized experience Customers becoming an integral part of digital BM	(Paiola et al., 2022; Rachinger et al., 2019)

Challenges can be categorized into organizational, technological and value network-related challenges. Regarding *organizational challenges*, incumbent SMEs experience *insufficient knowledge* and need to train or even recruit new employees to obtain access to digital capabilities (Gebauer et al., 2020; Müller, 2019; Rachinger et al., 2019). In addition, *managing change* consists of overcoming paternalism and an inconsistent understanding of DT. First, incumbents' owners who lead their company in an authoritarian way can prevent even the preceding stages of the BM's DT if they are reluctant regarding digital technologies. By not supporting digital initiatives, limited managerial attention is given to the topic. Making financial benefits transparent can help to overcome this particular challenge. Second, a lack of common understanding impedes the DT of the BM, which can be countered by employing and broadly communicating a digital strategy within the organization (Soluk & Kammerlander, 2021). Employee resistance in the face of change presents another barrier, often driven by individuals' hesitancy about how DT could affect their role in the company (Soluk & Kammerlander, 2021). Managers and employees alike also might have difficulties in adopting a new mindset, for instance when it comes to selling digital solutions instead of physical products which might result in a shift in value capture from one-time revenues to a subscription-based model (Paiola et al., 2022).

In terms of *technological challenges*, *shorter technology lifecycles* on the one hand raise the issue of making the right choice at the right time (Rachinger et al., 2019). This requires SMEs to keep flexibility in mind when designing digital BMs, particularly with regard to digital platforms (Paiola

et al., 2022). On the other hand, *managing the digital infrastructure* as a whole presents a challenge to incumbent SMEs because of data security and privacy concerns (Müller, 2019) and the necessity to not only manage digital interfaces within the company but also outside the firm's boundaries, for example towards customers (Rachinger et al., 2019).

Considerations concerning the digital infrastructure are partly connected to the *value network-related challenges* incumbent SMEs encounter when digitally transforming their BMs. *Balancing complexity and control* refers to the necessary alignment of internal processes and partner structures as incumbent SMEs depend on the digital capabilities of external partners (Rachinger et al., 2019). In contrast to this dependency, they also need to consider which aspects of the new BM to internalize to keep control (Paiola et al., 2022). Last but not least, SMEs are confronted with the *changing role of customers* in digital BMs. They do not only demand a highly individualized experience (Rachinger et al., 2019), but also represent an integral part of value creation, delivery and capture that requires closer interaction than before because digital BMs often aim at solving customer problems rather than simply delivering a product (Paiola et al., 2022).

2.4. Models and Frameworks for transforming the BM into a Digital BM

Independent from the specific context which is the subject of this work, there are a lot of frameworks, models and tools designed to help companies visualize and map out BMs, for instance the BM Canvas by Osterwalder and Pigneur (2010) or the St. Gallen Magic Triangle by Gassmann et al. (2014). Although the two aforementioned models are still popular among scholars dealing with the DT of BMs into digital BMs (Aagaard, 2018; Vaska et al., 2021) and might very well be used to map digital BMs, they will not be covered in this work because they do not explicitly address idiosyncratic characteristics of digital BMs. In addition, they seem to be very focused on the result of BMI, that is the final BM, and not on the transformative process necessary to realize it, which is also true for some of the selected models and frameworks. Taking a look at those models and frameworks presented from 2013 until today, it seems that there is a shift in focus from the outcome of the DT of the BM, that is mapping a digital BM, to a more practical and strategic management-oriented view of the DT of the BM. The models and frameworks were selected based on a keyword search and backward reference search and following the previously established understanding of key characteristics of a digital BM. The selection of models and frameworks does not claim to be exhaustive, but rather reflects the diversity and discontinuity in this research field. Chapter 2.4.1 introduces general models and frameworks before comparatively analyzing them and discussing their benefits and drawbacks while chapter 2.4.2 presents models and frameworks that were specifically created for SMEs.

2.4.1. General Models and Frameworks

VISOR model by El Sawy & Pereira (2013)

The VISOR model developed by El Sawy & Pereira (2013) aims to integrate elements that characterize “classic” BMs as well as digital elements such as user experience and interfaces. It classifies the components into five categories, “Value Proposition”, “Interface”, “Service Platform”, “Organizing Model” and “Revenue Model” (VISOR), and can be regarded as a mapping tool (see Fig. 4). The *value proposition* reflects the value which is created for the end-user of the focal firm's product or service, keeping in mind that this end-user does not have to be a direct customer of the firm. Depending on the definition of the targeted customer segment, the value proposition can be rather broad or narrow (el Sawy & Pereira, 2013).

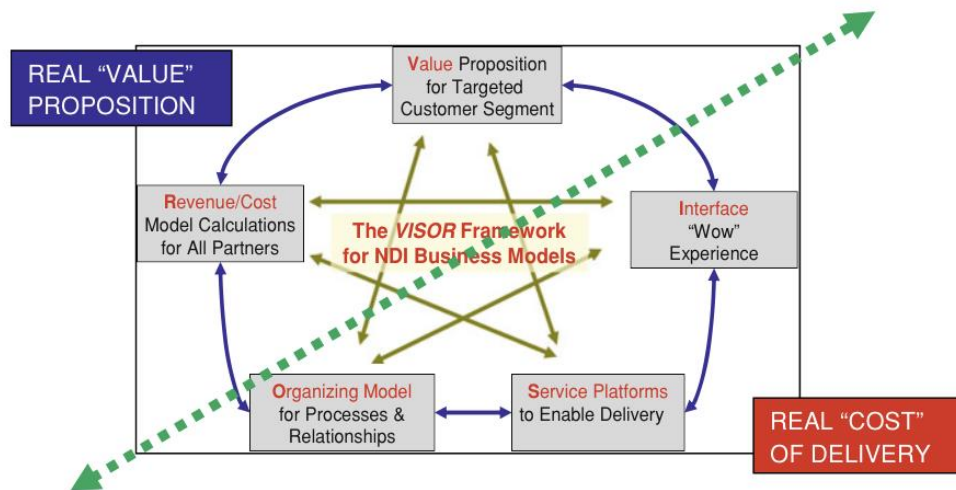


Fig. 4. VISOR model (El Sawy & Pereira, 2013, p. 24)

The user experience heavily influences customer perception of the value proposition and can be facilitated by designing the *interface* to invoke a “Wow” experience. It can be made up of both hard- and software. Furthermore, the authors considered the use of *service platforms* to enable value delivery as well as to enhance the value proposition. Companies have to decide whether to launch their own platform or join an existing one, for example. The *organizing model* seeks to answer questions related to business processes and partnerships needed for successful value delivery. It considers complementary assets or capabilities among the network of partners and the management of relationships within the value chain. Last but not least, the *revenue model* addresses the pricing towards the customer, revenue distribution among partners, product cost and market demand (el Sawy & Pereira, 2013).

BM framework for the Internet of Things (IoT) by Turber, Vom Brocke, Gassmann and Fleisch (2014)

The three-dimensional framework by Turber et al. (2014) (see Fig. 5) was created for visualizing, analyzing and designing BMs in the context of the IoT. It is network-centric and consists of three dimensions: Who (collaborating partners in the value network), where (sources of value creation in the layered architecture of digital technology), and why (benefits for each collaborating partner). The dimensions themselves are inspired by the St. Gallen Magic Triangle (Gassmann et al., 2014).

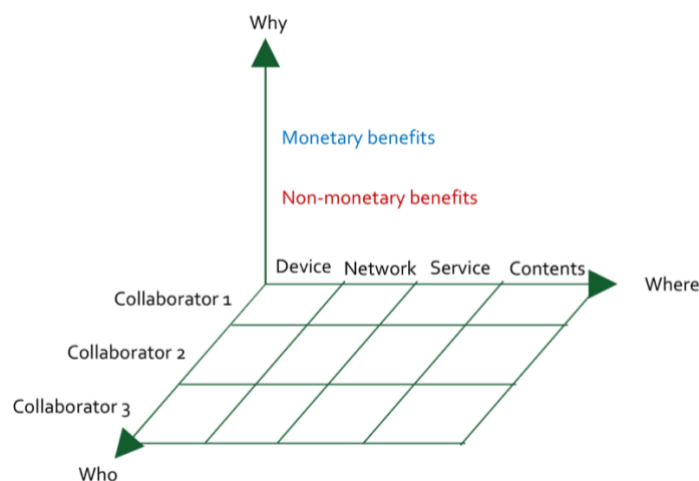


Fig. 5. BM framework for the IoT (Turber et al., 2014, p. 25)

In the “Who”-dimension, the framework adopts a service-dominant logic that considers potential collaborators in the company’s external environment as an important resource for value co-creation, including customers. It furthermore builds on the four-layered modular architecture of digitized objects in the “Where”-dimension, depicting that value creation in the IoT is happening on different levels, from the device layer, that is hardware and the operating system used to control hardware, through the network layer which facilitates the interaction of devices through transmission and standards, to the service layer containing the interaction with users through applications. Finally, the contents layer reflects the data created by the users directly or indirectly in the applications. These layers can be decoupled, thus allowing various stakeholders to contribute to the different layers, and leading to the necessity for interoperability. The authors distinguished between monetary and non-monetary benefits as reasons for collaboration in the “Why”-dimension.

BM design tool for the IoT by Westerlund, Leminen & Rajahonka (2014)

Following the belief that BMs intended for the IoT require an ecosystem perspective, Westerlund et al. (2014) developed a design tool that focuses on the ecosystem and not on the company level (see Fig. 6). The design tool strives to explain the activities between different actors in the ecosystem BM rather than the architecture of the BM itself. The highly conceptual model identifies four pillars that are crucial to designing an ecosystem BM.

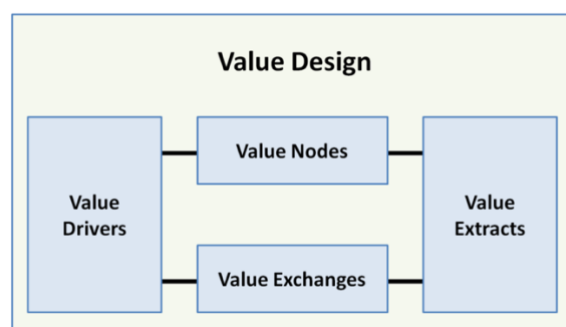


Fig. 6. Key pillars of a BM design tool for the IoT (Westerlund et al., 2014, p. 11)

First, *value drivers*, that is individual as well as shared motivations among participants in the ecosystem, provide a basis for a win-win ecosystem. Second, they influence the so-called *value nodes*, which are inter-linked actors, activities and processes to create value. Value nodes are characterized by a high degree of heterogeneity as they can take the form of hardware products (for instance sensors), services, organizations or even networks of organizations. Third, *value exchanges* take place within and between different value nodes in the ecosystem. These tangible and intangible value flows describe how resources, knowledge and money are being exchanged to create, but also to capture value. Thus, they also explain how returns are generated and distributed among participants in the ecosystem. Fourth, *value extracts* define the part of the ecosystem which creates value that can be commercialized and monetized. The concept of value extracts provides managers with a focus to understand the core value of the ecosystem BM. Overall, the four pillars are linked by a deliberate *value design* which is the overall architecture on the ecosystem level. It defines the boundaries of the ecosystem’s value creation and capture and results from the operations by the four value pillars (Westerlund et al., 2014).

Roadmap for DT of the BM by Schallmo (2016)

With his roadmap for the DT of the BM, Schallmo (2016) tried to provide a structure of five consecutive phases including relevant activities and results for the focal firm. In addition, value chain actors outside the company as well as so-called DT enablers are also considered (see Fig. 7).

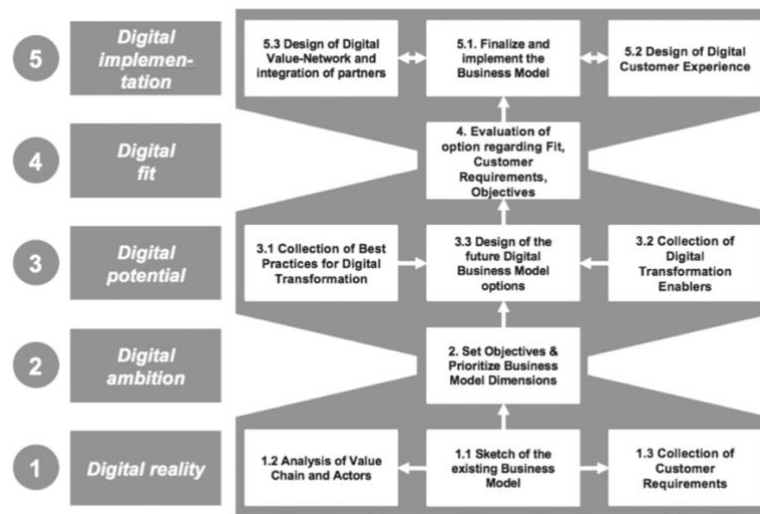


Fig. 7. Roadmap for the DT of the BM (Schallmo, 2016, p. 25)

In the first phase, *digital reality*, the status quo is analyzed by sketching the existing BM. During this activity, information on the value chain, its actors and customer requirements is collected. Second, in the *digital ambition* phase, objectives for the DT of the BM are defined. Following the prioritization of objectives BM dimensions, the third phase of *digital potential* focuses on collecting best practices and enablers for the DT of the BM. The author regarded digital data, automation, digital customer access and networking as the main categories of enablers. Both best practices and enablers are used to design future digital BM options which are evaluated in the fourth phase, *digital fit*. During this phase, the fit regarding the existing BM, customer requirements and previously established objectives is assessed to prioritize the digital BM options. Fifth, in the *digital implementation* phase, the chosen digital BM is finalized and implemented through designing a digital customer experience, a digital value creation network and integrating partners (Schallmo, 2016).

Conceptual framework for digitally transforming elements of the BM by van Tonder, Schachtebeck, Nieuwenhuizen and Bossink (2020)

Before developing the conceptual framework, van Tonder et al. (2020) identified constructs underlying digitalization, DT and digital BMI in a narrative review. The elements which are included in the final framework for digitally transforming elements of the BM are common among those three concepts. The framework describes how to digitally transform the elements on the left side into the elements on the right side through actions (indicated in the middle), the final result of which is BMI (see Fig. 8). First, the framework proposes to develop new digital products or adapt existing products in order to digitally transform the *product offering*. Second, *digital customers* should be served through digital platforms. Third, the focal firm needs to identify as well as acquire the *resources* which are needed to integrate digital technologies. Fourth, new *capabilities* might be needed to enable digitalization and finally the DT of the BM. Finally, the company's *strategy* has to consider DT as the core focus. A digital business strategy that leverages digital technologies is required for the successful DT of the BM (van Tonder et al., 2020).

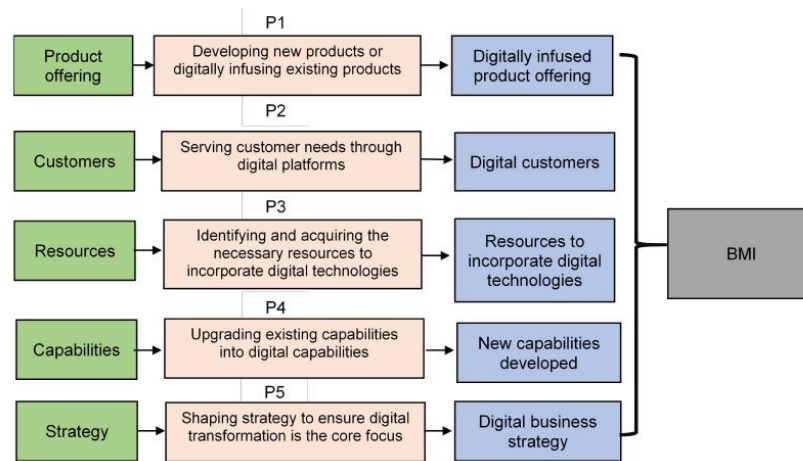


Fig. 8. Conceptual framework for the DT of elements of the BM (van Tonder et al., 2020, p. 126)

Comparing the selected frameworks and models, they vary greatly between being theoretical and practical. In addition, the scope differs from focusing on the focal firm to considering the entire ecosystem. Table 7 provides a comparative overview of the selected frameworks and models.

Table 7. Comparative analysis of models and frameworks for the DT of the BM

Key function	Authors(s) (Year)	Study design	Purpose	Perspective	Stakeholders	Key Findings
Mapping	El Sawy & Pereira (2013)	Theoretical study	Model for mapping digital BM	Company	Customers Value chain (including partners)	Digital BMs extend beyond the traditional understanding of a BM. Interfaces influence the user experience and service platforms enable value delivery.
	Turber et al. (2014)	Partly empirical study (smart home context)	Prototypical framework for designing, analyzing and visualizing IoT BMs	Ecosystem	Collaborators for value co-creation (including customers)	In the IoT context, BMs have to consider the entire ecosystem including multiple stakeholders for collaboration and different layers of digital technology as sources of value creation.
	Westerlund et al. (2014)	Theoretical study	Prototypical design tool for digital ecosystem BMs	Ecosystem	Value nodes	In the IoT context, the perspective needs to shift from a company BM to an ecosystem BM.
Transforming	Schallmo (2016)	Theoretical study	Five-phases-roadmap for digitally transforming the existing BM into a digital BM	Company	Customers Value chain / value network	The DT of a company's BM is linked to its strategic management. In the process, different internal and external factors should be considered and evaluated before implementing a digital BM.

Van Tonder et al. (2020)	Theoretical study	Conceptual framework for digitally transforming elements of the BM	Company	Customers	The DT of a company's BM requires a digital value proposition and serving customer needs through digital platforms as well as developing appropriate resources, capabilities and strategy.
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Although the VISOR model by El Sawy and Pereira (2013) lacked empirical grounding at the time of its development, it has since then been mentioned and applied by other publications as an example of digital BM design (see for instance Remane et al. (2017) and Teece and Linden (2017)). An advantage of this model is that the components of a classic BM lie at its core, that is the value proposition targeted towards a specific customer segment, the organizing model including management of the entire value chain and revenue and cost considerations. The authors added two elements that are only enabled by digital technologies and therefore specific to digital BMs, the interface towards the customer and the service platform. Even though the VISOR model considers the BM's ecosystem to some extent as shown by the emphasis on partnerships as an important part of the value creation, delivery and capture activities, its focus remains on the company level. Publications adopting a higher-level view on digital BMs and the IoT in particular mentioned the importance of taking the entire ecosystem into account when designing digital BMs (Turber et al., 2014; Westerlund et al., 2014).

Turber et al.'s (2014) BM framework for the IoT is quite similar to the design tool of Westerlund et al. (2014). Both models are intended for the IoT and are highly influenced by extant research on networks and ecosystems. The framework by Turber et al. (2014) is still at a prototypical stage and does not seem to have been developed any further, so the usability for companies who seek to design a digital BM in the context of the IoT is questionable (Aagaard, 2018). Still, because of the Design Science Research (DSR) approach which has already been undertaken, the importance of the proposed dimensions is not only based on a literature review, but also workshops conducted in various industries (heating, home security and smart lighting among others) and interviews with researchers and practitioners. The role of collaborators should therefore be highlighted.

The BM design tool for the IoT by Westerlund et al. (2014) is highly theoretical and does not seem practical at all. Even the authors themselves conceded that their outline of key pillars is not suitable for practical application. However, they introduce an important managerial implication to the topic of digital BMs. In a digital ecosystem, the focal firm's digital BM does not operate independently of other participants' BMs, but it is interconnected and cannot be designed isolated from its environment. Therefore, managers need to adopt an ecosystem perspective in the context of digital BMs.

The roadmap for the DT of the BM by Schallmo (2016) again focuses on the company level but provides a practical approach consisting of five consecutive phases. Although not explicitly mentioned by the roadmap itself, the author adopts the view that the DT of the BM is one element of the company's entire DT and is interconnected to the company's digital strategy (digital strategy being a part of or being similar to the corporate strategy) (Schallmo et al., 2019). This lack of clarification is one disadvantage of the roadmap, next to its visualization with the consecutive phases being presented from bottom to top rather than from top to bottom. Nevertheless, the importance the

roadmap places on customer requirements, ensuring that the final solution is desirable, as well as on the transformation of the value chain into a value network should be noted. In addition, the roadmap defines clear phases and actions and deliverables for each of the phases.

Finally, Van Tonder et al.'s (2020) five proposals to digitally transform elements of the BM contradict statements that call for a holistic transformation of the BM (see for instance Broekhuizen et al., 2021). Next to the value proposition, serving customers through digital platforms, acquiring resources and upgrading capabilities, they include strategy as part of the DT of the BM, but it remains unclear if there is a specific order in which the proposed actions should take place and how strategy and the DT of the BM are interconnected.

In conclusion, most of the presented models and frameworks are theoretical and have not been validated by empirical research with actual companies. Other existing models and frameworks for the DT of BMs into digital BMs which are out of scope regarding this thesis (for instance the process model for data-driven BMI by Hunke et al. (2017)) share this issue. Furthermore, they stem from different research streams and showcase the high degree of concept unclarity and fragmentation in the field of digital BMs and at the intersection of DT, BM and strategic management research.

2.4.2. Models and Frameworks for Incumbent SMEs

Limited studies have dealt with developing models and frameworks for the DT of SMEs' BMs until today. The studies identified in this thesis are very recent. All of them have been published in the prior year, again confirming that this particular research stream is only emerging, but seems to gain in relevance and popularity. A literature review by Van Tonder et al. (2021) investigated how SMEs deal with BMI in the context of Industry 4.0. They found that the BM Canvas, St. Gallen BM Navigator and Cambridge BMI framework are used most often for digital BMI and confirmed the lack of models and frameworks in the general context of digital BMs.

Andersen et al.'s (2021) qualitative study explored the digital BMI processes of 18 Danish SMEs from industries as different as textile and turbine manufacturing. This limits the generalizability of their findings to some extent, however, this context can provide interesting insights because SMEs in Denmark are leading in terms of digital intensity in the EU as shown in chapter 1.3. The result of their research is a theoretical framework of SMEs' BMI activities. First, SMEs should continuously *assess their environment to identify new opportunities*. In this stage, using insights from data can on the one hand broaden the search horizon of SMEs and on the other hand increase validity and accuracy. Second, when developing new BMs, *conveying a sense of urgency* inside and outside the company becomes key as the speed of change as well as the need for change increase, in particular in the context of DT as compared to other innovation activities. Third, *experimenting with digital innovation* requires SMEs to become more flexible, accept risks and failures as part of the learning process and motivate change in the organization by making potential benefits transparent. The integration of network partners and data becomes more important. Fourth, by *shifting decision-making from intuition to data*, SMEs can become more efficient through increased reliability and faster decision-making. This is closely connected with a shift in mindset which sees SMEs becoming more agile in response to a dynamic and uncertain environment and balancing intuition- and data-driven decisions.

Following a DSR approach (which is commonly used in IS research (van Tonder et al., 2021)), Hoch & Brad (2021) proposed an architectural framework for systematic BMI which they tested in the

German construction industry. Although they conducted semi-structured interviews with SMEs from this industry at the beginning of the DSR process and validated the model through a case study including workshops led by the researchers at a company that rents out construction machinery and conducting interviews with industry experts, it seems highly complex and not self-explanatory at all, thereby limiting its general usability. The framework considers three dimensions of time (past, present and future) and three system levels (“super-system”, i.e. the company’s external environment, “system”, i.e. the company’s BM and “sub-system”, i.e. the details of the BM). It consists of 14 consecutive steps during which the focal firm moves from the present to the past and then to the future alongside the different system levels. In addition, the framework integrates multiple theoretical lenses and tools, for instance the blue ocean framework by Kim and Mauborgne (2004) which adds to its complexity.

To sum it up, the first theoretical framework provides a good foundation for understanding, but it is too general and theoretical to be applied in practice. Although the second conceptual framework has been empirically validated, it seems to be overly complex. Research on models and frameworks for the DT of SMEs’ BMs seems to be scarce and only emerging.

2.5. Proposal of a Conceptual Model for the DT of Incumbent SMEs’ BMs

2.5.1. Research Gap addressed by the Proposed Conceptual Model

Because of the differences between pipeline and digital BMs, the usability of popular tools such as the BM Canvas (Osterwalder & Pigneur, 2010) is questionable when it comes to the DT of a BM. Moreover, these tools are often intended for mapping a BM and do not provide an answer as to how to approach the overall DT of the BM from a strategic point of view. On the one hand, the relationship between DT and strategic management to this day remains under-researched and studies dealing with both concepts simultaneously are only incipient, as a recent literature review by Rêgo et al. (2021) shows. On the other hand, DT and BMI research has not yet been linked properly (Böttcher & Weking, 2020). The existing models and frameworks which were discussed in chapter 2.4 mostly neglect the link between strategic management of the firm and its (digital) BM even though extant research on the DT of SMEs’ BMs has shown that having a strategy for this transformation and dedicated management attention is associated with more successful digital BMI (see chapter 2.3). Furthermore, they have not yet been sufficiently empirically validated, neither in the context of large companies nor in that of SMEs. Extant research regarding models and frameworks targeted at SMEs is even more limited (see chapter 2.4.2). The existing solutions do not seem to be applicable in the practical management context. All this substantiates the need to develop a conceptual model which does not only integrate strategic management aspects and characteristics of digital BMs but can also act as a usable guide and is validated through research with SMEs.

2.5.2. Overview of the Proposed Conceptual Model

In the following, a conceptual model for the DT of incumbent SMEs’ BMs is developed based on the findings from the previous chapters. In contrast to models and frameworks building a digital BM from scratch, the model has to assume a certain path dependency because of prior investments into resources and capabilities as well as an existing business model. At a later stage, the model should pay heed to the idiosyncratic characteristics of SMEs which were identified in the problem analysis, for instance resource constraints.

The process proposed by the conceptual model is partly based on the Double Diamond design process which was developed by the Design Council (2015). There are two phases per diamond. In the first phase, an issue is explored in-depth (divergent thinking) and in the second phase, it becomes more focused (convergent thinking). In the original model, the first diamond culminates in the formulation of the design challenge based on problem discovery, while the second diamond develops different solutions for the identified challenge and then tests them at an early stage to refine promising solutions and reject others. This design process is iterative and assumes that companies move back and forth through the process the more they learn about the challenge they are trying to solve which is in line with the BMI framework by Frankenberger et al. (2013) which was described in chapter 2.1.2.

The conceptual model considers several contextual elements (see chapter 2.5.3), namely environmental circumstances as the key drivers on the input side, the strategic management of the firm throughout the entire process, and sustaining the competitive advantage on the output side. The process itself shall support companies in analyzing the initial situation (see chapter 2.5.4), assessing the need for digitally transforming their BM based on their competitive position (see chapter 2.5.5), designing alternatives for a digital BM (see chapter 2.5.6) and assessing them with the final goal to identify one or more promising digital BM(s) (see chapter 2.5.7). The resulting conceptual model is displayed in Fig. 9.

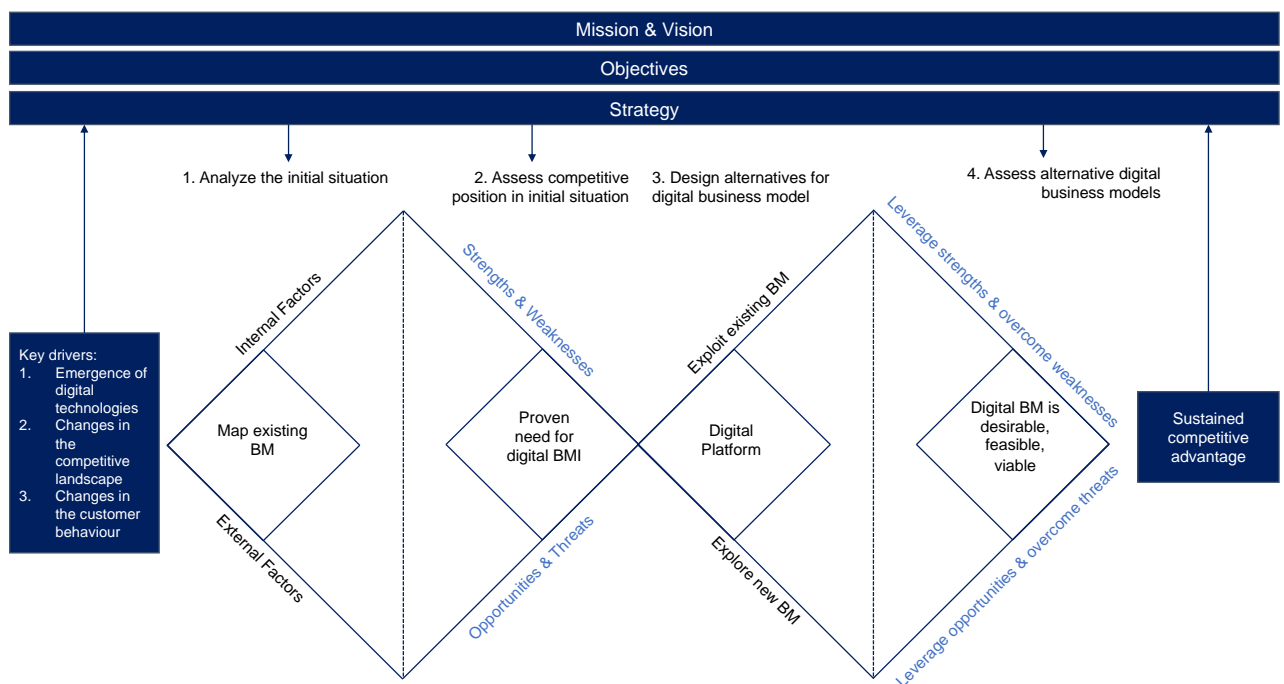


Fig. 9. Proposed conceptual model for the DT of incumbent SMEs' BMs

2.5.3. Contextual Elements

Key drivers

Chapter 2.1.1 showed that there are certain antecedents to the DT of BMs in a particular industry, namely the emergence of digital technologies, changes in the competitive landscape and changes in the customer behavior (Böttcher & Weking, 2020; Verhoef et al., 2021). Companies who have sensing capabilities (see chapters 2.1.2 and 2.3) at their disposal will notice these environmental changes and understand them as triggers to enter a BMI process to establish a digital BM.

Mission & Vision, Objectives and Strategy

As established in Chapter 2.1.2, strategy and BM are two distinct concepts. However, they are linked because strategy precedes the BM by making decisions on which resources and capabilities to invest into. According to Caputo et al. (2021), a digital BM requires the adoption of a digital strategy. In the case of transforming the current BM into a digital BM, the overall strategic plan consisting of the company's mission and vision, objectives and strategy must consider DT. Thus, the corporate strategy must incorporate or even be equal to a digital strategy that formulates the company's DT intentions, in particular how to apply digital technologies to products, services, processes and BMs (Schallmo et al., 2019). In the proposed conceptual model, the strategy officially "kicks off" the DT of the BM. It influences three of the four phases. The analysis and assessment of the initial situation are heavily impacted by the strategy the company is currently executing. After the alternative digital BMs have been designed independent of the current strategy, the evaluation of the options is again referring to the strategy next to other factors to establish to what extent the different options help to meet the objectives of the strategic plan.

Outcome

Successful digital BMI is associated with various outcomes. It has been found to positively influence firm performance (increased revenue or decreased cost), access to financial resources such as funding, and company valuation. It can lead to expansion as well as cannibalization of the old BM by the new digital BM. Furthermore, it is associated with intangibles, for instance developing a market position that cannot be easily imitated (Böttcher & Weking, 2020). In general, it can be said that the successful implementation of the digitally transformed BM is expected to lead to a sustained competitive advantage (Foss & Saebi, 2017; Verhoef et al., 2021). Due to the identified strategic gaps from the fourth phase, the company's strategy will probably need to be adapted to close these gaps and move forward.

2.5.4. Analysis of the Initial Situation

In order to gain an understanding of the initial situation the company faces, first, the existing BM is mapped. Mapping the existing BM is a starting point in a lot of process models for the DT of the BM (Hunke et al., 2017; Sathananthan et al., 2017; Schallmo, 2016) and can help to make an implicit BM explicit, in case it has not been designed deliberately from the very beginning. Companies can make use of pre-existing tools for this exercise, for instance, the BM Canvas by Osterwalder and Pigneur (2010) or the St. Gallen Magic Triangle by Gassmann et al. (2014). By identifying key elements of the BM such as key resources or customer segments, the focal firm can lay a foundation for the second task in this phase, which is defining internal as well as external factors which must be considered to carve out an opportunity for the DT of its BM.

An overview of the internal factors which could be relevant based on the available literature is given in Table 8, with a special focus on digital resources. Next to general company characteristics, the categorization of factors will be based on tangible and intangible resources (Barney, 1991). The main tangible resources in scope are physical and financial, the main intangible resources will be clustered according to a common categorization of Intellectual Capital (IC), namely human, structural and relationship capital (Marr, 2008). It is not the objective to provide an all-encompassing list of factors, but to give an exemplary overview.

Table 8. Exemplary internal factors impacting the DT of the BM

Category	Factor	References
Company characteristics	Age (start-up vs. incumbent)	(Heider et al., 2021; Miller et al., 2021)
	Size (large corporate vs. SME)	
	Ownership (public vs. family-owned)	
Physical resources	e.g. raw materials, buildings, production facilities, machines	(Barney, 1991)
Financial resources	Financial performance, e.g. financial slack from current and future revenues and profit	(Miller et al., 2021)
Human capital	Employees' digital capabilities (e.g. data analytics)	(Mugge et al., 2020; van Tonder et al., 2020; Verhoef et al., 2021)
	Managers' digital leadership capabilities (entrepreneurship, communication)	(Andersen et al., 2021; Mugge et al., 2020)
	Digital dynamic capabilities (sensing and seizing market opportunities provided by digital technologies)	(Matarazzo et al., 2021; Verhoef et al., 2021)
Structural capital	Digital assets (data storage, information & communication infrastructure, digital technologies)	(Verhoef et al., 2021)
	Digitalized business processes	(Ahmad et al., 2020)
	Agile organizational forms and development principles	(Mugge et al., 2020; Verhoef et al., 2021)
Relationship capital	Digital networking capability (entering co-creation activities with customers, partnering up with suppliers and third parties)	(Verhoef et al., 2021)
	Absorptive capacity (ability to recognize the value of external knowledge and internalize it)	(Mugge et al., 2020; Müller et al., 2020)
	Access to relevant shared and external resources	(Oberländer et al., 2021)

External factors such as the industry context also determine the DT of the BM (Rachinger et al., 2019; Teece, 2018). The categorization of the external factors impacting the DT of the BM can be done by considering the macro and micro environment of the firm (see Table 9), as it is usually done in a strategic analysis before the formulation of a strategy. While macro-level factors describe the company's broader environment's impact on the DT of the BM, micro-level factors are specific to the industry ecosystem. In strategic management, the PESTEL analysis is often used for examining political, economic, sociological, technological, environmental and legal (PESTEL) factors that account for the company's macro environment. The industry is often being examined using frameworks such as the five forces model by Michael Porter (Kaplan & Norton, 2008).

The PESTEL analysis seems to provide a good foundation for examining industry-independent external factors. However, with regard to the micro environment, it is suggested to consider stakeholders that are relevant in the context of the digital ecosystem rather than industry forces. For example, Broekhuizen et al. (2021) emphasize the importance of stakeholder management in the context of digital platforms. While Porter (1979) has identified customers, suppliers, competitors and new entrants in his framework, complementors, that is third parties whose offerings together with the focal firm's solution can create more value for the customer (Nalebuff & Brandenburger, 1997), and existing digital platforms, as described in chapter 2.2.1, also need to be taken into account.

Table 9. Exemplary external factors impacting the DT of the BM

Category	Factor
Macro-level (environment)	Political, e.g. support by governments for SMEs' DT activities
	Economic, e.g. saturation of economic growth requiring new forms of value capture
	Sociological, e.g. demographic change making digitalization of business processes necessary
	Technological, e.g. the emergence of digital technologies
	Environmental, e.g. sustainability goals which can be reached with the help of digital solutions
	Legal, e.g. data security regulations
Micro-level (industry ecosystem)	Customers (existing vs. non- / fringe / future, buyer vs. end user)
	Suppliers
	Competitors
	New entrants & disruptors
	Complementors
	Digital platforms

It is important to not only consider the present situation but also examine expected changes in the future. On the macro-level, megatrends which might impact the company's future BM should be examined. On the micro-level, concerning, for instance, customers, the company should not only look into existing customers and pay special attention to non-customers, fringe customers and potential future customers (see, for example, research on disruptive innovations (Christensen, 1997) or lead users (von Hippel, 1986)). In the B2B context, the distinction between buyers and end-users could be relevant.

2.5.5. Assessment of Competitive Position in Initial Situation

The evaluation of the identified internal and external factors has the objective to assess strengths, weaknesses, opportunities and threats (SWOT). The SWOT analysis has its origins in strategic planning and can highlight strengths that can be used to leverage opportunities, for instance a rising customer need, as well as weaknesses that can amplify environmental threats (Helms & Nixon, 2010). Other authors have also suggested applying the SWOT analysis to digital BMI (Sathanathan et al., 2017). The final goal of this exercise is to substantiate that there is a proven need for digital BMI, for instance a future customer need that can only be satisfied if the focal firm adopts a digital BM.

2.5.6. Designing alternatives for Digital BM

In the third phase, alternative digital BMs which can meet the previously identified need and commercialize the opportunity will be designed. In general, there are two extremes to BMI, may it be digital or not. Companies can either exploit an existing BM or explore a new one, as described in chapter 2.1.2. Based on the definition of a digital BM which is given in this thesis, the digital platform is at the center of designing alternative digital BMs. Regarding the digital platform, first, a company can act as a complementor to an existing digital platform or develop its own digital platform (see chapter 2.2.1). Second, the digital platform can be an innovation, transaction or hybrid platform (see chapter 2.2.2). In order to visualize the different alternatives, companies might make use of mapping tools that are intended for digital BMs, for instance the prior examined VISOR model by El Sawy and Pereira (2013).

2.5.7. Assessment of alternative Digital BMs

Last but not least, in the fourth phase, the alternative digital BMs will be assessed to exclude alternatives that do not meet pre-defined requirements by the company and prioritize promising ones for further development. Table 10 displays an exemplary overview of key questions which might be considered by the focal firm.

Table 10. Exemplary overview of key questions for assessing alternative digital BMs

Dimension	Key questions
Desirability	Does the digital BM address future customer needs?
	Does the digital BM solve future customer problems?
	Do future customers and other stakeholders see the value of the proposed digital BM?
Feasibility	Is the digital BM aligned with the company's overall mission & vision, objectives and strategy?
	Does the digital BM leverage the company's strengths?
	Does the company have access to the resources and capabilities needed to implement the digital BM (e.g. knowledge, technologies, complementors)?
	Can the company access or acquire the resources and capabilities needed to implement the digital BM, if it does not already have access to them?
Viability	Which investments are needed to implement the digital BM?
	Will the digital BM be financially sustainable in the future?

Considering that the conceptual model is based on a design process model, one idea could be to apply a method that is being used to evaluate design ideas. Originally developed by IDEO (2022), the desirability, feasibility and viability model provides a frame to assess a digital BM in terms of how well it solves future customer needs, which resources and capabilities are necessary to implement it, and how commercially beneficial it is. The assessment results in the identification of one or more promising digital BMs. Furthermore, it can provide insights into strategic gaps regarding resources and capabilities which need to be overcome to implement the digital BM successfully.

In summary, the term DT is recurrently mentioned in conjunction with BMs. The BM is distinct from the strategy concept, although the two concepts influence each other. Key drivers such as digital technologies, increasing competitive pressure from digital entrants and the deconstruction of value chains, and changing customer behavior drive the DT of the BM, a specific type of BMI, during which the company's existing BM is fundamentally changed or a new BM is adopted, resulting in the emergence of a digital BM. A digital BM describes the architecture of how a company operating in a digital ecosystem creates, delivers and captures value by digitalizing business processes, introducing digital products or services and applying data analytics on a digital platform it owns or complements.

An analysis of taxonomies and typologies of digital BMs indicates that there is no comprehensive overview of all possible digital BMs, that the available options are highly specific to the context of the focal firm, and that these classifications seem to be of little help in practice without considering these factors. A comparison of extant studies on the DT of incumbent SMEs' BMs partly confirms the understanding of DT of the BM established in this thesis. Key drivers are recognized by incumbent SMEs, but the DT of the BM does not exclusively result in the emergence of a new digital BM. Extant studies mainly consider antecedents and outcomes of digital BMI. Little is known about the process

of digitally transforming the BM, in particular in the context of the strategic management of the firm. Barriers and challenges are of an organizational, technological and value network-related nature. While most of the general models and frameworks for the DT of the BM are theoretical and lack empirical validation, they also showcase the high degree of concept unclarity and fragmentation in the field of digital BMs and at the intersection of DT, BM and strategic management research. Research on models and frameworks for the DT of incumbent SMEs' BMs is scarce and only emerging.

The proposed conceptual model does not only integrate strategic management aspects and characteristics of digital BMs, but can also act as a usable guide for incumbent SMEs in specific. Based on the Double Diamond design process model, four steps for the DT of the BM are proposed which are embedded into contextual elements, namely key drivers on the input side, the strategic plan of the firm throughout the entire process and sustaining the competitive advantage on the output side. It is proposed to first analyze the initial situation, second assess the company's competitive position in the initial situation, third design alternative digital BMs and fourth assess them with the final goal to identify one or more promising digital BM(s).

3. Research Methodology for Validating the Conceptual Model for the DT of Incumbent SMEs' BMs

In the following, a methodology is developed which shall help in reaching the *empirical research aim of validating the proposed conceptual model for the DT of incumbent SMEs' BMs*. After applying the research methodology, it is expected that the usefulness of the conceptual model can be evaluated and that challenges associated with its application can be identified. In addition, recommendations for other incumbent SMEs facing the DT of their BMs might be derived.

3.1. Research Design

Research investigating the DT of SMEs' BMs is in its infancy and existing frameworks and models have not yet been sufficiently empirically validated, as previously explained. Additionally, the research question itself is of an open nature which is why a *qualitative research methodology* was chosen. While quantitative research is based on extant theories, qualitative research contributes to theory building and testing in a field. This methodology assumes subjectivity and context specificity of experiences and strives to build meaning from these experiences. The researcher is key to data collection and acts as an observer or participant (McGregor, 2018). Qualitative research is especially suitable for questions dealing with “how”, “what”, “who”, “when” and “why” and for relatively new research areas (Basias & Pollalis, 2018). The *research design* displayed in Fig. 10 can be understood as “the overall strategy that researchers choose to integrate the different components of their study in a coherent and logical way” (McGregor, 2018, p. 208).

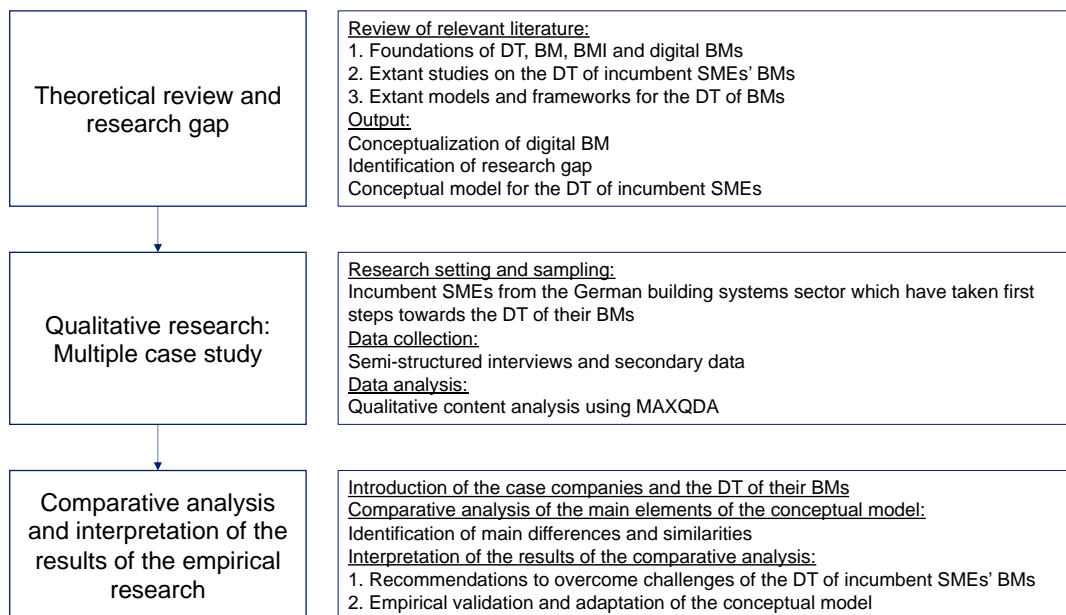


Fig. 10. Research process of the study

The problem analysis and theoretical review provide the necessary grounding to apply a *multiple case study method* to qualitatively investigate the aforementioned research question. This method has been successfully applied in this research field before (see for instance Müller (2019); Rachinger et al. (2019); Andersen et al. (2021)). Case study research has been described as “small-scale research with meaning” (Tight, 2017, p. 9). While single case studies are more focused, conducting multiple case studies allows to draw comparisons and makes a stronger case for theory building and testing

(Eisenhardt & Graebner, 2007; Tight, 2017). The next sub-chapters will elaborate on the research setting, sampling, data collection and data analysis.

3.2. Research Setting and Sampling

The analysis of extant research on the DT of SMEs' BMs in chapter 2.3 has shown that the results of this transformation differ between industries. In addition, as presented in chapter 1.3, within the EU there are vast differences in the adoption of digital technologies by SMEs between the different member states. Therefore the research question is investigated in a specific industry and country.

The research question calls for an industrial setting that is characterized by emerging digital BMs. The building systems sector provides such a dynamic environment. Applications as diverse as heating, ventilation, air conditioning and cooling (HVAC), lighting, power, security, fire and life safety, building automation and intelligence, data, video, and audio communications of various kinds make up the building systems sector (Ahuja, 1997). Under the influence of trends such as increasing awareness of climate change and sustainability, modern buildings have to meet the needs of different stakeholders, considering operators, users and the environment among others. So-called smart buildings are emerging which make use of the data created by different actors in the building ecosystem, for instance to automate control of different applications. In the future, smart buildings may even become thinking buildings, making predictions based on AI (Buckman et al., 2014). One of the challenges of smart buildings lies within the fact that they can be understood as an ecosystem in which many different actors (for example sensors, devices and systems) need to communicate with each other. For instance, the occupancy sensor attached to a luminaire needs to communicate the status of occupancy to the HVAC system to control all functions in a room accordingly. Large companies such as Cisco or Siemens are launching IoT solutions for smart buildings. This leads to the question of how incumbent SMEs from the building systems sector deal with the DT of their BMs.

As to the country of investigation, Germany was selected because of the researcher's familiarity with German SMEs and her knowledge of German which allowed her to conduct the case studies in the native language to minimize the loss of information and risk of misunderstanding. Due to the variety of industries that are part of the building systems sector, it is difficult to estimate the exact market size. There is no central reporting for the entire sector. In 2020, the German HVAC industry generated € 39.5 billion sales (VdZ Wirtschaftsvereinigung Gebäude und Energie e.V., 2021). For the German lighting industry, sales of € 4.8 billion were estimated in the same year (Statista, 2022).

In terms of the classification of SMEs in Germany, it is slightly different from the EU definition. While the EU definition considers a company to be medium-sized between 50 and 249 employees (European Commission, 2021a), the Institut für Mittelstandsforschung (Institute for Research on the Mittelstand) (2022a) proposes a headcount higher than 50 and lower than 500 due to idiosyncratic structures of German SMEs. Both consider medium-sized companies to have annual sales between € 10 million and € 50 million and apply the same boundaries to micro-sized (<10 employees, < € 2 million annual sales) and small-sized companies (<50 employees, < € 10 million annual sales).

This study employs *purposive sampling* to identify appropriate cases, so companies and interview partners are selected because they are best situated to give insights into the research question (McGregor, 2018). Therefore, the following criteria are considered for the selection of the cases:

1. The company is active in the building systems sector (HVAC; lighting; power; security; fire and life safety; building automation and intelligence; data, video, and audio communications).

2. The company is an SME according to the definition by the Institut für Mittelstandsforschung.
3. The company is an incumbent (i.e. “a firm which is already in position in a market” (Oxford Reference, n.d.)).
4. The company is headquartered in Germany.
5. The company has taken the first steps towards the DT of its BM (based on publicly available information, for instance, prior digitalization of business processes, integration into or development of a digital platform, adding digital services to products, introducing digital value propositions, establishing new ways of value capture, using digital channels to reach out to customers).
6. The company’s representative (i.e. the interviewee) is in a position to give valuable insights (responsibility for or participating in the DT of the BM).

Potential cases were selected making use of company databases, information from industry associations and prior recipients of awards such as the TOP 100 competition which evaluates companies’ innovation management and innovation successes in the context of the German Mittelstand (including SMEs) (compamedia GmbH, 2022). In addition, companies from the professional network of the researcher were contacted. A research brief was shared with each potential interviewee which included background information on the research and organizational details such as exemplary questions and general conditions of the interview process.

3.3. Data Collection and Analysis

Interviews are among the most relevant sources of case study evidence. However, it is also recommended to use different sources of evidence to allow for data triangulation (Yin, 2018). Therefore, the *data collection* considered secondary data which was obtained via publicly available sources in addition to the conduction of a *semi-structured interview* for each case to increase construct validity. Semi-structured interviews were chosen based on their suitability for eliciting insights in the context of exploratory research questions (Cassell, 2015).

An *interview guideline* was prepared which is aligned with the findings from the literature review and structured according to the proposed conceptual model. The guideline includes prepared questions and prompts which can be used to clarify unclear questions. The preparation of the interview guideline also followed suggestions by Cassell (2015) to pay special attention to opening questions which are designed in a way “to ease the interviewee into the interview” (Cassell, 2015, p. 30) as well as to the finishing of the interview. This should be used to explain the further proceedings to the interviewee, thank them for their participation and fill in demographic information which is relevant to the research context, if not previously obtained through the desk research. The interview guideline in English can be found in Appendix 1.

All interviews were conducted in German because of the researcher’s prior experience of an insufficient proficiency in English in the context of German SMEs. Furthermore, this allowed the identification of context-specific terminology. In total, four interviews were conducted between March 8 and March 24, 2022. All interviews took place in the format of video calls and the duration of interviews ranged from 55 minutes to 75 minutes. The general procedure was the same for all interviews. During the introductory phase, a common understanding of the topic was established and interviewees were invited to talk about their own experiences and vision of the DT of the BM. The main part of the interview dealt with the expected challenges regarding the conceptual model. The

wrap-up was used to reveal the most relevant issues and to explain the subsequent procedure to the interviewee. An overview of the conducted interviews is provided in Table 11.

Table 11. Overview interviews

Company information		Interview information			
Pseudonym	Size	Role of interviewee	Setting	Date	Duration
Fire Protection Co	Medium	Business Development Manager for establishing a new business unit	Video call	08.03.2022	60 minutes
Building Automation Co	Medium	Head of Sales & Marketing	Video call	17.03.2022	55 minutes
Lighting Co	Medium	Chief Technology Officer (CTO)	Video call	22.03.2022	65 minutes
Cooling Co	Medium	Business Development Manager for establishing a new business unit	Video call	24.03.2022	75 minutes

Ethical principles were enforced before, during and after data collection. Before the interviews, information on the research background, topic and type of questions was shared. All interviewees participated voluntarily. In order to ensure data privacy of the interviewees and confidentiality, all data which was gathered from secondary sources and the semi-structured interviews was anonymized before transcription. The case companies have been given pseudonyms that fit the value proposition which generates the most revenue at the moment.

The semi-structured interviews were transcribed in a clean-read format as suggested by Mayring (2014). The transcripts were then transferred to the software MAXQDA to perform a *qualitative content analysis*. Each case was analyzed on its own before all cases were comparatively analyzed. During the comparative data analysis, deductive category assignment was employed in the coding process (Mayring, 2014). The contextual elements and steps of the conceptual model formed the basis for the fundamental structuring dimensions. The coding was done in German to avoid loss of information because of unclear translations. Relevant quotes which are cited in this thesis were translated into English.

In conclusion, the expected outcome of following this research methodology is the validation of the proposed conceptual model for the DT of incumbent SMEs' BMs. Additionally, insights on the usefulness and challenges in applying the conceptual model might be gained. Recommendations that are formulated based on the findings of the empirical research could serve as best practices to incumbent SMEs facing the DT of their BMs.

4. Findings of the Empirical Research for Validating the Conceptual Model for the DT of Incumbent SMEs' BMs

In this chapter, an overview of the case companies is given and each case is presented on its own before a comparative analysis of all cases is conducted. Recommendations for the DT of incumbent SMEs' BMs are derived. The conceptual model is validated and adapted and theoretical and managerial implications, as well as limitations, are discussed.

4.1. Introduction of the Case Companies and the State of the DT of their BMs

Table 12 introduces the case companies and their respective circumstances. Each of the cases will be presented in more detail in the following sub-chapters, focusing on the interviewees' understanding of what the DT of the BM encompasses, the companies' activities and the biggest challenges they perceive in this regard.

Table 12. Overview case companies

Company	Size (Number of employees)	Age	Ownership	Management	Status DT of the BM	Type of customer relations
Fire Protection Co	Medium (< 250)	ca. 50 years	Family-owned	Family-managed	Digitalization of processes; digitalization of value delivery	B2B (OEM)
Building Automation Co	Medium (< 250)	ca. 40 years	40% family-owned, 60% private equity	Professionally managed	Digitalization of processes; digitalization of value delivery Considering the introduction of its own online shop	B2B (wholesale) B2C (wholesale and online marketplaces)
Lighting Co	Medium (< 250)	ca. 50 years	Family-owned	Family-managed	Exploring digital BM based on digital value proposition for predictive maintenance	B2B (mainly project business)
Cooling Co	Medium (< 500)	ca. 70 years	Family-owned	Family-managed	Exploring digital BM based on digital value proposition for Industry 4.0	B2B (OEM & project business)

4.1.1. Fire Protection Co

Fire Protection Co is a medium-sized company that develops, manufactures and sells thermally triggered glass ampoules for automatic sprinklers. Its headquarters are situated in Germany and it has several other locations worldwide. The company has been active for over 50 years and is the global market leader for solutions that detect and extinguish fires at an early stage. Fire Protection Co generates most of its revenue by serving Original Equipment Manufacturers (OEMs) which integrate the so-called sprinkler bulbs into their sprinkler systems from various industries, such as commercial and domestic buildings or automotive, marine and rail systems. In the past years, building on the development of a new solution that can be directly integrated into electrical devices which are prone to catch fire easily, Fire Protection Co has invested in the commercialization of this invention and is

working on establishing a new business unit which was also accompanied by changes to the existing BM. The interview has been conducted with the Business Development Manager who is responsible for this endeavor.

According to the interviewee's understanding, a BM "has an internal and external relationship and also sales aspects, that means how do I sell a product, a service". Regarding the digital BM, the interviewee gave the example of providing information and consultancy to customers by digital means, so "that maybe you don't need an entire tier in three-tier distribution anymore, but [...] you sell directly" (Fire Protection Co_Interview, Pos. 4). So far, Fire Protection Co digitally transformed aspects of its BM, including reaching out to potential customers through digital channels, introducing an ERP system, automizing invoice processes and taking data-driven decisions (Fire Protection Co_Interview, Pos. 6). During these transformative steps, Fire Protection Co went through a "classic change curve" (Fire Protection Co_Interview, Pos. 8). The interviewee found it difficult to assess Fire Protection Co's progress versus their competitors, stating that "we swim along quite well for our size" (Fire Protection Co_Interview, Pos. 12).

The two biggest challenges the interviewee experienced were connected to "culture" and "management support" (Fire Protection Co_Interview, Pos. 107). With regard to culture, they saw a necessity to answer the question "What's in it for me?" (Fire Protection Co_Interview, Pos. 62) for everyone involved in order to overcome "sensitivities" and "get everyone on board" (Fire Protection Co_Interview, Pos. 18). The issues around management support were multifold. On a strategic level, the DT of the BM would need to be "anchored in the overall strategy" (Fire Protection Co_Interview, Pos. 28). When it comes to implementing the strategy, assigning responsibility (Fire Protection Co_Interview, Pos. 30), but also allowing the responsible person to "pull [people] out of their daily business [...]" (Fire Protection Co_Interview, Pos. 42) to actively engage in digital BMI were key.

4.1.2. Building Automation Co

Building Automation Co is a medium-sized company that develops, manufactures and sells various products for building automation. Its production and administration are located in Germany and so far, it has mainly been active in the German-speaking market. Recently, the company has relaunched its website and modernized its branding. Building Automation Co was founded in the early 1980s and was active in the production of random access memories before shifting entirely to the development, production and marketing of products for building automation products in the late 2000s. The company has "a vertical range of manufacture of 97 %" and is "fully made in Germany". They offer around 300 products in three main categories, "sensors, that is [...] pushbutton interfaces, pushbuttons and so on, actuators, [that is] everything that is installed in the control cabinet [...] [and] system devices to maintain and ensure the operation of the system accordingly". Building Automation Co's core issues for the future include "growth, of course, but above all professionalization of structures, digitalization and internationalization" (Building Automation Co_Interview, Pos. 2). The interview has been conducted with the Head of Sales and Marketing who is a member of the management.

The interviewee's understanding of the DT of the BM focused on "how can we create efficiency along our value chain?" in order to "outsource certain repetitive activities and use intelligence [...] without needing manpower" next to "eliminating errors" and "getting better". They further emphasized the importance of considering the entire value chain because focusing only on "individual

blocks would still result in manual input on the one hand and manual output on the other” (Building Automation Co_Interview, Pos. 6). Recently, the company has modernized its brand, including the launch of a new web design, and is at the starting point of the DT of their BM: “We come from nothing. There is Excel and that’s it.” However, Building Automation Co has recognized the necessity to digitally transform their BM and is working on three strategic initiatives right now. When it comes to the selling process, the company is “currently implementing a solution for marketing automation” for the entire sales funnel from lead generation to the after-sales service to create “a 360 degree view” of the customer which enables every touchpoint within the company to “know exactly how to deal with them”. In parallel, Building Automation Co is implementing a Product Information System that is supposed to serve as a “single source of truth” for all product-related topics in the future, for instance up-to-date information on the website. Last but not least, the company is introducing Electronic Data Interchange (EDI) to enable “digital data transfer with our customers” (Building Automation Co_Interview, Pos. 8). The interviewee estimated that the current transformation efforts would take up to “three, four years” until full realization (Building Automation Co_Interview, Pos. 16) and could enable them to “perhaps even be one or two steps ahead of the large companies” (Building Automation Co_Interview, Pos. 10). They remarked that the industry is “archconservative and [...] no one is really doing anything” regarding the DT of the BM (Building Automation Co_Interview, Pos. 26).

The interviewee perceived the biggest challenges in the applicability of the conceptual model “in the front part” (Building Automation Co_Interview, Pos. 60), especially the question of “what to digitalize”. In Building Automation Co’s case, describing existing processes in the BM and redefining them was key because “if you have something that doesn’t work today and you digitalize it, it won’t work tomorrow either” (Building Automation Co_Interview, Pos. 14). They also missed the link between the analysis of the initial situation including the description of existing processes and “the new target state” (Building Automation Co_Interview, Pos. 58). They put particular emphasis on “where to find new business models” (Building Automation Co_Interview, Pos. 60). The interviewee raised other challenges connected to the explicit “description of the new business model” and “how this goes through the organization”. The change process was closely connected to this according to the interviewee, for instance how to deal with employees so “that you take away their fear that jobs will be lost due to digitalization” (Building Automation Co_Interview, Pos. 64).

4.1.3. Lighting Co

Lighting Co is a medium-sized company that develops and sells luminaires for retailers, for instance supermarkets, and devices for cleaning air, for example for gastronomy, artisanal and industrial food production. It has been active for more than 50 years and is family-owned and -managed. Its products are manufactured by subcontractors. The company’s headquarters are located in Germany and it markets its products and solutions worldwide. Lighting Co has developed luminaires that enable predictive maintenance and partnered up with a platform provider. Currently, Lighting Co has installed the system at pilot customers’ sites and is gathering data to determine the right model for monetization. The interviewee is the CTO of Lighting Co and is responsible for BMI next to the general research and development activities.

For the interviewee, the DT of the BM aims to “create an additional benefit around the hardware, which then also translates into monetary gains”. This might not only be accomplished by “offering additional services” (Lighting Co_Interview, Pos. 4), but the interviewee also emphasized that “the

digital business model begins where I start adding value with additional information and, if necessary, with the analysis [...] and processing of the information” (Lighting Co_Interview, Pos. 6), which is in line with the previously established definition of a digital BM. Lighting Co has started exploring the DT of their BM by building a system “which is able to generate additional data from the store based on the existing data of the luminaire itself”, with the objective to “first introduce predictive maintenance” (Lighting Co_Interview, Pos. 10). Although they have implemented the system at a pilot customer, the interviewee finds it hard to evaluate Lighting Co’s position versus their competitors, stating that they knew of “two, three providers who are working on similar systems. Maybe we’re in fourth, fifth place right now? I don’t know. But I would still say that we are relatively far ahead” (Lighting Co_Interview, Pos. 16).

One of the biggest challenges regarding the DT of Lighting Co’s BM is “the willingness of their own employees to change” (Lighting Co_Interview, Pos. 108). The interviewee gave the example of sales employees who need to “see that a service can also have a monetary value and not just the piece of hardware that I hand over to you” (Lighting Co_Interview, Pos. 24). With regard to the new digital BM, a specific issue Lighting Co is working on at the moment is the revenue model, that is how to “quantify the added value for the customer” (Lighting Co_Interview, Pos. 36). Last, but not least, limited internal knowledge, for instance of cloud systems or data analytics, necessitated the inclusion of “consultants and external partners” (Lighting Co_Interview, Pos. 66).

4.1.4. Cooling Co

Cooling Co is a medium-sized company that develops, manufactures and sells components and system solutions for control cabinet air conditioning as well as for optical and acoustic warning and emergency signaling. The company has existed for more than 70 years and is still family-owned as well as managed. Its headquarters are in Germany and it has several other locations worldwide. Cooling Co can be considered to be part of the “old economy [...], so everything is hardware”, and generates “70 to 80% of its revenue” from cooling units (Cooling Co_Interview, Pos. 5). When Cooling Co itself dealt with the topic of Industry 4.0, they developed a solution that gathers data generated within production, for example by different machines and assembling cells, and analyzes it with the objective to improve process efficiency and reduce cost. The interview has been conducted with the Business Development Manager who was hired three years ago to drive the commercialization of this new solution and also explore a digital BM in this context.

The interviewee described the DT of the BM as “taking something that exists and extending or replacing that with a function or a capability that can be mapped digitally [...] so that you can generate new revenue streams by selling data” (Cooling Co_Interview, Pos. 9). Cooling Co is exploring such a digital BM in the context of a new value proposition in their signaling portfolio for machines. Normally, these visual signaling devices indicate the status of machines or assembling cells in a production environment, similar to a traffic light. The interviewee explained how Cooling Co thought about “gathering that information” and cooperated with a startup that developed an operating system “for managing and handling industrial data”. At that point, the interviewee was hired “to drive the whole thing forward and make it ready for the market”, cooperating closely with the startup and other external service providers and distinct from Cooling Co’s core business. The value proposition consisting of the hardware product and software for displaying real-time status and historical data was launched in 2020 (Cooling Co_Interview, Pos. 5). The interviewee estimates that “the company

is not in a bad position compared to its direct competitors and in view of its size ” (Cooling Co_Interview, Pos. 19).

On the one hand, “gathering information” from internal and external sources is a major challenge for Cooling Co. The interviewee stated that having insights about “the customers, about the field, about the industry, about your competitors, about your customers’ competitors” is crucial, next to having “transparency in the company” in order to assess strengths and weaknesses as well as opportunities and risks. On the other hand, they said that “it’s no use if someone who has nothing to say” is in charge of the DT of the BM because it has to be considered in the company’s strategic management to be successful (Cooling Co_Interview, Pos. 83).

4.2. Comparative Analysis of the Main Elements of the Conceptual Model

In the following, the similarities and differences between the cases will be analyzed following the contextual elements and steps of the conceptual model. The sub-categories of each category will be formulated as lessons learned which reflect on the challenges and issues raised by the interviewees.

4.2.1. Contextual Elements

The contextual elements of the conceptual model include key drivers, the strategic plan (mission & vision, objectives and strategy) and the outcome. Next to these elements which form categories for the coding, two other elements have been identified during the comparative analysis of the cases: strategic leadership and the digital BMI process.

Table 13. Selected extractions for the category key drivers

Sub-category	Quotes
Emergence of digital technologies	“Supply creates demand when I hear about something and realize, ah okay, that could be interesting for us [...] you gain knowledge externally about digital possibilities that you might not have thought of yourself before” (Fire Protection Co_Interview, Pos. 24)
	“Since the technology offers additional options at this point, there is more or less a trigger to think more about it” (Lighting Co_Interview, Pos. 32)
	“the company also has another product portfolio, signal transmitters [...] at some point, they thought it would be cool to collect this information” (Cooling Co_Interview, Pos. 5)
Changes in the competitive landscape	“Sales decrease, sales slow down [...] competitors do things differently” (Fire Protection Co_Interview, Pos. 22)
	“I know of two or three competitors who are working on similar systems” (Lighting Co_Interview, Pos. 16)
	“tough competition, the price war in the segment we are in. [...] we’re in the middle of a red ocean and have to somehow get our sails into the blue one [...] we are now in a saturation” (Lighting Co_Interview, Pos. 32)
Changes in the customer behavior	“Mittelstand is well connected. [...] it is also the network where you get to know things” “one of the biggest triggers, which is also often a bit distorting, is of course trade fairs” “this peer pressure of ‘the industry is moving in that direction’, I think it’s quite strong” (Cooling Co_Interview, Pos. 37)
	“Customers point this out to you” (Fire Protection Co_Interview, Pos. 22)
	“The only trigger I sense is actually from our electrical wholesaler who wants EDI, i.e. electronic data interchange” (Building Automation Co_Interview, Pos. 12)
	“Information that you get from your own sales department. It’s quite clear when someone says, this customer has now converted everything to digital and they no longer walk through the hall and

	maintain their equipment, but they just look at the computer. These are, of course, signals that one notices” (Cooling Co_Interview, Pos. 37)
Intrinsic motivation	<p>“not sure if external triggers are the only ones. I could also very well imagine that internally an intrinsic motivation of employees demands this transformation, because of an overload of work and the desire to reduce the workload and increase efficiency” (Fire Protection Co_Interview, Pos. 22)</p> <p>“The challenge is rather how to take advantage of digital solutions [...] to meet a bottleneck of my person” (Fire Protection Co_Interview, Pos. 84)</p>
	<p>“I look at [external triggers] a bit critically [...] just because someone does something and talks about it as a trend doesn’t mean it’s a trend. We started from the internal and external triggers [...] are and were irrelevant for us” (Building Automation Co_Interview, Pos. 24)</p> <p>“How can [digital transformation of the business model] help us to outsource certain repetitive activities and to simply use intelligence or digitalization for them, without needing manpower? [...] To eliminate errors, to become better. And to become more efficient or effective” (Building Automation Co_Interview, Pos. 6)</p>

The three *key drivers* (see Table 13) which were proposed in the original conceptual model were all recognized during the interviews. Lighting Co and Cooling Co in particular pointed out the importance of being triggered by the opportunities *emerging digital technologies* offer for digital BMs. In Lighting Co’s case, operating in a saturated red ocean (see sub-category *changes in the competitive landscape*) was another reason to actively pursue the DT of the BM. Cooling Co perceived these developments as peer pressure and potentially distorting. They also noticed signals from their sales department regarding *changes in the customer behavior*. In contrast to this, both Fire Protection Co and Building Automation Co stated that their activities for the DT of their BM were mainly driven by *intrinsic motivation*. Fire Protection stated that the DT of the BM could benefit employees who face a high workload while Building Automation Co wanted to increase efficiency and effectiveness.

Table 14. Selected extractions for category strategic plan

Sub-category	Quotes
Formulate mission & vision	“Mission and vision. That’s always key for me as well. To have that and really have it, rather than just having it written down” (Fire Protection Co_Interview, Pos. 104)
	“We also have a mission, a vision” (Building Automation Co_Interview, Pos. 28)
	“Mission and commitment: The careful use of energy is the challenge of our time. Lighting Co always focuses on factors such as environmental compatibility, energy conservation and energy cost reduction in the development, production and operation of its products” (Lighting Co_Website, Pos. 2)
Define objectives that use DT of the BM as a means to an end	“In our company we work in a goal-driven manner in any case. Deriving the strategy is then often easier” (Fire Protection Co_Interview, Pos. 105)
	“We also have [...] our goals or what we want to achieve, until when” (Building Automation Co_Interview, Pos. 28)
	“not just digitalizing for the sake of digitalizing” (Building Automation Co_Interview, Pos. 14)
	“at this point, digital transformation is [...] the engine that simply makes the whole business safer and less error-prone” (Lighting Co_Interview, Pos. 14)
	“We had to present the need [for the digital transformation of the business model]” (Lighting Co_Interview, Pos. 36)
	<p>“The purpose of a strategy is to reach a goal [...] I still see digital transformation as a tool” (Cooling Co_Interview, Pos. 39)</p> <p>“The goals changed over time. And that’s also [what] made this project so difficult in the end” (Cooling Co_Interview, Pos. 41)</p>

Derive strategy for DT of the BM from objectives	“[It is a challenge] that it is first of all anchored in the overall strategy [...] That certainly depends on who is at the center of power” (Fire Protection Co_Interview, Pos. 28)
	“We have a three-year plan [...] now you can talk about strategy here because it is [...] anchored there [...] it’s not anchored as the digital transformation of the business model, but really as concrete projects” (Building Automation Co_Interview, Pos. 28)
	“It is challenging for many [other SMEs] to anchor this topic in the strategy” (Building Automation Co_Interview, Pos. 60)
	“Fortunately, in the Mittelstand, the distances are incredibly short [...] I can simply call my colleague from sales management and say that we need to [...] come up with a new strategy” (Lighting Co_Interview, item 42)
	“A lot comes out of the strategy. That is, you have to formulate it in the strategy as well” (Cooling Co_Interview, Pos. 83)

All four companies confirmed the importance of considering the DT of the BM in the strategic plan (see Table 14). Every company except for Cooling Co mentioned having *formulated a mission and vision*, although currently, they did not seem to particularly drive the DT of the BM. All companies were acting in a goal-oriented manner. Building Automation Co, Lighting Co and Cooling Co emphasized that the objective was not to digitally transform the BM, but to reach a specific goal through this transformation (see sub-category *define objectives that use DT of the BM as a means to an end*). Cooling Co faced the issue of changing goals when exploring a new digital BM. Regarding *deriving a strategy for the DT of the BM from the objectives*, Fire Protection Co indicated that it was a challenge to “anchor” the DT of the BM in the strategy and also depended on the “center of power”. For Building Automation Co and Lighting Co, formulating the strategy was easier. In Building Automation Co’s case, the strategic initiatives connected to the DT of the BM are described as “concrete projects” in a three-year plan.

Table 15. Selected extractions for category strategic leadership

Develop digital vision	“Does this person even have the knowledge, the ambition and also the vision to prioritize the topic of digital transformation?” (Fire Protection Co_Interview, Pos. 28)
	“There is no one with digital know-how. I have to work that out on my own” (Building Automation Co_Interview, item 42)
	“We simply have an innovative and technology-enthusiastic managing director who is quite prepared to take a bit of a risk at first” (Lighting Co_Interview, Pos. 36)
	“When something like this is initiated, it comes from the management in a company, as is the case with Cooling Co” (Cooling Co_interview, Pos. 37) “very important to clarify to also determine motivation among employees [...] how do I want to earn money in five, ten or 15 years [...] I would say creativity and visionary thinking are definitely part of it. Also a good dose of courage” (Cooling Co_Interview, Pos. 39) “Where do I want to go? Do I want to stick to simply creating a network of signaling devices? Or do I want to be the one who enables my customers [...] to exchange data back and forth, to be efficient?” (Cooling Co_Interview, Pos. 41) “You need a clear vision of where you want to go, but you also need certain freedoms. And there, for example, also the freedom to perhaps move away from the business model with which you are currently earning money” (Cooling Co_Interview, Pos. 49)
Support digital BMI and assign responsibility	“who is in the lead, which department or person or group is taking on this issue, that is at least being accountable for it?” (Fire Protection Co_Interview, Pos. 30)
	“to have the permission to [...] pull [people] out of their daily business” (Fire Protection Co_Interview, Pos. 42)”
	“That might be one thing I would add to the conceptual model, without management support it’s not going anywhere” (Fire Protection Co_Interview, Pos. 105)

	<p>“[I] was not integrated into the core business. It was also relatively difficult to access resources from the core business” (Cooling Co_Interview, Pos. 5)</p> <p>“that’s also where things got stuck in the end. I was responsible for this” (Cooling Co_Interview, Pos. 21)</p> <p>“[Product Managers] were busy with operational activities from the core business and [...] not in the mindset at all” (Cooling Co_Interview, Pos. 51)</p> <p>“Then, of course, you have to set up the process properly. So it’s no use if somehow someone who has nothing to say is responsible for the implementation” (Cooling Co_Interview, Pos. 83)</p>
Establish culture of leading the change	<p>“We then went through the classic change process [...] from first ‘we can’t do this’ through a ‘valley of tears’ until hopefully at some point you realize that change can also have positive aspects” (Fire Protection Co_Interview, Pos. 8)</p> <p>“There is, of course, the larger perspective of the boss or the managing director and then it only works when [...] it is intrinsically motivating for me in my position” (Fire Protection Co_Interview, Pos. 64)</p> <p>“I would expand the model to include ‘accepted or encouraged by culture’” (Fire Protection Co_Interview, Pos. 107)</p>
	<p>“This will be a painful change process, because of course we have to pull the team along” (Building Automation Co_Interview, Pos. 10)</p> <p>“Above all, you have to take the team with you in such a way that you take away their fear that jobs will be lost” (Building Automation Co_Interview, Pos. 64)</p> <p>“Every employee [...] is involved in small subgroups during implementation and is allowed to give their input. In other words, the framework is defined, but every employee who works with the system afterwards can contribute his or her ideas. I hope that this will lead to greater acceptance right from the start” (Building Automation Co_Interview, Pos. 66)</p>
	<p>“How open to change is my workforce? That is, I think, the biggest hurdle in the matter and change affinity to the point of fear for jobs, etc.” (Lighting Co_Interview, Pos. 48)</p>
	<p>“in order to survive as a company like Cooling Co, you have to train all your employees in what digitalization means [...] It’s no use if you have the best product managers in the world and then somewhere another staff unit is taking care of the digital transformation of the business model and telling the others how to do it and how not to do it. You simply have to teach them that this is something they now have to consider” (Cooling Co_Interview, Pos. 23)</p>

All companies talked about challenges on a strategic level which were connected to the necessity to develop a digital vision, support digital BMI and assign responsibility, and, most importantly, establish a culture for change. Therefore, the category *strategic leadership* (see Table 15) was introduced. *Developing a digital vision* is the responsibility of the management as pointed out by Cooling Co. Building Automation Co talked about the challenge of a lack of digital knowledge for this task, which was also reflected by Fire Protection Co. Lighting Co and Cooling Co established the importance of the management being ambitious and courageous as well as willing to experiment and take risks. Cooling Co in particular focused on having a long-term vision of the future company, but also indicated that this vision should not be too narrow and allow for “certain freedoms” to move away from the existing BM in the future. Fire Protection Co and Cooling Co faced challenges when it came to the management *supporting digital BMI and assigning responsibility*. While in Fire Protection’s case, accountability was unclear and the necessity of management support was emphasized strongly, in Cooling Co’s case it was difficult for the interviewee to access resources from the core business although they had been given responsibility for the exploration of a new digital BM, which might also be due to their position as they were directly reporting to, but not a member of the management. All companies recognized the need to *establish a culture of leading the change*, which was also perceived to be one of the biggest challenges by Fire Protection Co, Building Automation Co and Lighting Co. Building Automation Co introduced the initiative of involving all

employees during the implementation phase to counter this issue. For Cooling Co, the challenge is to train employees in matters connected to the DT of the BM.

Table 16. Selected extractions for category digital BMI process

Sub-category	Quotes
Take incremental steps and prioritize	“We are not an online corporation that has had a digital concept from the very beginning. I think we will develop aspects further” (Fire Protection Co_Interview, Pos. 6)
	“We set up the implementation in phases [...] Another learning from the past: We don’t need everything at the start, but rather we start with two or three small steps, then we involve the team, then we do the next two or three steps, get the team involved again, the next two or three steps, and so on” (Building Automation Co_Interview, Pos. 16)
	“For us, this is a revolution. But I’d say that to the outside world, I see it more as an evolution” (Building Automation Co_Interview, Pos. 26)
	“so that we, as a medium-sized company, don’t somehow take three steps at once. You have to be able to manage that, to have the organization” (Lighting Co_Interview, Pos. 12) “What do you prioritize? We can’t do everything at once. That’s one of the key issues” (Lighting Co_Interview, Pos. 84)
Iterate and adapt strategy	“Floating specs. Just because I have written a specification does not mean that we have to go through it one-to-one, but: Fail fast and learn faster [...] we have to iteratively look at where we actually want to go” (Fire Protection Co_Interview, Pos. 18)
	“There is an impulse [which] brings about a transformation, and then again triggers a larger thought process that results in a strategy [...] first the strategy and then the transformation, although it goes hand in hand and it is not linear, but always iterative” (Fire Protection Co_Interview, Pos. 34)
	“I need a basic idea of the business model. It doesn’t have to be polished yet, so that I can then use the strategy to see where I’m going, and then finalize it. So a little bit iterative” (Lighting Co_Interview, Pos. 40)
	“that the technology iteratively affects the business model again. So if I discover things during the doing that I can now offer in addition, then the question arises again as to whether the business model, as it is conceived, is the best” (Lighting Co_Interview, Pos. 118)
	“you just need these iterations, you need quick changes [...] especially in business areas that are still unknown and where not so much is established” (Cooling Co_Interview, Pos. 29)
	“you may find out something about the digital platform or the business model that you haven’t described before [...] You certainly have to do a loop back beforehand and check again, is this the case with the business model that we have now come up with?” (Cooling Co_Interview, Pos. 85)

The category *digital BMI process* (see Table 16) was introduced because all companies experienced the DT of their BM in a non-linear way. Fire Protection Co, Building Automation Co and Lighting Co saw a necessity to *take incremental steps and prioritize* because of a low level of digital maturity and lack of resources. Building Automation Co is adapting its existing BM in phases and involves the team after each step. For Lighting Co, one of the key issues is to prioritize the right initiatives. In a similar vein, during the DT of the BM, Incumbent SMEs need to *iterate and adapt their strategy*, as described by Fire Protection Co, Lighting Co and Cooling Co. For instance, Lighting Co reflected on shorter technological cycles which might require changes in the new BM.

Table 17. Selected extractions for category outcome of digital BMI

Sub-category	Quotes
Develop digital branding	“The more you digitalize, the more you are perceived that way. In other words, the more you do there, with digital touchpoints, the more you are associated with digital” (Building Automation Co_Interview, Pos. 56)

	“you have a marketing story. That must not be completely disregarded. Because storytelling is, of course, also a pound of gold for us in the shark tank of the red ocean; you present yourself in an innovative way” (Lighting Co_Interview, Pos. 106)
Intensify customer centricity	“Our motivation is rather to generate more customer satisfaction and loyalty” (Building Automation Co_Interview, Pos. 56)
	“I achieve an enormously high level of customer loyalty in reverse. This means that I constantly learn from the customer’s data what the behavior in the store is like and can draw conclusions from this” (Lighting Co_Interview, Pos. 104)
Ensure profitable growth	“Definitely [see growth opportunities]” (Fire Protection Co_Interview, Pos. 98)
	“to increase our market share” (Building Automation Co_Interview, Pos. 56)
	“added values, which can of course also be monetized” (Lighting Co_Interview, Pos. 106)
	“what’s the point of being a digital company with the greatest digital products, which is not profitable at all and I’ll be broke in a year?” (Cooling Co_Interview, Pos. 39)
Continuously sustain competitive advantage	“what we gain as a result can develop into a sustainable competitive advantage [...] also a question of time. I believe it depends on the analysis at the beginning, also to say how valuable is the competitive advantage that I am currently developing” (Fire Protection Co_Interview, Pos. 96)
	“The competitive advantage is only sustainable if I actively continue to work on it all the time. If I go through this process once and perhaps launch a cool product on the market and then maintain it, then this sustainable competitive advantage, depending on how fast my competitors are, how quickly the world changes, can be gone again relatively quickly” (Cooling Co_Interview, Pos. 81)

Regarding the *outcome of digital BMI* (see Table 17), for Building Automation Co and Lighting Co the DT of the BM could result in *developing a digital branding* by being associated with digital innovations as well as *intensifying customer centricity* through either improving the customer experience or even acting on data obtained from the customer. All companies saw an opportunity for growth, although Cooling Co raised the issue of profitability. Therefore, *ensuring profitable growth* from a long-term perspective seems to be key. Last but not least, both Fire Protection Co and Cooling Co saw the challenge of *continuously sustaining the competitive advantage*, stating that it was a question of the time frame in scope as well as dependent on changes in the company’s environment.

4.2.2. Analysis of the Initial Situation

The analysis of the initial situation encompasses mapping the existing BM, internal factors and external factors.

Table 18. Selected extractions for category mapping the existing BM

Sub-category	Quotes
Define processes	“if you digitalize a crap process, [you] just have a crap digitalized process” (Building Automation Co_Interview, Pos. 12)
	“It was really painful because you have to get people to say ‘let’s map out the process’. How do we do it today, how do we do it tomorrow? What is the desired actual state for us? So, I can see that this is a real challenge [...] This was a real issue for us because many of our structures had grown over time” (Building Automation Co_Interview, Pos. 32)
	“you simply do top-down [...] because you don’t have all these political games [compared to a large company]” (Building Automation Co_Interview, Pos. 38)
	“digitalizing a crappy process leads to a digital crappy process” (Cooling Co_Interview, Pos. 27)
Analyze existing BM	“Analysis of the existing business model is feasible” (Fire Protection Co_Interview, Pos. 38)
	“You have to be aware of your own business model” (Fire Protection Co_Interview, Pos. 62)

	“You have to be clear about your own business model first” (Building Automation Co_Interview, Pos. 12)
	“I don’t see any challenge regarding what our business model is, we have already outlined that pretty clearly” (Lighting Co_Interview, Pos. 44)
	“If that’s where companies fail, then they don’t even need to start with digital. So if they don’t even understand their existing business, I don’t think they’ll be able to understand a new business they’re not in. To put it so provocatively. Therefore, this is a compelling must-have and certainly a good point for many to consider: How exactly does my business model work?” (Cooling Co_Interview, Pos. 47)

In the context of *mapping the existing BM* (see Table 18), all companies agreed that *analyzing the existing BM* is necessary to even consider the DT of the BM. While Fire Protection Co and Lighting Co saw no specific challenge in doing this, Cooling Co and Building Automation Co stressed the importance of *defining processes* before further proceeding. Building Automation in particular had to overcome the barrier imposed by old structures. This was given management attention, so although the exercise itself was painful, the company successfully moved through it.

Table 19. Selected extractions for category internal factors

Sub-category	Quotes
Manage financial limitations and resource constraints	“Where you don’t have the people” (Fire Protection Co_Interview, Pos. 18) “financial resource to buy time by hiring employees who then dedicate themselves to this topic. [...] So I believe that the company is prepared to take on this investment because of its own financial situation and strategic orientation” (Fire Protection Co_Interview, Pos. 100)
	“You don’t get positions like [Chief Digital Officers] in the Mittelstand because you can’t afford it. It’s the question, okay, is it worth the investment” (Building Automation Co_Interview, Pos. 18)
	“Of course, only limited resources of financial capital are available to medium-sized companies. And of course, you have to be extremely careful with that because you have to show the return on investment somewhere” (Lighting Co_Interview, Pos. 62) “That we afford a software engineer who essentially acts as a project manager, that’s venture capital for us” (Lighting Co_Interview, Pos. 132)
	“We don’t have anyone who is a dedicated, I’ll say, chief digital officer or who just takes care of that kind of thing” (Cooling Co_Interview, Pos. 21) “If you have a dedicated team, that needs to be made available with sufficient resources, including monetary” (Cooling Co_Interview, Pos. 49)
Drive agility and intrapreneurship	“Internal factors could be the issue of people, [...] could be the issue of organizational structure” (Fire Protection Co_Interview, Pos. 40)
	“We are simply faster and more agile and tailor the topics to suit our needs” (Building Automation Co_Interview, Pos. 10)
	“for example, a part that I work in an agile way? I think that’s relatively important because in this industry we are still very waterfall-like, project-like” (Cooling Co_Interview, Pos. 29) “Human Resources. You need capable people. You need people who are generally interested in this topic, who are tinkerers, who are up for it, and who get involved” (Cooling Co_Interview, Pos. 49)

Regarding *internal factors* (see Table 19) which need to be considered in the analysis of the initial situation, all companies experienced the need to *manage financial risks and resource constraints* when it comes to the DT of the BM. Building Automation Co and Cooling Co raised the issue of not being able to hire a Chief Digital Officer who takes dedicated care of the DT of the BM. Lighting Co saw the investment into hiring a software engineer for exploring a digital BM as venture capital while Fire Protection Co has taken no such investment yet. By *driving agility and intrapreneurship*, some

of the risks associated with digitally transforming the business could be mitigated. Fire Protection Co, Building Automation Co and Cooling Co talked about organizational structures and that working in an agile way was important. The personal motivation and interest of employees in project teams, according to Cooling Co, were equally as important.

Table 20. Selected extractions for category external factors

Sub-category	Quotes
Identify lead customers	“You have to find the customer. Who has the affinity to pay for it accordingly” (Lighting Co_Interview, Pos. 10) “that’s a market push position. And if you ask me about the difficulties, we’ll have to deal with that somewhere” (Lighting Co_Interview, Pos. 32)
	“if I have a customer who says I need such data points and I would be willing to pay you the money for them, that would be the dream, so to speak, that hardly ever happens in reality. But what helps, of course, is if your customer is also already focused on this topic. Otherwise, that’s the huge difficulty, that you’re back between push and pull” (Cooling Co_Interview, Pos. 53)
Select partners to access digital resources and capabilities	“that’s a good point that I wouldn’t have thought of at first” (Fire Protection Co_Interview, Pos. 48)
	“then it’s just the way it is in medium-sized companies, and this is how we do it: We buy in this capability. Yes, we go further with external partners, because we cannot accomplish it on our own” (Building Automation Co_Interview, Pos. 44)
	“those with whom we are in the closest exchange, of course, are the platform providers” (Lighting Co_Interview, Pos. 54)
	“we may have an IT-savvy project manager, but of course, we don’t have deep expertise in cloud systems. And if you take data analytics: at this point, we are simply dependent on consultants and external partners “(Lighting Co_Interview, Pos. 66)
	“We have engaged experts for the topic of UX design” (Lighting Co_Interview, Pos. 130)
	“I worked quite closely with the start-up [...], also because the skills that this new business model needed were not available sometimes” (Cooling Co_Interview, Pos. 5) “with the digital topic, it’s always going to be like this. You always have resources that are external. You can’t have three or four top programmers as a medium-sized company. At least not today. That will certainly be different in the future” (Cooling Co_Interview, Pos. 29)

Considering *external factors* (see Table 20) that impact the DT of the BM seemed to be more important to Lighting Co and Cooling Co than to the other two companies. Lighting Co and Cooling Co emphasized that *identifying lead customers* was key to overcoming a technology push position. Every company except for Fire Protection Co considered the *selection of partners to access digital resources and capabilities*. Again, Lighting Co and Cooling Co discussed in greater detail which partners were particularly important for them, in Lighting Co’s case platform providers and experts for cloud systems, data analytics and user experience design. Cooling Co worked closely together with a start-up.

4.2.3. Assessment of the Competitive Position in the Initial Situation

The assessment of the competitive position in the initial situation includes a SWOT analysis and validation of the need for digital BMI.

Table 21. Selected extractions for category SWOT analysis

Sub-category	Quotes
Utilize SWOT analysis to	“we are aware of our position and who we are and what we do, where we are strong” (Building Automation Co_Interview, Pos. 40)

align strategy and further transformation	“absolutely not necessary, because you identify what you need. And then you don’t look, do you have the ability. Why? Because you know that’s what I need” (Building Automation Co_Interview, Pos. 44)
	“A SWOT analysis always makes sense to clearly see in which direction I want to go. So that I don’t take a risk in proceeding in this way. So I find it really comprehensible” (Lighting Co_Interview, Pos. 70)
	“transparency in the company is of course also absolutely helpful when it comes to strengths, weaknesses, opportunities, risks” (Cooling Co_Interview, Pos. 83) “what most people have never done properly with SWOT analyses [...] is to take the next step and work out the strategy. It’s always nice when you combine a strength and an opportunity. But what do I do with it? I think people can handle the single step,[because] you already know your strengths and weaknesses” (Cooling Co_Interview, Pos. 57)
Take external perspective	“consulting firms or by consulting with others who have already more knowledge or experience in this area” (Fire Protection Co_Interview, Pos. 32)
	“you have a certain blind eye [... The challenge would certainly be to subject oneself once again to a more objective opinion” (Fire Protection Co_Interview, Pos. 50)
	“The comparison to the outside, we never did that” (Building Automation Co_Interview, Pos. 40)
	“When it comes to opportunities and risks in the digital field, you can of course still get someone from outside to help you look at the bigger picture and see what opportunities you don’t see or what risks there are” (Cooling Co_Interview, Pos. 57)

When it comes to the SWOT analysis (see Table 21), Building Automation Co did not see any value in *utilizing a SWOT analysis to align the strategy and further transformation* whereas the other three companies supported this step. Fire Protection Co and Cooling Co proposed to *take an external perspective* and enlist the help of experts outside the company to assess opportunities and risks.

Table 22. Selected extractions for category validate the need for digital BMI

Sub-category	Quotes
Get customer feedback	“that you don’t develop something bypassing the customer” (Fire Protection Co_Interview, Pos. 56)
	“we may end up lacking customer feedback” (Lighting Co_Interview, Pos. 72)
Communicate the need for DT of the BM to employees	“make this need for this transformation clear to all involved: ‘What’s in it for me?’. What’s in it for me as a production manager if the sales department sets up the business model digitally?” (Fire Protection Co_Interview, Pos. 64)
	“challenge, how do I get my workforce to see this necessity [...] to make this clear and not simply to say: Yes, we are now doing digital transformation. But if it could be really endangering the entire company and the business, then the point must be clearly formulated [...] why the whole thing is being done” (Cooling Co_Interview, Pos. 59)

Validating the need for digital BMI (see Table 22) before entering into the design phase has two dimensions. First, Fire Protection Co and Lighting Co saw the necessity to *get customer feedback* before making investment decisions. Second, at this point, both Fire Protection Co and Cooling Co suggested *communicating the need for DT of the BM to employees* to either convince them of the benefits of this transformation or explain the necessity for the company’s long-term survival.

4.2.4. Designing Alternatives for Digital BM

The design of alternatives for the digital BM can happen along two main dimensions: exploiting the existing BM and exploring a new BM. Digital platforms play a special role in the context of digital BMs and formed the third category in this section.

Table 23. Selected extractions for category exploit existing BM

Sub-category	Quotes
Digitalize processes and elements of the BM	<p>“There will always be digital aspects of a business model from a medium-sized manufacturing company” (Fire Protection Co_Interview, Pos. 6)</p> <p>“We have looked at [using digital platforms to explore a new BM]. And we decided, no, we don’t want to do that. As far as the digital transformation of the business model is concerned, platforms play a role for me in other respects. [...] introducing software [such as an ERP system] could also be a platform [...] If you just have a process that you’re trying to automate, [...] for me it’s more of a process and not a platform. And yet I would still see that as part of the digital transformation of the business model” (Fire Protection Co_Interview, Pos. 80)</p>
	<p>“it is extremely important to look at this along the value chain because I believe that digitizing only individual blocks would still result in manual input on the one hand and manual output on the other, but you have to somehow look at how we can, as best we can, digitalize this topic along the entire chain” (Building Automation Co_Interview, Pos. 6)</p> <p>“We come from nothing. There is Excel” (Building Automation Co_Interview, Pos. 8)</p>
	<p>“We are thinking about putting an online shop on our website. That would be really hardcore – in this industry. Because nobody does that. And we’re still thinking about whether or not to do that” (Building Automation Co_Interview, Pos. 48)</p> <p>“the system on which we are now launching the new website has the option to be extended by an online shop” (Building Automation Co_Interview, Pos. 50)</p>
Prepare for exploration of future digital BM	<p>“Strategically, we now only buy products that are capable of providing these additional functions from the outset” (Lighting Co_Interview, Pos. 36)</p> <p>“to some extent, it is a Trojan horse” (Lighting Co_Interview, Pos. 38)</p>

The efforts Fire Protection Co and Building Automation Co undertook to digitally transform their BM can be categorized as *exploiting the existing BM* (see Table 23). In this sense, both companies aimed to *digitalize processes and elements of the BM*. For Lighting Co, digital platforms only played a minor role while Building Automation Co considered introducing a transaction platform in the form of an online shop. At the stage of exploiting the existing BM, both Building Automation Co and Lighting Co found it important to *prepare for the exploration of a future digital BM* by designing the value proposition in a flexible way that allowed for applying a new BM.

Table 24. Selected extractions for category explore new BM

Sub-category	Quotes
Experiment with new digital BM	<p>“that additional services can be offered around the hardware” (Lighting Co_Interview, Pos. 4)</p> <p>“The digital business model starts where I start adding value with additional information and, if necessary, with the analysis of the information, with the processing of the information” (Lighting Co_Interview, Pos. 6)</p>
	<p>“That you can therefore generate new revenue streams with the sale of data, etc.” (Cooling Co_Interview, Pos. 9)</p> <p>“that one often sells only a service” (Cooling Co_Interview, Pos. 17)</p> <p>“what I was doing. That was clearly exploring a new business model” (Cooling Co_Interview, Pos. 65)</p>
	<p>“I don’t know if I know ten percent of the opportunities that exist or if I’m at over 50” (Fire Protection Co_Interview, Pos. 66)</p> <p>“What are other companies doing well? [...] not reinventing the wheel, but looking at obvious solutions and approaching the topic” (Fire Protection Co_Interview, Pos. 68)</p> <p>“Best practices of companies that appeal to you or that you are also made aware of” (Fire Protection Co_Interview, Pos. 70)</p>
Benchmark best practices within and from outside the industry	<p>“Where do you find new business models?” (Building Automation Co_Interview, Pos. 60)</p>

	<p>“There just aren’t as many best practices to be seen yet” (Lighting Co_Interview, Pos. 116)</p> <p>“We can try to see some core things and somehow build a business model around that. Somehow there are 55 business models” (Lighting Co_Interview, Pos. 78)</p>
	<p>“of course, with all these efficiency products, the coolest thing would be to just say I get a percentage of your efficiency increase. [...] But with our product, it was simply very difficult to measure its impact in the end. And that’s why the possibilities for business models were relatively limited. [...] the exploration of how to solve it was more of a technical nature” (Cooling Co_Interview, Pos. 67)</p>
Prepare the organization for new digital BM	<p>“now I have to somehow convince the sales department of the benefits. That means that the whole thing is working according to a snowball system, and it’s quite difficult to convince people, especially sales colleagues, to make the change” (Lighting Co_Interview, Pos. 18)</p> <p>“There are services everywhere that are given away for free. And in this respect, this company is indeed service-oriented, but still has no feeling for the fact that service must also generate money in any case” (Lighting Co_Interview, Pos. 24)</p>
	<p>“From the company’s point of view, you have to be prepared in terms of financial accounting and generally all the finance things so that we don’t sell any more machines, but rent them out, for example [...] If you rent out the equipment, then you also have to make sure that you always take it back or scrap it. [...] there is a certain process involved when you rent out the equipment” (Cooling Co_Interview, Pos. 17)</p> <p>“you [have to] manage to establish this in the organization and teach it to your sales department, which is an area sales organization anyway. Then you have a chance to really get the message across to customers” (Cooling Co_Interview, Pos. 23)</p>

In contrast to the other two companies, Lighting Co and Cooling Co *explore a new BM* (see Table 24). They are actively *experimenting with a new digital BM*. Although they were not engaged in this activity yet, Fire Protection Co and Building Automation Co confirmed the challenge Lighting Co saw in *benchmarking best practices within and from outside the industry*. Lighting Co mentioned the St. Gallen Business Model Navigator as a potentially helpful tool. Cooling Co’s options to design different digital BMs were limited due to difficulties in measuring the exact efficiency increase customers could obtain through their solution. Another challenge was connected to *preparing the organization for the new digital BM*. Lighting Co experienced a barrier in the mindset of the sales employees who were not yet prepared for selling a digital value proposition encompassing services instead of a physical product. Cooling Co also touched on the importance of adapting internal processes.

Table 25. Selected extractions for category digital platform

Sub-category	Quotes
Integrate third-party digital platforms’ BMs into own digital BM	<p>“the payment models behind [third-party digital platforms] ultimately influence the company’s profitability. At what price can I offer such a business model? And the models are so diverse that it’s difficult to get a clear picture of them in the first step because they are also kept complex” (Lighting Co_Interview, Pos. 86).</p>
	<p>“the platform providers [...] charge a monthly fee. That is, we would not have been able to do a one-time price at all, because we have the monthly license from the start-up whose digital platform we use” (Cooling Co_Interview, Pos. 17)</p>
Build up the foundation for data analytics	<p>“We are in close contact with [data analysts] because at the end of the day they do not only see our business model on its own, but also see it on a somewhat different level for many industries” (Lighting Co_Interview, Pos. 54)</p> <p>“[we had] very little experience at the beginning: What volumes of data are needed? How often do I need [data] retrievals?” (Lighting Co_Interview, Pos. 86)</p> <p>“[Another factor are] the prescribed analysis options. So the pre-made, the pre-programmed ones. If [the platform provider] has to program a new analysis for you, it becomes unaffordable” (Lighting Co_Interview, Pos. 86)</p>

	<p>“There are companies that have no problem at all giving out data. But there are also other companies that won’t give up any data. It’s always relatively easy to say that we collect data from customers, but it’s incredibly difficult, sometimes even technically difficult” (Cooling Co_Interview, Pos. 17)</p> <p>“there is a very secretive mindset and it is certainly also a German thing” (Cooling Co_Interview, Pos. 17)</p>
Secure future operability	<p>“I suspect that [changing the platform provider] will, in any case, involve transformation costs because one thing or another will probably have to be redone” (Lighting Co_Interview, Pos. 90)</p> <p>“[Running our own platform is] not a long-term solution. Why not? Because then I need people. I need a security concept for such a platform. I need to create a backup system for it for us, that’s too much” (Lighting Co_Interview, Pos. 96)</p>
	<p>“Is that platform dependent on being maintained by anyone, being updated, can you make sure it’s still around in five years” (Cooling Co_Interview, Pos. 75)</p> <p>“We were already using the platform of this startup, which provided the operating platform, so to speak. And our application was programmed on it in such a way that we could have run it on other platforms in case of doubt. In other words, we deliberately said that we keep it flexible, and, if necessary, if something did not longer work, we could also run it on other platforms” (Cooling Co_Interview, Pos. 77)</p>
Manage digital infrastructure	<p>“Data security: How can I secure this platform against third parties or also within my system?” (Lighting Co_Interview, Pos. 92) – “We hope that the cloud provider has a solution for this. Because at the moment, of course, we are not yet at an awareness level with the test customers where this plays a major role” (Lighting Co_Interview, Pos. 94)</p> <p>“This is a medium-sized business, where you have a programmer who tries to keep the threads together with great effort, and you need at least one system administrator at the moment when you go live with the whole thing, who takes full care of such a system. And that goes on and on” (Lighting Co_Interview, Pos. 132)</p>
	<p>“of course, there’s always the matter of interfaces” (Cooling Co_Interview, Pos. 55)</p> <p>“you also need internal technical know-how or you have to buy it. That already starts with: What kind of databases do you use? Do you use open source databases, or do you build your own?” (Cooling Co_Interview, Pos. 75)</p>

With regard to innovating on a *digital platform* (see Table 25), challenges were only named by the two more experienced companies, Lighting Co and Cooling Co. Both companies chose to work with third-party platforms due to their medium size and limited experience. They raised the challenge of *integrating the third-party digital platforms’ BMs into their own digital BMs*, that is adapting their own monetization mechanism. They also found it necessary to *build up a foundation for data analytics*. While Lighting Co experienced problems concerning their internal capabilities which could be overcome by working with partners, Cooling Co faced the issue of retrieving data from their customers because of technical or even cultural problems. *Securing the future operability* also posed a challenge to both companies. In Cooling Co’s case, they programmed their application in such a way that it could also be transferred to another platform. Last but not least, both companies expected that investing in their own resources would be necessary to *manage the digital infrastructure* in the long run and not only rely on the platform providers.

4.2.5. Assessment of Alternative Digital BMs

In the last step, the assessment of alternative digital BMs (see Table 26), the desirability, feasibility and viability of different options is evaluated.

Table 26. Selected extractions for category assessment of alternative digital BMs

Sub-category	Quotes
Check desirability of digital BM	“[When it comes to implementing an online shop, the challenge is] the existing customer relationships. You would really upset them” (Building Automation Co_Interview, Pos. 54)
	“This is clearly about the whole issue of customer benefits. How can I put customer benefits first?” (Lighting Co_Interview, Pos. 98)
	“as soon as it was a new business model with a new product, as it was with us, you also often have new customers [...] With new customers, you are like any startup and don’t really know anything at first” (Cooling Co_Interview, Pos. 69)
Check feasibility of digital BM through testing	“take out three options, actively test them [...] at some point, you [...] evaluate them with the help of an evaluation matrix based on the priorities you have set yourself, and then you [...] say ‘Go or No Go’” (Fire Protection Co_Interview, Pos. 92)
	“The challenge is to think about what I have to do internally for this and can I manage to process these business models at all [...] How are you going to evaluate those, so that’s there, using strengths and overcoming weaknesses [...] to look at it in such an evaluation matrix. I have to look at the effort and the benefit. So what effort do I have to put into establishing this, what benefit do I derive from it?” (Cooling Co_Interview, Pos. 79)
Check viability and options for monetization of digital BM	“I don’t see anything else as a challenge, because that is a classic profitability analysis” (Building Automation Co_Interview, Pos. 54)
	“What is the monetization? How can you really quantify the added value for the customer from this? That is still the difficulty at the moment” (Lighting Co_Interview, Pos. 36)
	“Our next step would be to [...] set up the business model and then compare costs against possible revenue models” (Lighting Co_Interview, item 100)
	“How do we design the revenue model, how do we make the prices? In the Mittelstand, you often still work with a sales price” (Cooling Co_Interview, Pos. 17)
	“Viability can of course be relatively difficult in this area. Because something can of course change from one day to the next, and this is an area that continues to develop [...] the evaluation has to be done with respect to a defined time period” (Cooling Co_Interview, Pos. 79)

Regarding *checking the desirability of digital BM*, Building Automation Co saw a potential challenge in managing existing customer relationships when switching from an indirect to a direct sales model through an online shop. Both Lighting Co and Cooling Co found it difficult to define the exact customer benefit of the new digital BM. When it came to *checking the feasibility of a digital BM through testing*, Fire Protection Co and Cooling Co suggested acting in an incremental and iterative manner to single out the most attractive option. While Building Automation Co did not perceive any challenge in *checking the viability*, the higher degree of digital BMI in the case of Lighting Co and Cooling Co became apparent once again. For Lighting Co, assessing the *options for monetizing the digital BM* posed a significant issue. Cooling Co was skeptical about the long-term viability of the new digital BMs.

4.3. Recommendations based on the Degree of Digital BMI and Organizational Focus

During the comparative analysis, key differences between the case companies were observed which led to the identification of two distinguishing dimensions, the degree of digital BMI and organizational focus.

First, the *degree of digital BMI* varied. Fire Protection Co and Building Automation Co have started driving forward the DT of their BMs by primarily digitalizing business processes within the existing BM. Thereby it can be said that the degree of digital BMI is low in their case. In contrast to the first

two cases, Lighting Co and Cooling Co have a high degree of digital BMI. They are actively exploring new digital BMs which are in line with the previously established definition.

Second, differences regarding the *degree of organizational focus* exist. The organizational focus encompasses the extent to which the management of the focal firm has anchored the DT of the BM in its strategic plan, supports digital BMI by allocating the necessary resources and responsibilities, and actively works on establishing a culture of leading the change among all employees. In this regard, only Building Automation Co seems to have a high degree of organizational focus as their activities are driven by the top management and they also consider change management. In Fire Protection Co’s case, the company has neither implemented the DT of the BM in the strategy nor managed to overcome employees’ hesitancy. Although Lighting Co’s CEO seems to have developed a digital vision, the company faces challenges with regard to cultural acceptance of the new BM. For Cooling Co, the main challenge was a lack of management support in unlocking resources from the core business. Table 27 summarizes how the two dimensions can be assessed.

Table 27. Dimensions for categorizing cases

Dimension	Low	High
Degree of digital BMI	Primarily driven by intrinsic motivation to increase efficiency and effectiveness Digital BMI is focused on existing BM	Primarily driven by digital technologies, competitive pressure & customer behavior Digital BMI is focused on new digital BM, i. e. introducing a digital value proposition to offer solutions to customers based on data analytics and the integration into a digital platform and ecosystem
Degree of organizational focus	DT of the BM is not or is only loosely anchored in the company’s strategy Management does not support or only passively supports digital BMI Management does not focus on establishing a culture of leading the change among all employees	DT of the BM is firmly anchored in the company’s strategy Management actively supports digital BMI Management actively works on establishing a culture of leading the change among all employees

When bringing the two dimensions together, four profiles with distinct strategic priorities emerge (see Table 28). Table 29 presents universal recommendations for these profiles based on the degree of digital BMI and organizational focus.

Table 28. Categorization of case companies

2) Exploiter Building Automation Co	4) Transformer
1) Starter Fire Protection Co	3) Explorer Lighting Co; Cooling Co

Fire Protection Co is classified as a *starter* with a low degree of both digital BMI and organizational focus. The company has digitally transformed aspects of its BM, but this was not done based on the strategy or in an organized way. Starters that want to exploit their existing BM should, first of all, identify potential gains of the DT of the BM to derive strategic objectives and anchor the DT of the BM in the strategy. Management support should be given right from the start while assigning clear responsibilities. Fire Protection Co elaborated how it would be helpful to intrinsically motivate employees. Understanding the existing BM is necessary for the exploitation of the existing as well as

the exploration of a new BM. Benchmarking what other SMEs are doing and getting help from external partners, for instance consultants, could help in the decision of which direction to move into.

Building Automation Co can be described as an *exploiter*. The degree of digital BMI is low, but the degree of organizational focus is high in comparison to the other three companies. Lessons learned from Building Automation Co indicate that managing the implementation of strategic initiatives from the top was equally as important as involving employees in the incremental change process. It is necessary to consider the entire value chain when digitally exploiting the BM. Exploiters might also consider the future exploration of a new BM and prepare accordingly when digitalizing aspects of the current BM. For instance, Building Automation Co launched a new website that could be extended by an online shop in the future, should the company decide to move from an indirect to a direct sales model.

Table 29. Recommendations for the DT of incumbent SMEs' BMs

Degree of Organizational Focus	High	<p>Exploiter</p> <ul style="list-style-type: none"> • Manage implementation of strategic initiatives from the top • Act incrementally and prioritize • First assess and adapt, then digitalize processes to gain efficiency and effectiveness along the entire value chain sustainably • Involve employees, if possible, to establish a culture of leading the change, and to drive intrapreneurship • Prepare for moving from solely exploiting the existing BM to exploring a digital BM in parallel, if applicable 	<p>Transformer</p> <ul style="list-style-type: none"> • Manage ambidexterity of exploiting existing BM while shifting to a new digital BM from the top • Consider hiring a member of the management dedicated to the DT of the BM, e.g. a Chief Digital Officer • ...
	Low	<p>Starter</p> <ul style="list-style-type: none"> • Establish potential gains of the DT of the BM for the company's efficiency and effectiveness to define strategic objectives • Anchor DT of the BM in the strategy • Assign responsibility for strategic initiatives • Ensure management support right from the start • Create a pull among employees for the DT of the BM rather than pushing out changes to the BM • Understand how the existing BM works • Benchmark what other companies are doing • Get help from external partners, if needed • Evaluate options for new digital BM 	<p>Explorer</p> <ul style="list-style-type: none"> • Develop a vision of the digital BM and align it with the strategy • Give management support to intrapreneurs and unlock resources from the core business • Consider employees' concerns and develop initiatives to counter them • Act in an iterative and agile manner to manage uncertainty and keep the digital BM flexible • Test digital BM with lead customers to identify customer value and revenue model • Invest into own digital resources and capabilities carefully to balance (financial) risks and future feasibility of digital BM • Build up a network of digital partners • Test third-party digital platforms in the context of the BM • Prepare the organization for the new digital BM, e.g. sales employees
		Low	High
Degree of digital BMI			

Although there are slight differences between the challenges they experienced, both Lighting Co and Cooling Co are perceived to be *explorers* with a high degree of digital BMI and an overall low degree of organizational focus. Explorers are advised to focus on developing a digital vision of how the company could create, deliver and capture value in the future. Management should support exploration activities and consider if resources from the core business should be allocated to the effort. Since adopting a digital BM in the future might render the existing BM obsolete, managers should not underestimate employees' concerns, but develop initiatives to counter them. Acting in an iterative and agile manner, as well as carefully steering investments, is essential to reduce uncertainty and react quickly to changes, for example from a technological perspective. At the same time, it is advised to work together with lead customers and digital partners while testing third-party digital platforms. Explorers should also start preparing the entire organization for the DT of the BM, for instance by adapting processes that need to be handled differently for the digital BM.

Last but not least, none of the companies in the sample can be considered to be a true *transformer*, that is an incumbent SME with a high degree of both digital BMI and organizational focus. Therefore, reflecting on challenges and best practices is pure speculation. Based on the findings from the literature review in chapter 2.3, it is expected that transformers might focus on managing the ambidexterity of exploiting existing BM while shifting to a new digital BM. At that stage, under the premise that uncertainties regarding the viability of the digital BM have been resolved, a transformer might even consider hiring a member of the management solely dedicated to the DT of the BM, such as a Chief Digital Officer.

All in all, referring to the challenges identified by prior studies (see Chapter 2.3.2), the *organizational challenges* in the form of *insufficient digital knowledge* and *managing change* could be identified in all companies. *Technological challenges*, that is *shorter technological lifecycles* and *managing digital infrastructure*, proved to be more important for explorers. The same is true for the *value network-related challenges* of *balancing complexity and control* and the *changing role of customers*.

4.4. Adaptation of the Conceptual Model for the DT of Incumbent SMEs' BMs

Based on the empirical research, it can be stated that all the contextual elements and steps of the conceptual model could be confirmed, although the relevance of specific items varied between cases. The degree of digital BMI the case companies were pursuing heavily influenced the applicability of certain elements and steps in the model, so differences could be observed between Fire Protection Co and Building Automation Co on the one hand and Lighting Co and Cooling Co on the other hand. Fig. 11 shows the adapted conceptual model.

The *contextual elements* of the conceptual model were confirmed and extended to reflect challenges raised by the interviewed companies. All companies agreed that there were *key drivers* which triggered them to consider the DT of the BM. In the case of Fire Protection Co and Building Automation Co, intrinsic motivation was the key driver while Lighting Co and Cooling Co perceived the emergence of digital technologies to be the strongest driver next to changes in the competitive landscape and customer behavior, respectively. The *strategic plan* was confirmed to influence the DT of the BM. The two most important findings regarding the strategic plan concern the objectives and strategy. Building Automation Co, Lighting Co and Cooling Co emphasized that on a strategic level, objectives should be defined that use the DT of the BM as a means to an end. All companies agreed that a strategy for the DT of the BM should be derived from these objectives. The element of *strategic*

leadership has been added to the conceptual model to reflect the need for a strategic management instrument that drives the DT of the BM beyond the strategic plan. Developing a digital vision was found to be necessary for exploring a new digital BM in particular, as was the case for Lighting Co and Cooling Co. Management support is particularly important in case digital BMI activities are driven by employees who are not members of the management, including the assignment of clear responsibilities. All companies raised the challenge of overcoming employee resistance and hesitancy which is why establishing a culture of leading the change was also included in the strategic leadership element of the conceptual model. With regard to the *outcome* of the DT of the BM, incumbent SMEs in particular could profit from developing a digital brand. Other outcomes are an increase in customer centricity as well as business growth. Fire Protection Co and Cooling Co expected that they would have to continuously sustain competitive advantages gained by the DT of the BM, showing that the outcome was not static.

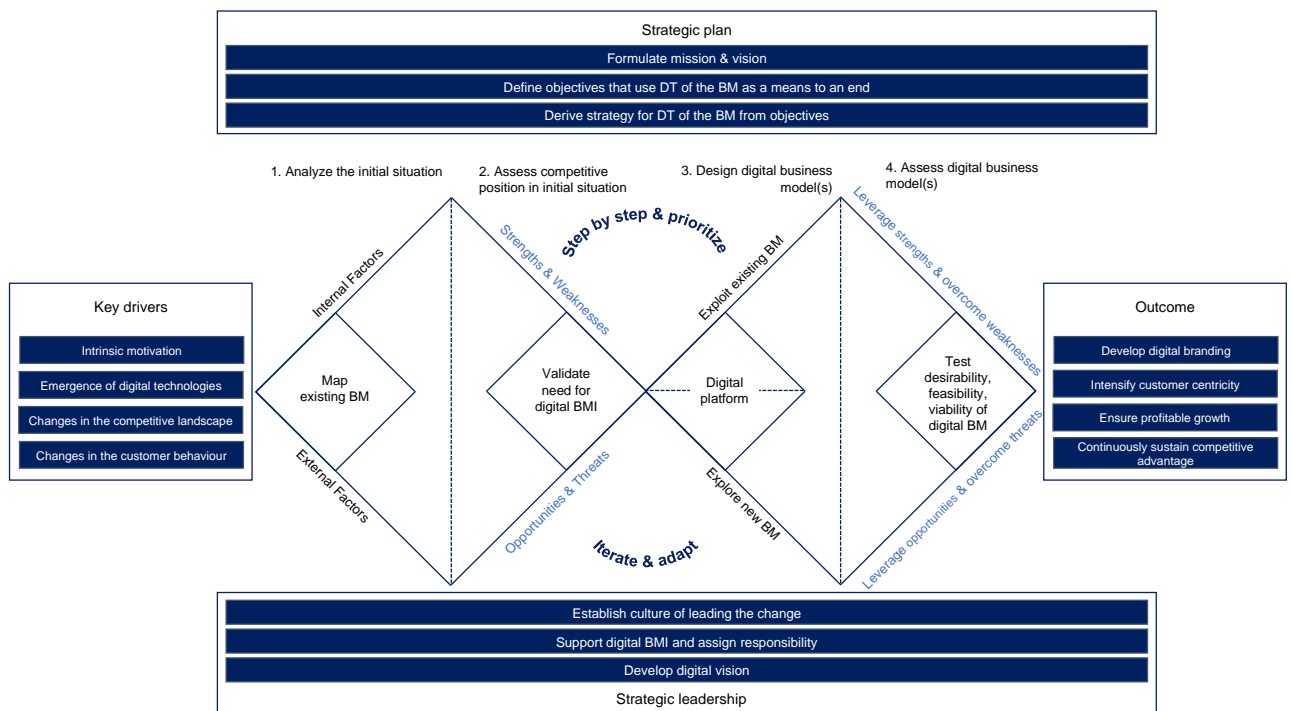


Fig. 11. Conceptual model for the DT of incumbent SMEs' BMs

Regarding the process itself, the interviewees perceived the four steps as linear in the proposed conceptual model although all companies stated that the DT of their BM took place in a non-linear way. For instance, goals were changing constantly during the exploration of Cooling Co's new digital BM and Lighting Co reflected on shorter technological cycles which might require further adaptations, even to a new digital BM. Therefore, the element *iterate & adapt* has been introduced to the conceptual model. Similarly, for Fire Protection Co and Building Automation Co whose degree of digital BMI was low, introducing changes incrementally proved to be the right way to overcome a lack of resources and knowledge. Thus, the element *step by step & prioritize* was added.

The four steps of the conceptual model were confirmed during the empirical research, although their relevance varied between the cases. In the *analysis of the initial situation*, all companies recognized the necessity to start by *mapping the existing BM*. The *internal factors* which could be identified during the comparative analysis, namely financial risks, resource constraints, agility and intrapreneurship, seemed to be important regardless of the degree of digital BMI whereas *external*

factors which impact the DT of the BM seemed to be more important to Lighting Co and Cooling Co than to the other two companies. This insinuates that explorers are more dependent on external stakeholders to access resources and capabilities, for instance, lead customers, and digital partners and experts. Building Automation Co was the only company that did not see any value in *assessing the competitive position in the initial situation*. The other three companies supported the utilization of a SWOT analysis, in particular when considering the iterative alignment between strategy and DT of the BM. Once again, two companies suggested consulting external experts to assess opportunities and risks. Validating the need for digital BMI was also seen to have an internal dimension in terms of fostering employees' understanding and acceptance as well as an external dimension towards potential customers. In the step *design digital BM(s)*, the two dimensions *exploiting the existing BM* (Fire Protection Co and Building Automation Co) and *exploring a new BM* (Lighting Co and Cooling Co) were confirmed. It is unclear to what extent the companies considered different digital BMs before entering their current BMI activities, although Cooling Co's options were limited by a lack of data transparency, for instance, and Lighting Co, among others, missed best practices from other incumbent SMEs. The topic of the *digital platform* as a key element of a digital BM was only discussed in-depth by Lighting Co and Cooling Co. Therefore, the conceptual model was slightly altered to illustrate that explicitly considering digital platforms in the BM makes a key difference between exploitation and exploration. Last, but not least, the key dimensions for *assessing the digital BM(s)* were confirmed. Fire Protection Co, Lighting Co and Cooling Co saw the need to test the desirability, feasibility and viability of different options and once again emphasized the importance of acting in an incremental and iterative manner.

To sum it up, the conceptual model has been validated successfully. Based on empirical research with incumbent SMEs from the German building systems sector, the conceptual model proved to be applicable both for SMEs exploiting their existing BM – even if this type of digital BMI did not lead to the emergence of a truly digital BM – and for SMEs exploring a new digital BM. The element of strategic leadership was found to be crucial for all case companies and was therefore added to the conceptual model. In addition, another adaptation concerns the nature of the process underlying the DT of the BM which was described to be incremental rather than radical, requiring prioritization because of resource constraints. Moreover, the case companies exploring a digital BM conceived the four steps of the conceptual model to be non-linear and alluded to acting iteratively.

4.5. Discussion

4.5.1. Theoretical Implications

From a theoretical standpoint, this study extends the extant research on the *DT of incumbent SMEs' BMs*. Prior findings suggesting that the DT of incumbent SMEs' BMs is driven by internal as well as external triggers (Rachinger et al., 2019) are supported. The results from the study imply that externally triggered digital BMI is associated with exploring a new digital BM while intrinsic motivation to increase efficiency and effectiveness leads incumbent SMEs to exploit their existing BM through digitalizing activities along the entire value chain. For incumbent SMEs in particular, a more nuanced understanding of the DT of the BM is required as internally triggered digital BMI does not immediately result in the emergence of a digital BM. Next to digitalizing processes, developing a digital value proposition, as was previously found by Soluk and Kammerlander (2021), was an important prerequisite for the two companies exploring a digital BM. In addition, they were focused

on solving end-user problems through data analytics, underlining the integral role of customers in digital BMs (Paiola et al., 2022).

Contributing to *BMI research*, the study results indicate that the BMI process is iterative (Frankenberger et al., 2013), also in the context of the DT of incumbent SMEs' BMs (Gebauer et al., 2020). Furthermore, findings by Paiola et al. (2022) and Andersen et al. (2021) that incumbent SMEs' digital BMI activities are incremental and require experimentation and trial-and-error-learning were confirmed during the empirical research.

Results from previous studies assigned an important role to the overall company strategy and the top management of incumbent SMEs as strategy providers and enablers for the DT of the BM (Bouwman et al., 2018, 2019; Matarazzo et al., 2021). These findings were confirmed by all case companies. Through the development and validation of a conceptual model for the DT of incumbent SMEs' BMs, the *strategic management* perspective of prior models and frameworks for the DT of the BM (Schallmo, 2016; van Tonder et al., 2020) was extended. During the empirical research, strategic leadership was identified as an important element of the conceptual model. The relevance of developing a digital vision, management support and establishing a culture of leading the change as enablers for the successful DT of the BM was demonstrated through the case studies and should be considered in future studies investigating digital BMI practices of incumbent SMEs.

Finally, the theoretically and empirically validated conceptual model for the DT of incumbent SMEs' BMs represents the key theoretical contribution. Furthermore, the degree of digital BMI and organizational focus were identified as distinguishing dimensions concerning the progress of this transformation. Although the conceptual model has only been tested in the context of one particular country and industrial sector, it is expected that it is also applicable to incumbent SMEs from other countries and industries.

4.5.2. Managerial Implications

From a practical viewpoint, the findings from the study have several implications for managers of incumbent SMEs, in particular in the building systems sector or similar industries. First and foremost, managers should develop sensing capabilities to recognize internal and external key drivers which signal the necessity for the DT of the BM. In order to successfully digitally transform an incumbent SME's BM, continuous top management attention and support are required. Furthermore, the case companies reported the need to firmly anchor the DT of the BM in the company's strategy and to establish a culture of leading the change among all employees, not only the ones engaged in digital BMI activities. Strategic leadership is a key influencing factor for the DT of incumbent SMEs' BMs. The outcome of this transformation might enable the focal firm to develop digital branding, intensify customer centricity and ensure profitable growth, as described by the case companies. However, the gained competitive advantage will have to be continuously sustained.

Incumbent SMEs are facing the challenge of having to manage financial limitations and research constraints. Driving agility and intrapreneurship can help in overcoming this challenge. Overall, taking incremental steps and prioritizing are advised. Acting in an iterative manner and switching between adapting and implementing the strategy is particularly important for managing the uncertainty connected to a new digital BM.

For incumbent SMEs wanting to explore a new digital BM, considering external factors such as lead customers and digital partners are more relevant than for those exploiting the current BM. Exploration of a new digital BM is more difficult and less straightforward than exploiting the existing BM and requires the owner or CEO of an incumbent SME to develop a digital vision. In addition, incumbent SMEs have to closely cooperate with third-party providers of digital platforms as most incumbent SMEs do not have sufficient resources to develop their own platforms.

Managers in incumbent SMEs can use the validated conceptual model before entering into or during the DT of their BM to understand key requirements on the contextual level or to purposefully enter the process of digitally transforming the BM by moving through selected steps of the model in workshops with relevant stakeholders. The recommendations which were developed based on the degree of digital BMI and organizational focus provide managers with best practices for the DT of the BM based on different initial situations.

4.5.3. Limitations and Avenues for Future Research

The generalizability of the findings of this qualitative study is limited due to several reasons. First, regarding the methodology, only four cases were examined from the building systems sector. Since only one interview was conducted per company, there is a risk of single respondent bias. Although recommendations to consider publicly available secondary data for later data triangulation to increase construct validity were followed (Yin, 2018), the information obtained from these secondary sources did not provide too many insights concerning the DT of the companies' BMs. The cross-case design of the study poses another limitation.

Second, the research setting further limits the generalizability of this study. Germany is typically associated with incremental rather than radical innovation. Relationships between employees and employers are strong and labor laws, as well as collective agreements, provide strong protection to employees. German companies tend to focus on long-term outcomes rather than short-term developments (Hall & Soskice, 2001). The German building systems sector is grounded in manufacturing and incumbent companies are highly specialized. The mindset of companies as well as customers towards digital BMs, in particular sharing data, is rather conservative, as also noted by some of the interviewees. It is expected that German SMEs operating in more dynamic environments, such as e-commerce, pursue digital BMI more frequently and intensively. Concerning the situation of the case companies, the shared characteristics within the sample make the results applicable to similar companies. All of the case companies were medium-sized incumbents whose past activities were strongly focused on offering products.

Differences existed with regard to the companies' ecosystem, especially the type of customers the companies served. In the studied sample, only two out of four SMEs explored a digital BM which was in line with the scientific understanding established in this thesis. These companies had developed a digital value proposition and a strong end-user focus while the other two companies served OEMs and wholesalers with mainly hardware products, respectively. Therefore, the type of customer relationships and value proposition should be considered in the sampling of future studies with a focus on new digital BMs.

As the research field is nascent, further research opportunities may lie in conducting a longitudinal case study of incumbent SMEs who are digitally transforming their BMs to derive even more best practices, in particular regarding the strategic leadership element of the conceptual model. Case

companies frequently raised the issue of a lack of successful examples from incumbent SMEs, so future researchers should focus on examining transformers, that is incumbent SMEs who have a high degree of digital BMI and organizational focus. Such companies might provide more insights into how to handle organizational ambidexterity and resource constraints during the establishment of a new digital BM. In addition, the conceptual model could be used as a frame to explore the different steps in workshops with incumbent SMEs. For instance, the usability of digital BM patterns or mapping tools could be tested during the third step, designing digital BMs.

Conclusions

- 1. Although research on the DT of BMs is increasing, it provides only limited guidance to incumbent SMEs that face a digital gap in comparison to large companies and tends to neglect the important relationship to the strategic management of a firm. Based on a review of definitions of key concepts, the DT of the BM is understood as a specific type of BMI which ultimately results in the emergence of a digital BM. The conceptualization developed in this thesis places digital platforms at the center of digital BMs as they enable the creation of new types of customer value through digital value propositions and data analytics.**

Digital technologies, increasing competitive pressure from digital entrants and the deconstruction of value chains, and changing customer behavior drive the DT of BMs. Regardless of their size, incumbents' traditional pipeline BMs in various industries are under threat of getting disrupted by digital BMs based on platforms. They face the challenge of digitally transforming their BMs to sustain their competitive advantage through establishing a digital BM.

This is particularly relevant for incumbent SMEs who play an important structural role in many countries, also in the EU. Policymakers recognize a digital gap between SMEs and large companies and want to accelerate the DT of incumbent SMEs' BMs. Since SMEs' idiosyncratic characteristics have been found to influence their ability to digitally transform their BMs, tools and solutions must be specifically designed to fit their needs.

Despite the increasing amount of publications investigating the DT of BMs, two major research gaps exist with regard to first, incumbent SMEs, and second, the relationship between strategic management and the DT of BM. In order to resolve some of the persisting construct unclarity for this thesis, both an understanding of the DT of the BM and a conceptualization of a digital BM have been developed. An analysis of taxonomies and typologies of digital BMs resulted in the realization that such are only helpful to a limited extent in practice without considering the focal firm's context.

- 2. The proposed conceptual model for the DT of incumbent SMEs' BMs is based on the findings from extant studies in the context of incumbent SMEs' BMs as well as a comparative analysis of models and frameworks for the DT of the BM. It goes beyond existing solutions that focus on either mapping digital BMs or digitally transforming the BM and integrates relevant contextual elements such as key drivers, the focal firm's strategic plan and targeted outcome. In addition, digital platforms are specially taken into account as they are an integral part of digital BMs. Since the conceptual model was also developed in accordance with a design process model, it can serve as a guide to incumbent SMEs in advance as well as in the process of digitally transforming the BM.**

The analysis of extant studies investigating the DT of incumbent SMEs' BMs confirmed the previously established existence of key drivers such as digital technologies and competitive pressure but emphasized that digital BMI in this context did not necessarily have to result in the immediate adoption of a new digital BM, as opposed to other researchers' understanding. Having a strategy for the DT of the BM, top management dedication and the availability of digital talents were found to be enablers to overcoming organizational, technological and value-network-related challenges.

Research on models and frameworks for the DT of BMs with a focus on incumbent SMEs is scarce. The general models and frameworks which were comparatively analyzed were mostly theoretical and

lacked empirical validation and served the function of mapping digital BMs or transforming existing BMs into digital BMs. Thus there is a lack of applicable models and frameworks for incumbent SMEs.

The conceptual model for the DT of incumbent SMEs' BMs consists of four steps which are embedded into contextual elements, namely key drivers on the input side, the strategic plan, that is mission and vision, objectives and strategy, throughout the entire process, and sustaining the competitive advantage on the output side. The four steps are based on the Double Diamond design process model which allows to explore a problem and design a solution by alternating and iterating between divergent and convergent thinking. It is proposed to first analyze the initial situation considering internal as well as external relevant factors and to assess the company's competitive position in a second step. Before moving to the next step, it is suggested to validate the need for digital BMI towards relevant internal and external stakeholders. The third step consists of designing alternative digital BMs. SMEs should consider how they can integrate digital platforms into their existing or into a new digital BM. In the last step, the alternative digital BMs are assessed in terms of their desirability, feasibility and viability.

3. The multiple case study research methodology that has been developed allows validating the proposed conceptual model with incumbent SMEs from the building systems sector in Germany. In addition, it forms the basis for evaluating the usefulness of the conceptual model, identifying challenges in the application, and deriving recommendations for the DT of incumbent SMEs' BMs.

Since academic research in this field is quite recent, a qualitative research approach has been chosen. The multiple case study methodology has been selected because it allows drawing comparisons between cases and makes a stronger case for theory building and testing than single cases. It has also been successfully applied by other researchers investigating the DT of incumbent SMEs' BMs.

The interview guideline was prepared based on the findings from the literature review and structured according to the contextual elements and steps of the proposed conceptual model. Data was mainly collected through the conduction of semi-structured interviews. In addition, secondary data was obtained via publicly available sources before the interviews. In total, four medium-sized companies were investigated.

Due to the high context specificity associated with the DT of the BMs, it was important to identify cases with a similar background which is why incumbent SMEs who are active in the German building systems sector were purposefully sampled. Digital BMs are on the rise in this sector, for instance in the context of smart buildings, but most incumbent SMEs still have traditional pipeline BMs in place.

4. The validated conceptual model for the DT of incumbent SMEs' BMs can serve as a guide to the owners and managers of incumbent SMEs moving through the incremental and iterative DT of their BMs, starting from the exploitation of the existing BM through digitalization to exploring a new digital BM. The addition of the contextual element of strategic leadership implies that the DT of the BM does not only need to be anchored in the focal firm's strategy but also builds on the foundation of a digital vision, management support and a culture of leading the change among all employees. It is recommended that

incumbent SMEs should set the strategic priorities for the DT of their BMs depending on the degree of digital BMI and organizational focus.

Based on the comparative analysis of the empirical research findings, the conceptual model could be validated and improved. The conceptual model proved to be applicable both for SMEs exploiting their existing BM and for those exploring a new digital BM. While the exploitation of the existing BM was driven by intrinsic motivation, exploration of a new digital BM was triggered externally.

All case companies reported challenges connected to strategic leadership which is why this element was added to the context of the conceptual model. Strategic leadership includes developing a digital vision, support by the management for digital BMI activities and the assignment of clear responsibilities, and, most importantly, establishing a culture of leading the change to overcome employees' resistance and fears. In addition, the case companies stressed that the DT of the BM is an incremental process that requires prioritization because of resource constraints. Acting in an iterative manner is important to manage uncertainty. Considering external factors during the initial analysis and assessment of the competitive position as well as focusing on digital platforms during the design of digital BMs is of higher relevance for the companies exploring a new digital BM. In this sense, the conceptual model can guide SMEs in an early stage of digitally transforming their BMs, for instance with regard to the relationship between strategic management and the DT of the BM, and serve as a more in-depth design process model at the later stage of considering a digital BM.

Based on the differences which were observed between the case companies, recommendations for the DT of the BM were derived depending on the degree of digital BMI (low/high) and organizational focus (low/high). SMEs with a low degree of digital BMI focus on increasing the efficiency and effectiveness of the existing BM, and SMEs with a high degree of digital BMI concentrate on a new digital BM. Organizational focus describes the extent to which the management of the focal firm has anchored the DT of the BM in its strategic plan, supports digital BMI by allocating the necessary resources and responsibilities, and actively works on establishing a culture of leading the change. The study results allow the provisional identification of four profiles with distinct strategic priorities, ranging from starters with both a low degree of digital BMI and organizational focus, through exploiters and explorers, to transformers that are establishing a new digital BM within their organization and toward customers and other external stakeholders.

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Appendices

Appendix 1. Interview guideline for semi-structured interviews in English

Section	Questions	Objective
Introduction	<p>Introduction of the researcher and interviewee</p> <p>Introduction to the research topic</p> <ol style="list-style-type: none"> 1. What is your understanding of “Digital Transformation of the Business Model”? 2. What characterizes a digital business model from your point of view? <p>Introduction of key concepts (DT of the BM; digital BM incl. digital platforms)</p>	<p>Determine prior knowledge of the interviewee and establish common understanding for the context of the interview</p>
Company Introduction	<ol style="list-style-type: none"> 3. What has your company done so far to digitally transform its business model? <i>If you have done something, which challenges did you face and how have you overcome them?</i> <ol style="list-style-type: none"> 3.1. Have you digitalized existing processes or customer interactions? 3.2. What was your business model ten years ago and what is it today? Have there been any changes? 3.3. How is your position compared to competitors? 3.4. Who is responsible for digitally transforming the business model in your company? 4. Before we take a look at the model I propose for the digital transformation of the business model, what is your own vision how this might be done in practice? 	<p>Kick off the interview</p> <p>Check the status of the company’s DT of the BM and allocation of responsibility regarding BMI</p>
Conceptual Model		
Overview	<p>Introduction of conceptual model (visually supported)</p> <p>Introduction to the research question (focus: challenges in the application of the conceptual model)</p>	<p>Give overview and clarify focus</p>
Key drivers	<ol style="list-style-type: none"> 5. The model proposes that the need to digitally transform the business model is triggered by key drivers. Which key drivers do you observe which signal the need for the digital transformation of your business model? <ol style="list-style-type: none"> 5.1. Digital technologies? Competitors? Disruptors? Customers? Other? 5.2. Have you observed digital business models emerging in your industry? 	<p>Validate the notion that key drivers drive the DT of the BM</p>
Mission, Vision, Objectives and Strategy	<ol style="list-style-type: none"> 6. The model proposes that the digital transformation of the business model needs to be part of the company’s overall strategy and that the strategy influences almost all steps of the model. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them?</i> <ol style="list-style-type: none"> 6.1. What comes first: Formulating a digital strategy or digitally transforming the business model? Or is this a simultaneous process? 	<p>Determine the influence of company strategy on DT of the BM</p>
Analyze the initial situation	<ol style="list-style-type: none"> 7. The model proposes that the first step should be to analyze the initial situation, starting with the existing business model. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them? Are there any tools which can help you to do so?</i> 8. In addition, internal as well as external factors which are relevant for successfully digitally transforming the business model should be identified. Are you familiar with the internal and external factors which you need to consider in this specific context? Which challenges do you see in that respect? <i>If challenges exist, how to overcome them? Are there any tools which can help you to do so?</i> <ol style="list-style-type: none"> 8.1. Human Capital: Employees’ digital capabilities? Managers’ digital leadership competences? Capabilities to sense and seize opportunities arising from digital technologies? 8.2. Structural Capital: Digital infrastructure (digitalized processes, data, information & communication technologies)? Digital technologies? Agile organization forms and development principles? 	<p>Determine the challenges that arise when identifying relevant internal and external factors for the DT of the BM</p>

	<p>8.3. Relationship Capital: Digital networking capabilities (co-creation with customers, partnering up with suppliers / third parties)? Abilities to recognize the value of external knowledge and internalize it? Relevant shared or external resources?</p> <p>8.4. Environment: Political? Sociological? Technological? Environmental? Legal?</p> <p>8.5. Stakeholders: Customers? Competitors? Suppliers? Complementors? Platforms? Ecosystems?</p>	
Assess competitive position in initial situation	<p>9. The model proposes that the second step should be to assess the identified factors to identify strengths, weaknesses, opportunities and threats. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them? Are there any tools which can help you in this assessment (especially regarding the digital assets and capabilities)?</i></p> <p>9.1. Strengths? Weaknesses?</p> <p>9.2. Opportunities? Threats?</p> <p>10. Furthermore, the model proposes that the opportunity which constitutes the need to digitally transform the business model should be explicitly stated before entering the next phase. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them?</i></p>	Determine challenges which arise during the assessment of the competitive position
Design alternative digital BMs	<p>11. The model proposes that the third step should be to design alternative digital business models which correspond to the opportunity identified in the prior step. Which challenges do you see in identifying the range of possible business models? <i>If challenges exist, how might they be overcome?</i></p> <p>11.1. Exploit existing one: Changing aspects of value creation, delivery and capture, e.g. enabling data capture of physical products and using data analytics to provide digital services on top of products to customers</p> <p>11.2. Explore new one: Completely overturning the existing BM, e.g. shifting from a pure pipeline business model focused on physical product to a digital platform to manage interactions and transactions between and towards the company's customers, suppliers, partners and other stakeholders</p> <p>12. In addition, the model proposes that digital platforms play a central in designing digital business models and should therefore be considered in particular. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them?</i></p> <p>12.1. Develop own? Complement existing?</p> <p>12.2. Type of platform?</p>	Determine challenges which arise when designing alternative digital BMs.
Assess alternative digital BMs	<p>13. The model proposes that the fourth step should be to assess the alternative digital business models in how far they are desirable to customers and other stakeholders, feasible to implement, and viable from a financial point of view. Which challenges do you see in that respect? <i>If challenges exist, how to overcome them?</i></p> <p>13.1. How challenging is it to narrow down the list of alternatives at this point in time? What else do you need to take this decision?</p>	Determine challenges which arise during the assessment of alternative digital BMs
Outcome	<p>14. The model proposes that the identified digital business model will enable the company to sustain its competitive advantage in the face of external triggers such as changes in the competitive landscape or customer expectations. Do you agree with this notion or do you see other outcomes?</p> <p>14.1. Growth opportunity (e.g. serve new customer segments)</p>	Validate the notion that digital BMI is necessary for sustaining competitive advantage and check if there are other aspects
Wrap-up	<p>15. To wrap it up: what are the key challenges in applying the model from your point of view?</p> <p>16. How do you rate the general applicability of the model in your company and business context?</p> <p>16.1. Is this a linear process? Or more iterative?</p> <p>16.2. Is there something you would change or improve?</p>	Wrap up the interview

Finishing	<p>Check if demographic data is complete (industry as per NACE code, company size as per SME classification, year of foundation, role of the interviewee), thank the interviewee, give information on the further procedure</p> <p>Ask if company would like to participate in workshop to hypothetically apply the four steps of the model to the specific situation of the company if this seems to be valuable from the interviewer's perspective</p>	<p>Ensure data completeness</p> <p>Assure the interviewee of confidentiality</p>
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