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OPEN INNOVATION IN SMES: A PROCESS VIEW TOWARDS BUSINESS MODEL INNOVATION

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Abstract

To be competitive, small and medium-sized enterprises (SMEs) need to transform their business models. To overcome the liability of smallness, SMEs often need to collaborate with external partners – implement open innovation. The complex processes behind business model transformation and open innovation combined remain unexplored. Linking the literature on business model innovation, open innovation, and SMEs, we examine how open business models can be a solution for SMEs. In particular, taking a process perspective, we study business model transformations in several European SMEs using a two-dimensional typology of SME business model innovation, considering the radicalness of the transformation and SME openness towards external partnerships. We identify the triggers for SMEs' business model innovation: market turbulence, market immaturity, competition, prior failure in open innovation, and scaling the production. We also signify how SMEs address the challenges related to the open business model transformation.

Keywords: Small Business/Small & Medium Enterprises; Open Innovation; Business Models

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1. Introduction

Firms continually attempt to achieve a sustainable competitive advantage. Superior resources, capabilities, market positions, product and service innovations are among the common sources of competitive advantage for all firms (Hitt et al. 2001; Tidd and Bessant 2013). Open innovation (Chesbrough 2003), business model innovation (Saebi and Foss 2015), and the combination of the two — open business model innovation (Chesbrough et al. 2018; Visnjic et al. 2018a)—have become increasingly important to reach competitive advantage in a globalised, interconnected economy (Chesbrough 2006; Gay 2014). However, the processes behind opening value creation and value capturing in business models are proven to be complex and difficult to understand (Chesbrough et al. 2018; Sjödin et al. 2020a), particularly in the context of small and medium-sized enterprises (Berends et al. 2014; Svejenova et al. 2010).

To outline the focal context, let us first define it. Small and medium-sized enterprises (SMEs) particularly in this paper are understood in terms of the staff headcount (<250) and turnover (\leq € 50 m) – see European Commission (2018) for a definition of SME. To develop and pursue their business model innovation (Brinkerink et al. 2017) SMEs lack the necessary internal resources (e.g. financial and human resources) and capabilities (e.g. technical and commercialisation) due to their liabilities of smallness (Brunswicker and Vanhaverbeke, 2014). Large firms have research and development departments, core technologies, and well-developed internal routines to launch new offerings into the market, but SMEs have to rely on partners to get access, assimilate, and integrate resources and capabilities to enhance their competitiveness (Spithoven et al. (2013). Spithoven et al. (2013) compare open innovation in firms of different sizes and find that SMEs' dependence on open innovation is usually stronger than that of large firms, due to their lack of internal resources and capabilities. SMEs thus turn to value chain partners and technology partners for their innovation activities, including business model innovations (Berends et al. 2016; Brunswicker and Vanhaverbeke 2014; Spithoven et al. 2013).

Due to the liabilities of smallness and newness, business model development processes in SMEs are less linear, more agile (Chesbrough and Tucci 2020; Vanhaverbeke 2017) and tend to have a more experimental character than those in large firms (Berends et al. 2016; 2014; Rissanen 2019). This, combined with the complexities of collaborative innovation, makes our understanding of the open business models in SMEs even more challenging and opens new opportunities for research (Berends et al. 2016; Svejenova et al. 2010; Vanhaverbeke 2017). This study aims to advance the current understanding of collaborative business model innovation in SMEs since SMEs are recognised contributors to the global economy and innovation (European Commission 2018; Fang et al. 2015; Fuest and Huber, 2000).

Vanhaverbeke (2017) makes two observations analysing open innovation activities in European SMEs. First, those only make sense in the broader context of strategic choices. In other words, SMEs embrace open innovation as a part of their change in strategy or business model transformation. Second, innovating with partners takes time, and consequently, open innovation and related business model transformation involve a process that develops and evolves over time.

This process view is rarely applied in open innovation studies, with a few notable exceptions (Lee et al. 2010; Parida et al. 2012; Sjödin et al. 2020a; Visnjic et al. 2018a). At the same time, the alignment between value creation and value capture in interorganisational relations has been recognised as a common and unsolved strategic challenge (Ritter and Lettl 2018; Sjödin et al. 2020a). Given the complexity of collaborative business model innovation in SMEs, we develop a fine-grained process view of their open innovation activities and changes to a business model. We expect with this approach to discover the ways in which SMEs can benefit from open innovation in their business transformation process.

The benefits and challenges of open innovation in SMEs have been discussed in the literature (Lee et al. 2010; Parida et al. 2012; Van de Vrande et al. 2009). However, how do SMEs having limited resources and capabilities manage open innovation and simultaneously transform their business model (Claus et al. 2019; Visnjic et al. 2018b)? Zott and Amit (2013), in their seminal review of the literature on business models, encourage further research on business model innovation in the context of value chain partnerships and ecosystems. Claus et al. (2019) specifically investigate the SME context and distinguished between different types of firms regarding business model reconfigurations—changes in value creation, value delivery, and capture. Their results highlight the need to further understand not only the nature of the business model transformations made by SMEs, but also the ways they perform these transformations while innovating with partners, and the process behind the transformations (Claus et al. 2019). Therefore, we aim to understand how open business models become a solution for the competitive challenges of SMEs that could not be solved by their existing (closed) business models.

In this study, we use the terms ‘business model innovation’ and ‘business model transformation’ rather interchangeably, perceiving the latter as a special instance of the former. Here we are following Geissdoerfer et al. (2018)’ classification of business model innovation and focus particularly on its ‘business model transformation’ type, where ‘the current firm’ business model is changed into another business model’ (Geissdoerfer et al. 2018, p. 407) – see Section 2 for further clarification. The literature highlights the radicalness of the business model innovation in terms of its novelty and scope (Foss and Saebi 2017), and the intensity of external collaborations in terms of their breadth and depth (Laursen and Salter 2006) as key dimensions to approach business model transformations. Business model innovation may require SMEs to abstain from open innovation or engage in moderate or intensive collaboration with partners (Snihur and Wiklund 2019). The business model innovation itself can vary from incremental to radical (Foss and Saebi 2017). Not unexpectedly, management requirements for these different types of transformation also vary considerably. We examine the challenges SMEs face throughout the business model innovation and the strategies they employ to cope with these challenges. Specifically, we are interested to understand what types of SME business model transformations exist considering the radicalness of the transformation and SME openness towards external partnerships.

This study makes several contributions to the literature. First, this study is among pioneering research taking the process perspective towards business model transformation in SMEs (Berends

et al. 2014; Claus et al. 2019; Svejenova et al. 2010). Second, this study bridges the open innovation and business model transformation literature by distinguishing between four types of approaches juxtaposing the degree of openness and radicalness of the business model change. Third, we investigate potential dependency between the choice of open or closed innovation and the radicalness of the SMEs' business model transformations. Finally, we explore the issues of openness and radicalness of the business model transformation in relation to the value-creating and capturing components of the business model.

2. The process of open business model transformation in SMEs

Studying open business model innovation in SMEs already poses a few research challenges at the literature review stage. First, the open innovation and business model innovation studies represent two rather distinct streams of literature, even though they are known to be interconnected (Foss and Saebi 2018; Lindgren et al. 2012; Saebi and Foss 2015; Weiblen 2014). This interconnectedness of the two different research domains makes studying the chosen phenomenon more grounded but also more challenging (Chesbrough 2007; Saebi and Foss 2015), as so far it is mostly reflected by the positive effects of openness on organizational performance and business model innovation (Foss and Saebi 2018; Liao et al. 2019; Saebi and Foss 2015). Second, the lessons learned from open innovation and business model transformation in large firms are not readily transferable to the context of SMEs, as SMEs tend to suffer from liabilities of smallness, less formalised practices, and distinct management and leadership styles (Anderson et al. 2018; Brinkerink and Rondi 2020; Lee et al. 2010; Sjödin et al. 2020a; Vanhaverbeke 2017). Third, while the existing literature contributes to understanding open innovation, business model innovation, and open business models as static phenomena (or a snapshot) (Demil and Lecocq 2010; Frankenberger et al. 2013; Grama-Vigouroux et al. 2019; Sjödin et al. 2020a), the processes behind each of these phenomena and their combination becomes a focus of this paper. With the following literature review, this paper attempts to start addressing these challenges. We first address the first two abovementioned points by combining the existing literature on open innovation and business models in the context of SMEs. Next, we turn to the third point, that is a process perspective as a tool to study a dynamic phenomenon of open business model innovation. Finally, we review a few existing studies which attempt to unpack the processes of open innovation and/or business model transformations in SMEs.

2.1. Open business model innovation in SMEs

To unpack the complex phenomenon of open business model innovation, let us first explain the key conceptual components shaping it: open innovation, business model, open business model, and business model innovation.

Open innovation is defined as 'a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with each organization's business model' (Chesbrough and Bogers 2014, p. 27). A 'business model' is described as the 'rationale of how an organisation creates, delivers, and

captures value' (Osterwalder and Pigneur 2010, p. 14). The concept of an 'open business model' (discussed by Chesbrough 2007) is defined as 'the architecture of the value creation and value capturing of a focal firm, in which collaborative relationships with the ecosystem are central to explaining the overall logic' (Weiblen 2014, p. 57). The 'business model innovation' concept (Foss and Saebi 2018; Zott and Amit 2010) has been recently clarified as 'conceptualisation and implementation of new business models' (Geissdoerfer et al. 2018, pp. 405-406). The business model transformation implies a certain degree of transformation of the entire firm, since it 'can affect the entire business model or a combination of its elements' (Geissdoerfer et al. 2018, p. 406). The process behind such a transformation (Anderson et al. 2018), specifically in a SME context, is the focus of this paper. What does it imply to combine open innovation and business model innovation? To better understand this, we first look at the known classifications of business model innovation and open innovation.

Business model innovation/transformation can be either incremental or radical. Foss and Saebi (2017) label those 'modular' or 'architectural changes' to the business model, respectively. Using the terminology of Osterwalder and Pigneur (2010), this implies either incremental or radical changes to the business model canvas. The business model canvas is a visual chart, which describes a firm's or product's value proposition, infrastructure, customers, and finances (see Osterwalder and Pigneur (2010) for the original chart, and the findings section for its adoption for this study). If canvas elements are loosely coupled, a change to a single element or even several of them will only imply a 'modular' (or 'incremental') change of a business model (Khanagha et al. 2014). When business model canvas blocks appear tightly interdependent, a change to a business model will be 'architectural' (or 'radical').

Open innovation scholars distinguish different degrees of intensity of external innovation collaborations in terms of their breadth and depth (Laursen and Salter 2006). These dimensions are implied in different types of innovation (business model innovation, product, processes) (Snihur and Wiklund 2019). We understand organizational openness as a continuum from closed to open. In business model innovation process firms, accordingly, may abstain from open innovation (Chesbrough 2007; Grama-Vigouroux et al. 2019) or engage in moderate or intensive collaboration with partners.

The business model transformation (varying from incremental to radical) (Foss and Saebi 2017; Saebi and Foss 2015) and the openness of the resulting business model (varying from closed to open) (Snihur and Wiklund 2019) represent the axes of a two-by-two matrix of business model transformation proposed by us (Figure 1). The matrix assumes four specific types of business model transformation/innovation, and empirical data provides evidence for those types. Applying open innovation principles to business model innovation assumes complementarity between internal and external resources (Chesbrough 2007; Chesbrough 2006; Chesbrough and Bogers 2014). We aim to understand what it takes a small-sized firm to transform its business model while engaging with external partners. The complexity of business model innovation implies constant change and represents a challenge, especially for resource-constrained SMEs (Arbussa et al. 2017).

This is where a process perspective is needed as it allows understanding the specific stages and reduces complexity (Demil and Lecocq 2010; Sosna et al. 2010). We follow with an overview of a few studies that help shaping the current understanding of the process behind open business model innovation in SMEs.

<Insert Figure 1 about here>

2.2. A process perspective towards (open) business model innovation in SMEs

Sjödin et al. (2020a), in their recent study on open business model innovation, highlight how such a complex process may clash with the firms' business as usual. "Navigating this process of redefining value creation and value capture and shifting relational roles and responsibilities is a daunting task that is often at odds with the existing modus operandi of traditional business-to-business relationships" (Sjödin et al. 2016; Sjödin et al. 2020a, p. 159). Using a process approach has become an increasingly recognised tool for unpacking the complexity behind open business model innovation (Berends et al. 2016; Sjödin et al. 2020a 2020b; Visnjic et al. 2018b 2017). However, most of these recent studies attempt to explain business model transformation in large firms (Linz et al. 2017; Sjödin et al. 2020b; Visnjic et al. 2018b) and do not tackle the complexity of this process in a SME context (Berends et al. 2016).

The literature suggests that business model innovation is triggered by either internal or external factors (Bucherer et al. 2012; Stampfl 2015). For SMEs, Svejenova et al. (2010) define several triggers for an SME business model transformation, but solely from an entrepreneur/individual perspective, not from an organizational perspective. Bucherer et al. (2012), studying business model transformation in firms of different sizes, found that at the implementation stage of business model transformation, a firm faces a mixture of challenging and supportive factors. They highlight that those factors differ for SMEs and large firms. These latest findings although outline the triggers for the change, do not consider yet what happens after the change is triggered and what the role of the firm' openness is in the process of business model transformation (Liao et al., 2019).

The complexities of collaborative business model innovation in SMEs, in combination with the lack of evidence and understanding of the process stages in the SME context (Berends et al. 2016, 2014), shape the research gap addressed in this paper. Consequently, we approach business model innovation in SMEs, not only in terms of its radicalness and openness, but we also take a process perspective by studying SME pathways. The need for such a process view is highlighted in the recent literature in the contexts of both family-based firms (Brinkerink and Rondi 2020) and SMEs in general (Barann et al. 2019; Berends et al. 2016; Svejenova et al. 2010).

2.3. Challenges and strategies for SME' open business model innovation

Although the number of studies that examine the processes behind open business model transformation in SMEs is limited, some of the recent works provide a few insights. The most common challenge for SMEs is an inherent liability of smallness and the related lack of internal resources (Müller et al., 2018), which among other strategies could be addressed by opening up

the business model and by using external complementary resources (Hoffmann and Schlosser, 2001; Van de Vrande et al., 2009).

Business model innovation implies some cost-increasing effects and “hidden risks” specifically in an open innovation context (Marullo et al., 2018). The latter originate from the need to search for partners, which is especially challenging when an SME is changing its industry focus (Marullo et al., 2020). Other challenges are related to management of the external network (Vanhaverbeke et al., 2012), maintaining a balance between collaboration breadth and depth (Laursen and Salter, 2006), and information asymmetries (Brunswick and Vanhaverbeke, 2014). A network of partners which is too extensive may dilute SMEs’ competitive advantage (Boschma, 2005). In turn, the development of overfocused business models may constrain the evolution of SMEs’ core competencies, keep SME focused on technology and partner proximity (Boschma, 2005) and rise the risks of remaining locked into the available technological knowledge (Marullo et al., 2018).

The power distance between SMEs and their larger partners may become a challenge for SMEs’ open business model innovation (Albats et al., 2020; Van Der Meer, 2007). Thus, proximities in partnerships (cognitive, organizational, social, institutional and geographical) need to be balanced (Boschma, 2005). Too little proximity can be addressed by effective coordination and control (ibid). Over-proximity, in turn, can be treated by ensuring openness and flexibility (ibid).

Limited resources and lack of access to scientific expertise may make SME’ innovation activities rather non-systematic and hard to integrate with operations and production (Hossain and Kauranen, 2016). This becomes especially difficult when speedy implementation is demanded by SME customers and competitors are up to every move (Hoffmann and Schlosser, 2001; Müller et al., 2018). SMEs may also struggle to understand their present and potential customer needs, but the continuous progress in information and communication technologies generates helpful and affordable tools to address this challenge (Parida et al., 2012).

Scaling the production/service levels can represent a dilemma for resource-constrained SMEs (Müller et al., 2018). Issues related to protecting the know-how from immediate imitation is also a significant challenge (Van de Vrande et al., 2009), particularly for high-tech SMEs (Hossain and Kauranen, 2016). SMEs in high-tech and research-intensive sectors often face these appropriation problems. Consequently, they may either keep their business model closed or consider selling or licensing their IP to scientific communities as the most suitable strategy (Marullo et al., 2018). Liao et al., (2019) show that inbound open innovation and market capitalising agility are the most critical factors in SMEs achieving BMI, followed by operational adjustment agility. By market capitalizing agility Liao et al., (2019) imply a combination of (1) fast and appropriate decision-making when facing market/customer changes; (2) continuous organizational reengineering to better serve customer needs; and (3) threatening market-related changes and apparent chaos as opportunities to capitalise quickly. By operational agility the researchers imply (1) the ability to quickly scale up/down the production/service levels to support demand fluctuations on the market; (2) adjusting rapidly to suppliers’ disruptions; and (3) always fulfilling the demands for rapid-

response, special requests of the customers. Our study aims to explore how those agilities unfold in SME' open business model innovation.

Digitalization is both a solution and a problem for many OI and BMI related challenges, because it may imply disruptive innovations and hard-to-predict competition (Garzella et al., 2020; Priyono and Moin, 2020; Seetharaman, 2020). According to Priyono and Moin (2020, p. 3) "It is easier for firms to execute the transition path to develop a digital technology-based business model if they do not produce their outputs in physical form, and are more related to information, such as media, banking, or insurance". Regardless of the sector, Garzella et al., (2020) show that SME capabilities to manage technological and relational aspects directly impact business model innovation. Collaborative new product and service development supported by digitalization and big data can stimulate SME' open business model (Drexler, G., Duh, A., Kornherr, A., & Korošak, 2014). However, to benefit from open innovation firms need to develop digitalisation and big data capabilities (Del Vecchio et al., 2018), which can be most challenging for SMEs due to limited resources. Furthermore, operating in the digital environment poses a threat to privacy and data security (Del Vecchio et al., 2018; Müller et al., 2018).

Overall, appropriate governance mechanisms, high level of communication, trust and commitment among open innovation partners are considered to be the key strategies to successfully address the challenges of open business model innovation (Hoffmann and Schlosser, 2001; Mohr, 1994).

3. Methodology

3.1. Research method and sampling

Open and business model innovation represent very context-dependent phenomena. Therefore, we use a case study method, which allows capturing this rich context (Yin, 2009). Particularly, the multiple case study method not only allows to perform in-depth context analysis, but also helps to identify common patterns across diverse cases. Following this method, we can apply a 'replication logic' to identify both theoretically similar or contradicting patterns across various cases (Bryman and Bell 2015; Yin 2009).

As our paper has a rather narrow research focus, which requires context diversity and richness in sampling, we applied a purposeful sampling strategy (Patton 1990). Specifically, following Patton (1990) and directed by our research goals, we have applied a combination of three purposeful sampling strategies. First, as we aimed to study open innovation in SMEs, we were looking for SMEs that have applied a theoretically framed open innovation practice, so we used theory-based sampling. Second, to achieve contextual richness, we had to target cases situated in different settings in terms of geographic region and business sector, so we used maximum variation sampling. Third, among pre-selected cases of open innovation in SMEs, we had to specifically select those going through changes in their business model, so we applied criterion sampling.

The empirical data for this research were collected within the large-scale EU project INSPIRE (www.inspire-smes.eu) focused on open innovation in SMEs. All authors of this study took part

in the entire research process from the design and sampling to data collection and analysis. Using secondary data, professional networks, and published case studies, an initial sample was built comprising 369 EU-based SMEs involved in open innovation. The SMEs differed in size, age, region, industry, tech intensity, and development stage. Subsequently, a careful selection of the cases was done based on several criteria. First, the richness of the information about open innovation activities within each case were considered. By richness of the open innovation activities, following Laursen and Salter's (2006) breadth and depth approach, we understand the number of external cooperation partners and the intensity of collaboration. Further criteria included the availability of the SME' representatives for a further in-depth interview, and the targeted diversity of SME types. The selection resulted in a database of 103 SMEs practicing open innovation.

3.2. Data collection

For each of the 103 cases, the project team (including the authors of this paper) conducted semi-structured interviews with SMEs' representatives. The interviewees for each SME (at least one or two per case) were selected based on the following criteria: 1) a good understanding of the entire SME business, and 2) direct involvement in the open innovation project. Typically, such an informant is a SME co-founder, a CEO, or a manager.

The interview guide was developed based on the innovation process framework, following prior studies on the temporal dimension of organisational change, as well as on changes happening in the innovation and open innovation context (Bahemia et al. 2018; Bessant and Tidd 2015; Langley et al. 2013). The interview guide was first reviewed by a focus group of 20 experts in innovation management: researchers, practitioners, and business consultants working with SMEs and 50 entrepreneurs. It was then tested on nine SMEs located across the EU, so any necessary adjustments were considered. The interviews were conducted between November 2016 and May 2017 and were subsequently transcribed verbatim. Along with this primary data collection, secondary data such as background information on the open innovation projects were collected from firms' websites, materials shared by the interviewees, and databases like Amadeus.

3.3. Data analysis

To systematise the case study analysis, first, a 'template analysis' technique (Cassell and Symon 2004) was applied. A literature-based template analysing the innovation pathway for each SME was filled and the SME's background information was carefully documented. To ensure the validity and reliability of the interpretations made, the member-check technique was applied (Patton 2002): the interviewees were invited to review, validate, and if necessary, revise the completed case templates to avoid any misinterpretations.

The database of 103 case studies was then transferred to NVivo software for further analysis. A keyword search for 'business model' was run across all cases. This search identified 13 case studies where the concept 'business model' was used at least once. The risk of missing any relevant case

study in the database was mitigated via 1) the initial unification of the terminology applied, and 2) a manual check of the case studies' summaries. In-depth reassessment of the selected 13 cases revealed that in two of them, the 'business model' keyword did not have a link to open innovation in the SME. We, therefore, eliminated these two cases and focused on the remaining 11 for further analysis (see Appendix A).

Multiple rounds of auto-coding and manual data coding were run. With the help of automated data search and auto-coding in NVivo, we could spot the events in each case story when the SME had started to go through a 'change' or was facing a particular 'challenge'. Further manual data analysis in NVivo revealed that SMEs were pushed to change their business models by either external or internal triggers, rather than undertaking this change proactively. Thus, we labelled the first major category of the SME pathway as a 'trigger' for the business model change. Cross-case analysis allowed us to identify the common triggers, which resulted in several subcategories. Analysing the SMEs' pathways further, we first looked at where the firms arrived after the change: what the 'new business model' was, how 'radical' the change was, and to what extent the external parties were involved in the change (the radicalness and openness as subcategories of the 'new business model'). Therefore, the 'new business model' category reflects the final point of the SMEs' business model transformations analysed in the scope of this paper.

To unpack the process of the SMEs' business model change, we studied all events occurring between the emergence of the trigger and the development of the new business model. We discovered that the studied SMEs faced multiple 'challenges' and applied specific 'strategies' to cope with these challenges. Thus, 'challenges' and 'strategies' became the interim major categories on the SME's pathway. To assure internal validity and reliability, the analysis of the case studies was first run by two researchers independently, after which their results were compared, discussed, and aggregated.

4. Business model transformations: Triggers, challenges, and strategies

4.1. Business model transformations and triggers

A broad spectrum of business model transformations across the cases varied from incremental changes in just a few blocks of the business model canvas, such as improving the existing product/service, to a complete overhaul with architectural changes, such as introducing radically different products and targeting completely new customer groups (Figure 2; Appendix B). Across all cases, both radical and incremental business model innovations were happening along with shifts towards more intensive collaborations with a wider variety of external stakeholders. Furthermore, in both radical and incremental transformations, the firms were shifting from solely transactional relationships with their clients towards customer-led developments and peer-to-peer learning.

The changes to the business models, whether radical or incremental, were triggered by factors that led the SMEs through a step-by-step business transformation process. Competition which is also

highlighted by Müller et al., 2018 was the most common trigger for a change in the studied cases (5 out of 11). We found the triggering role of competition for example in the case I: *'Founded in the late 1970s, the company was heavily centred on cork-based products for bathrooms and kitchens... In 2000, it found that silicone offered many interesting properties. Sales nearly quadrupled in four years. But when you are in the hands of other brands, the retailers... the market had been theirs [the market was rather entirely controlled by the retailers] [and] ... [the case business success] fell away again.... I entered as CEO in 2005 and insisted that the company should have its own branding... It was a total change of the business model—where, with whom (clients), the way of selling.... We created a small marketing department [and] involved external collaborators for the design of the packaging and advertising, as well as the industrial design.'* (Case I—cookware producer).

<Insert Figure 2 about here>

We coded crises that triggered business model changes as 'market turbulence' and found those in two cases. An example of those is the dot-com bubble of the early 2000s: *'We took one of these expensive [IT] systems and... offered [it] as a service to smaller telecom companies. That was the original business idea... [and] then in 2003 the dot-com bubble arrived; 80% of all our potential customers went bankrupt. We changed to providing innovation, process consulting, and business model development. Then in 2006, we started working with clustering [working with regional cluster organisations, which support clusters – groups of organisations in a certain sector].'* (Case C – consultancy serving business clusters). The information technology landscape is rapidly developing and changing. These changes call for a reactive type of business model transformation as a response to the changes in the external environment (cases A, C).

A proactive type of behaviour, in turn, might be needed in cases when the proposed technology or service is radically new and/or when society or market is not ready to accept the new offering quickly and easily. We called these triggers as lack of market readiness or 'market immaturity' to keep it a shorter label. In this situation, a firm transforms completely, offering a new product/service and a radically new business model to the entire market (Foss and Saebi 2017; Muñoz and Cohen 2018): *'... there are some markets in Europe that have not known digital banking at all, or are at the very beginning. So there [is a] lot of room [market space] for us.'* (Case J—a community-based online banking service); *'...people have this built-in fear of electricity; and most people don't really understand how the brain works either. So, a lot of people are putting chemical substances (painkillers, caffeine, nicotine, all types of drugs) without realising that they are manipulating their brain. So, when you invite people to put a brain stimulating headset directly on the head, they don't see it as the same thing [to using chemical substances].'* (Case K—the brain stimulating headset developer).

We labelled these three above-mentioned triggers (competition, market turbulence, and market immaturity) as external triggers for the business model transformations as they stem from the external environment. We found that all radical business model transformations were triggered by

these external factors, and not by internal organisational changes. This was also observed by Linz et al. (2017).

Incremental business model changes, carried out collaboratively or by the SME alone, were caused by both external factors and internal organisational issues. One of these internal issues was the struggle to scale the business because of the need for larger-scale production, while the SME was neither capable nor interested in running large-scale production on its own. A joint venture with another SME that was capable to scale the production was the solution, but it inevitably required adjustments in the focal business model. Another firm-specific trigger for an open business model adjustment was the failure of the SME's former business model. Despite attempts to closely collaborate with customers (large automotive companies) installing recycling equipment for them implied substantial lobbying. The answer from the automotive industry giants was simple: *'Why should we do it if our competitors don't!'*. That triggered the SME to change its focal technology and target customers: *'After all the struggle: about four years ago when we put back those systems into various places in Europe [customers in the automotive sector] we decided that we would look to solve a problem. So, we did that by looking at the waste as fuel [as a useful resource] ...'* (Case D—recycling equipment developer).

Figure 3 illustrates the process of business model transformation being triggered externally (market turbulence, market immaturity, and competition) or internally (prior open innovation failure and production) (For the exact details on the old and new business model for each case, we refer to Appendix B). The pathways in the figure were initiated by these different triggers and led each SME to a new business model. The business models on the right side of the figure are further categorised along the openness and radicalness dimensions of the transformation. We furthermore coded the resulting four types of business model transformation as radical open business model transformation, incremental open business model transformation, radical closed business model transformation (none of the cases we studied ended up in this quadrant), and incremental closed business model transformation. We clarify these four types of business model transformation in the discussion section. In the next section, we focus on the challenges SMEs faced and the strategies they applied.

<Insert Figure 3 about here>

4.2. What is behind the process of business model transformation?

Following the process perspective, we mapped the SME pathways through their business model transformation (Figure 4). After a transformation was initiated, the SMEs faced various challenges and employed strategies to cope with these challenges. We identified market-driven challenges (unready customers and intensified competition) and organisational challenges (leap of faith, liability of smallness, re-assessing customer needs, increasing scale and scope).

Liability of smallness

Struggling with the 'liability of smallness,' lack of internal resources and capabilities is a common problem for all SMEs (Hewitt-Dundas and Roper 2018; Presenza and Meleddu 2017). The technical, financial, and organisational challenges of manufacturing a physical product were faced by many SMEs that were going through an incremental business model transformation. Notably, all these firms used a similar strategy to cope with this challenge, such as finding a partner with strategic convergence. A partner must be willing to share the risks with the focal SME and possess the production capability and resources needed to invest.

<Insert Figure 4 about here>

Furthermore, partners having a strategic fit with the studied SMEs were also SMEs, and not large firms. Prior experiences of collaboration with large players were particularly negative in several interviewed firms due to the large firms lacking agility and speed. *'Where we weren't able to go it alone, we sought alliances, partners... people with whom we had shared values and ideals. They are companies of a similar size to ours. And we created subsidiaries together. One of the things... about our experience with... open innovation in collaboration with big companies, is that it hasn't been very positive. We've had projects with large companies who have approached us because they saw us as an opportunity to innovate and understand our way of working. We started working with them on joint projects, and finally we got nowhere. Why? Because they are extremely slow and not agile; they value results above anything else; they changed people and contacts frequently, which meant we kept having to restart and re-explain things.'* (Case I—cookware producer).; The other interviewee comments on their SME' compatibility with a small-sized partner: *'...the trouble is that [we are] a very small company. We are constantly running out of cash. But now we have a lot of interest and we are expecting a lot of orders. We found somebody who is willing to take the risk to build a system. The difference with [the picked partner company CEO] is that he wants to make the company sustainable, look for new technology, and recognises that there is an issue at the back end of their machines. He recognises that he needs to solve that, and he solves it by finding us.'* (Case D—recycling equipment developer).

The 'liability of smallness' challenge is a major issue for small firms since internal competencies and skills are limited, and they need to find these required competences and skills outside—in crowds, other firms, universities, and research labs. In one of these cases, this challenge was the immediate cause of the change to the new business model: *'...the community manages itself by itself... as a startup you cannot do everything by yourself.'* (Case J—a community-based online banking service). In another example, the SME first started to grow in terms of head count, but it soon realised that its product (a neuro-stimulation headset) required such diverse expertise that it could not hire all the required talent. Instead, it had to externalise the core functions: it subcontracted developers, involved external experts on an on-demand basis, and established an advisory board. We coded these practices as 'inbound open innovation'. *'The fewer people on the team the more dependent we are on externals. We do short workshops with external designers [and] we iterate with user involvement in between. We've done the same with electronics. So*

instead of making a whole department inside, we basically hire one outside. One of the first things we did was to start building the advisory board of experts. If we didn't have that from the beginning, we would still be at the prototyping stage.' (Case K—the brain stimulating headset developer).

Another SME was invited by its clients to overcome the 'not-sold-here syndrome' (West et al. 2006) and open its infrastructure via the development of a technology subsidiary. We coded this strategy as 'outbound open innovation'. *'B2B partners came to us saying "Oh, we are interested in what you do, the bank, can you launch it for us, or can we use your infrastructure?" and that is how the technology subsidiary developed. The technology subsidiary and the B2B companies became possible thanks to open infrastructure and we enable banking organisations, retail organisations, as well as telecoms, to deploy digital banking solutions in the retail and SME sector.'* (Case J—a community-based online banking service).

All these examples of SMEs successfully opening up and seeking complementary capabilities outside illustrate the recent findings of Gimenez-Fernandez et al. (2020) on liabilities of newness and smallness in start-ups to be addressed by openness rather than by internal R&D investments.

Five of the SMEs specifically reported the challenge of funding their innovation project and they applied a logic of combining their own internal resources with external, resources. Financing was commonly achieved through joint projects, which in turn relied on external funding, including government funding.

Customer needs

In encountering the change, many firms (8 out of 11 cases) had to reassess customer needs. The SMEs did this by either involving the end-users/community in product/service development (four cases) or by collecting feedback from them. The cookware producer, for example, opened out their business to consumers as creators of digital content and leveraged their cooking talents. *'We're working with users to get content... and interact with them. We want to be a reference point for them—from advice, to habits, to recipes... We observed how people cooked. We found another way of working and set up practical workshops based on design thinking methodologies. These workshops involved many kinds of people from different backgrounds: cooks and chefs, nutritionists, consumers'* (Case I—cookware producer). Alternatively, firms introduced operational improvements (for example, new invoicing or ICT systems) or ran a benchmarking study to observe clients and learn from them. The common thread in all these strategies was that the business model change was a rather lengthy and iterative process (see Figure 4).

Leap of faith

One of the most interesting challenges observed in the business model transformations was the need to enter a field that is either new to the firm or new to the world—in other words, the need to 'take a leap of faith' as it was described by one of our interviewees. *'...to be completely honest we were making a leap of faith. I think an important element is the network of companies, competition, and partners... This for us has been a way of learning what they are doing, what they have, and*

how we can add something to that.' (Case B—a former game developer transformed into a 3D urban visualisation developer). SMEs mainly face this challenge when they change their business model in a radical way (four cases). However, two SMEs undergoing incremental shifts also faced this challenge. One firm was changing its focus from heat-energy recovery to recovery of energy from residual waste, and the other was changing from being solely a technology out-licensing firm to a product developer and manufacturer.

To deal with this challenge, most firms were learning intensively from different external actors, through networking, professional communities, or benchmarking with competitors. *'The benefit [of this strategic partnership] is that we have learned a great deal about process engineering and process development, so we can take what we do in the lab to the pilot scale—and [we] have a workable production system. That has been a great learning [experience] for us and has extended the breadth of our R&D capability.'* (Case E—a biotech firm developing healthcare products); and *'There are at least four open communities with people who are building these devices themselves and who are open with their knowledge. We could never have developed so quickly unless we had all these people who were online.'* (Case K—the brain stimulating headset developer). Two firms also recognised that they were able to apply experiences to new fields or applications. *'We [first] put them into various places across Europe... we put them into cars and trucks and this knowledge and experience was useful for us when we shifted the focus.'* (Case D—recycling equipment developer).

Intensified competition

As for any business, intensified competition presented a challenge for several SMEs during their business model transformation. The competition was addressed with a variety of strategies. For example, one firm acquired its only direct national competitor. Another firm, an online community-based bank, had a unique selling point (community-based bank services) combined with an unsaturated market (Europe), and this created good conditions for business growth, in which efficient community management was reported as an essential success factor. *'I think the community itself is a very strong model that is difficult to replicate. Growing the community, and knowing about how to animate it, [was important].'* (Case J—a community-based online banking service).

For the other cases, the competitive situation was less favourable, and firms took measures to decrease their dependency on external parties. For example, the consulting firm and the farmers' cooperative started co-opetition. A cookware producer established its own brand and hired in-house designers: *'We aimed to be an expensive product, based on quality. We made sure that we complied with the various [highest-standard] EU regulations for safety. I insisted that the company should have its own branding. We also changed the sales points to specialised shops which would value the products and have the knowledge to advise and sell the products well, and this required a change in the way salespeople worked.'* (Case I—cookware producer). In dealing with competition, this firm employed a differentiation strategy: the management went for higher standards and higher price segments and chose to collaborate only with specialised shops—a

strategy similar to the 'raising quality and building a brand' approach employed by China's Haier at the beginning of its transformation (Teece 2020, p. 19).

Scale and scope

Once they entered the growth phase, four SMEs found it particularly challenging to increase the scale (the volume of products produced/sold, or services delivered) and/or scope (the variety of offerings) of their businesses. Two of the firms, a business consultancy and the farmers' cooperative, were targeting business consolidation. In these cases, multiple actors banded together to share infrastructure: joint invoicing and ICT systems; resources for service development and branding; and distribution channels. *'...joint investment in a cooling van and ICT system to enable planning and coordination of the new "pick, drive, and deliver" concept. The competitiveness of the offerings was the cost efficiency that was achieved through the collective and shared distribution network.'* (Case H—farmers' cooperative). This strategy enabled them to save costs and increase scale (the volume of sales for each farmer in the case of the second firm) and scope (the variety and volume of services in the case of the consultancy).

Digitalisation was another approach to increase the scale of the business in at least three cases. One firm—a consultancy specialising in training cluster organisations—planned to digitalise its training content to reach a greater number of customers via e-learning. *'Our main challenge is to move from being a consultancy to a company that has a scalable business model that is not dependent on selling man-hours. To be scalable, we plan to start working at digitising content—moving from traditional physical training sessions into a combination of e-learning and learning sessions.'* (Case C—consulting firm serving business clusters). The cooperative of farmers invested in an ICT system to enable planning and coordination of the new 'pick, drive, and deliver' concept. A cookware producer discovered the potential of online sales for its business when analysing its previous market losses. *'We didn't have any online business, and today online sales represent an important part of our turnover. Shops have changed: lots of the traditional specialised shops have closed (especially in the USA and France), and so we've lost an important number of shops and clients.'* (Case I—cookware producer). These strategies of a shared infrastructure and digitalisation (or a combination of both, in the case of the farmers' cooperative) helped the firms grow. Managing organisational boundaries in response to the call for digital business model transformation was recently found to be particularly important for such a transformation (Garzella et al. 2020).

Unready customer

Finally, one more market-driven challenge was found in three firms, namely that the target customers were unready or the market was too small for the focal SME. Two firms had to educate their customers to create the market. The cookware producer expanded internationally to markets with the greatest potential for its products, as well as developed local distribution channels and partnerships. *'It took nearly three years to commercialise well, because at first nobody believed that silicone could be used for cooking—people thought of it like plastic which melts in the oven—until they were able to get a couple of clients who took and promoted the products'* (Case I—

cookware producer). In another case, a competitor creating a similar product appeared to be helpful in addressing this challenge. *'We've had the idea since 2011, but we've been waiting for the market to be ready. Back in 2011, it was so new that we didn't think any consumers would understand what it was. We had to educate users about what it is, how to use it, whether it's safe... The only external factor that sparked our incentive to start the project was that another company that launched a similar product. It had a lot of funding, and we decided that... this is a good time for us as well.'* (Case K—the brain stimulating headset developer).

5. Discussion

In this study, we investigated how SMEs develop open business models to cope with competitive challenges they could not solve if they continued to rely on their existing business model. In the previous section, we demonstrated several external and internal triggers that forced SMEs to adopt new business models. This is, in essence, a dynamic, process-like view of a business model transformation. In what follows, we provide a framework to structure our understanding of these transformations in SMEs. We also illustrate with our SME cases the business model transformation typology proposed in section 2.1.

5.1. A process view towards business model innovation in SMEs' OI

We approach SME open innovation from a process perspective (Vanhaverbeke 2017) and focus on the phenomenon of business model transformations in SMEs (Geissdoerfer et al. 2018). We propose a framework for SME pathways from an old to a new business model (Figure 5). The process of the transformation includes the triggers explaining 'why' these SMEs start a business model transformation (Svejenova et al. 2010), the challenges and the SMEs' strategies and responses to these challenges (the 'how'), which finally enable the SMEs to establish a new, more open business model (the 'what') (Bucherer et al. 2012; Svejenova et al. 2010; Zott and Amit 2010). The proposed framework can be used by managers and coaches of SMEs to track and potentially map useful business journeys when an SME starts the business model transformation.

The framework shows the external and internal triggers and thus, reveal when the current SME' business model is no longer sustainable. When SMEs try to change business models, they inevitably face several challenges. Which challenge they face depends on the context and the triggers, but in all cases, SMEs have to develop appropriate strategies to deal with them. The strategies addressing the challenges will finally lead to a new business model. It is important to understand whether an SME has to engage in open innovation, and with which type of partners, and whether the business model transformation will be incremental or radical. This typology—which we further discuss in Section 5.2—contributes to the first attempts to classify SME business model innovations (Lee et al., 2012) and determines the principal differences between radical and incremental, and open and closed business model transformations.

In their systematic literature review, Torchia and Calabrò (2019) call for unpacking the SMEs' open innovation processes. Our study responds to this call not only by looking at the open

innovation process, but also by tracing the business model transformation sub-processes that take place when SMEs are engaging with external partners (as discussed by prior studies, see Albats et al. 2019; Cosenz and Bivona 2020; Gould 2012).

<Insert Figure 5 about here>

5.2. A typology of firms in terms of openness and radicalness of the business model transformation

Business transformation leads to pivoted or new business model for the SME. We can categorise the resulting business models into four groups based on the differences in SMEs' business model innovation and openness. The business model innovation literature highlights the radicalness of the business model innovation. The open innovation literature characterises the external collaborations of any innovation process along the dimensions of breadth and depth (Laursen and Salter 2006; Snihur and Wiklund 2019; Lee et al., 2012). The analysis of the 11 cases allowed us to group different business models along this two-dimensional framework explaining business model transformation (Figure 6). The framework shows how business model transformations can be characterised as open or closed and as incremental or radical. This results in four types of business model transformations (Figure 6).

<Insert Figure 6 about here>

The lowest risk business model change is represented by the lower left cell in Figure 6: if an SME does not yet embrace open innovation, it tends to adjust the business model on its own in small incremental steps (closed business model adjustment). A single case A (Figures 3–6) arrived at this quadrant. Despite the business model change being incremental, it enabled the firm growth. Closed innovation in combination with incremental business model changes can be a successful approach for SMEs, but it is rather exceptional as most SMEs need to open up their innovation process because they do not have the required resources, skills or competencies in-house to implement the business model change (Del Vecchio et al., 2018).

The 'open business model adjustment' represents the case where SMEs make small changes in their business model but rely on external collaborations in it. Given the relative simplicity of such collaborative initiatives, they may be used by SMEs as a first step to open innovation. Five of the studied cases chose this type of transformation, although their pathways differed (Figures 3–5). 'Closed business model transformation' is a strategy for a self-reliant radical business model transformation that is virtually impossible for SMEs, because they most likely do not have the required knowledge and resources to drastically transform the current business model on their own. No surprise that none of the cases in our sample adopted this type of business model transformation. If it happens, it is likely to fail, and those cases are even harder to identify and get access to. It would be an interesting research topic to study under which conditions a 'closed business model transformation' strategy works for SMEs. For instance, when IP is hard to enforce, an SME may choose to develop new technologies internally (Marullo et al., 2018).

Radical business transformation requires ecosystems of external parties (Williamson and De Meyer 2012). However, their strategic interests and driving forces of these parties may not always be aligned, and tensions between partners must be traced and managed proactively. Five case studies (Figures 3–5) represent this type of business model transformation. Radziwon and Bogers (2019), in their study of SMEs' open innovation, took an ecosystem approach and found that SMEs face challenges exactly because their business model is in misalignment with the business model of other actors in the ecosystem. In this study, we propose that a radical shift in business model transformation may put an SME at the core of an ecosystem: this type of business model requires that other actors play the game according to the SME's rules. Such a power shift, however, may indeed appear quite risky, and stakeholders in such a business model transformation should be carefully selected with compatibility and power divide in mind (Albats et al. 2019).

5.3. The role of internal and external triggers in SMEs' business model transformation

Some authors have highlighted that SMEs do not engage in a business model change unless the competitive context forces them to do so (Vanhaverbeke 2017; Svejenova et al. 2010). In other words, there is a need for a trigger to start the business model transformation process. In line with Foss and Saebi (2017) as well as Bucherer et al. (2012), Stampfl (2015), our study shows that both internal and external triggers are responsible for pushing SMEs towards business model transformation and opening up. Notably, the firms that carried out a radical business model shift were triggered to do so by changes in the external environment—intense competition, market immaturity, or market turbulence. In contrast, incremental tweaks to the business models were also triggered by internal, organisational factors; for example, the challenge of product manufacturing while lacking manufacturing capacity, or the firm's own negative experience with prior open innovation projects. These findings partly resonate with the conclusions of Osiyevskyy and Dewald (2015), where a perceived non-critical threat was found to trigger only an incremental business model change. However, Osiyevskyy and Dewald (2015) propose, based on their results, a notable role of opportunity recognition as a trigger for a business model change, where our study suggests that a search for an opportunity needs to be first triggered by an internal or an external factor—particularly in the context of resource-constrained SMEs. This is in line with the findings of other scholars. See, for example, De Marco et al. (2020) for recent evidence on SMEs engaging in open innovation when they lack funding, and Kohnová et al. (2019) for internal factors as triggers for business transformations.

5.4. Radical and incremental business model transformations

SMEs engaging in open innovation are likely to do so to implement business model changes. These can vary from minor adjustments (changes to a single or limited number of blocks in the business model canvas) (Osterwalder and Pigneur 2010) to radical changes (fundamental changes affecting many blocks of the business model canvas). However, as soon as SME decides on a change, it

ends up with insufficient internal resources and it does not have the required capabilities to implement the change on its own, thus forced to involve external parties.

Furthermore, both incremental and radical business model transformations are possible regardless of whether the firm has opened the value creation end of the business model, the value capture end, or both ends (running an 'open innovation based open business model') (Weiblen 2014). Accordingly, the conceptual dimensions of value (creation, delivery, capture) (Chesbrough et al. 2018) co-exist with the radicalness of the business model transformation, rather than the dimensions determining each other.

A more radical change in the business model is likely to lead to a greater number and a larger variety of challenges for SMEs. Consequently, the risk of failure is greater in the case of a radical business model change. The liability of smallness, lack of resources and capabilities, and market and competition threats, form the core challenges influencing the way SMEs make strategic decisions in changing their business models – which resonates with the prior findings by Müller et al. (2018) and Marullo et al. (2018). Various forms of partnerships, external learning, reliance on experiences and user communities (Kohler 2015), as well as differentiating the firm's value proposition, were the most common strategies to cope with the challenges faced. These findings, when contrasted with prior studies of large companies, illustrate how the process of business model transformation in SMEs differs from large firms. Frishammer and Parida (2018) already studied the process of business model transformation towards open circular models in incumbent firms and developed the framework of a step-by-step transformation process. However, our study shows that business model transformation in SMEs is far from being gradual and is the result of multiple push and pull factors, with internal and external triggers and challenges emerging along the way. These findings contribute to the ongoing research on SME heterogeneity (Karoui et al. 2017) but go beyond firm characteristics as it tackles the complex processes of business model transformation in open innovation projects. Cosenz and Bivona (2020) present one of the first attempts to unpack the process of SME business model transformation, but unlike our study, they do not examine this within an open innovation context.

6. Conclusions

Open innovation and business models for SMEs are complex, heterogeneous, and context-dependent phenomena. Despite these attributes, we could trace common patterns in the triggers for business model change and in the actual business model transformation pathways. Our study contributes to the ongoing research on SME heterogeneity by explaining the processes of business model transformation specifically in an open innovation context.

This study is not without limitations. First, the cases studied in this paper stem from an initial sample that itself was purposeful in targeting SMEs that had implemented open innovation, and therefore, there are no cases in the sample that successfully changed business model in a radical way without external collaborations. Future research should focus on SMEs that successfully change business model using a closed innovation approach. This would allow us to determine

under which conditions open or closed innovation is driving business model changes. Furthermore, the sample size was too small to trace the impact of the firms' characteristics (size, sector, stage of development, region, etc.) on open innovation and business model transformation. Future research could implement a quantitative approach to assess the impact of firm characteristics on these processes.

Second, the data on SMEs' performance are limited by the interviewees' readiness to disclose it. Future research could use the proposed typology of the SME business model in terms of radicalness and openness (Figure 4) not only to validate it further on a larger sample, but also to trace the impact of each business model type on firm performance. Similarly, the process view and the stages of the business model transformation identified in this study (Figure 5) should be validated with a larger sample.

Third, this study focuses exclusively on SMEs. A study explicitly comparing business model transformation in SMEs with large firms could further assist in highlighting the differences and peculiarities of the SME open innovation context (Spithoven et al. 2013; Vanhaverbeke 2017).

Fourth, it might also be important to study the differences between categories of SMEs. Lambrechts et al. (2017) studied, for instance, how small family firms that invest in constructive family bonds and high-quality relationships among family owners characterised by reciprocity, consideration of one another, and directness, find it easier to pursue an open innovation strategy. Family-owned firms and small firms that are not family-owned are likely to use different mechanisms to transform their business models through open innovation activities.

Fifths, our study examined open innovation and business model transformation at the organisational level (Bogers et al. 2017). However, we should not only understand what the SMEs do and how they do it, but also which organisational capabilities and individual competences facilitate a particular type of transformation (more or less radical, more or less open) (Kohnová et al. 2019). Moving beyond the organisational level towards a higher level of analysis is also important, particularly for policy makers (De Marco et al. 2020).

Despite the limitations, the present study advances our understanding of how SMEs engage in open innovation activities to develop new business models after being triggered to act by changes in the external or internal environment. There are very few studies that take a process perspective on SMEs' open innovation activities and business model transformations. This longitudinal approach is suitable to disentangle different factors that help SMEs to develop new business models and understand the sequence and interaction of triggers, challenges, and strategic reactions that empower SMEs to shift to a new business model. We also distinguished four types of business models that SMEs adopt after such a transformation. Open innovation is important for all SMEs, whether they adopt an incremental or radical business model transformation. Radical business model transformation requires more changes in different parts of a business model (value creation, value delivery and value capturing) and therefore requires more complex forms of open innovation. This paper is the first explorative study on the role of open innovation in SMEs' business model transformations. We encourage other scholars to take a similar process view and

study more diverse SMEs over time. New business models are not developed overnight, and the role of open innovation activities in crafting new business models can only be analysed properly when SMEs are observed for a longer time. Only in this way can we understand what triggers firms to start open innovation processes, what kind of problems they face in open innovation, which strategies can be used to overcome these hurdles, and how they lead to more successful business models.

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Appendix A: The cases studied – summary¹

Case	Country	Lifecycle stage	Product/ Service	Sector/ Industry	Tech intensity (Low-Medium-High Tech)	# of employees	Revenues, k€	Interviewees	Interviewee gender (M/F)	Interview length, mins	Additional sources	Impact of the OI project and BM transformation for the SME business
A	FI	Early Stage	Services	Consulting	LMT	9	704	Consultant	M	57	SME website, interviewee' LinkedIn profile, blog posts, Amadeus database	The number of consultants has increased by about 20% and invoicing in the same period has increased from 20 to 30%.
B	FI	Early Stage	Product	Software development	HT	6	151	CEO/ co-founder; Developer/ co-owner	M, M	90	SME website, interviewees' LinkedIn profiles, focal project documentation (proposal, minutes), Amadeus database	Collaborative initiatives analysed helped the firm to completely change its business focus from games development to 3D visualisations of the city development plans and architectural projects.
C	NO	Established	Services	Consulting	LMT	9	194	CEO/ founder	M	75	SME website, interviewee' LinkedIn profile, focal project website, Amadeus database	The SME was growing for the last four years, portfolio of bigger set of clusters. The SME was able to increase the pricing of the service they provide, so they got a larger margin.
D	UK	Established	Product	Recycling equipment	LMT	12	NA	CEO/founder		108	SME website, interviewee' LinkedIn profile, Amadeus database	Patent filled, new product that fits into a new value chain,
E	UK	Established	Product	Biotech manufacturing	HT	6	NA	Founder/ managing director	M	30	SME website, interviewee' LinkedIn profile, Amadeus database	Patent granted, a small financial impact that can be directly attributed to the project, obtained through selling product to customers.

¹ The data are given as per the moment of the interview

Forthcoming in *The Journal of Small Business Management* (authors' version)

F	BE	Mature	Service	Multimedia	HMT	27	NA	CEO; CTO	M	23	SME website, interviewee' LinkedIn profile focal project website, Amadeus database	The project was a success and went live in the presence of thousands of people during a concert in Antwerp. Increased brand awareness in the market of wireless communication in difficult circumstances. New clients acquired. New service offerings developed.
G	BE	Mature	Service => Product	Medical ICT	HT	17	NA	CEO/ co-founder	M	45	SME website, interviewee' LinkedIn profile, Amadeus database	Development of a unique, innovative software solution for dialysis centres and hospitals; internationalisation, IPR owned
H	BE	Mature	Product	Agriculture	LT	2	NA	Owner	M	40	SME website	This innovation led to the job creation of 2 full-time employees at the distribution company. For the farmers, their turnover in the shop increased considerably (from 10% to 300% additionally), even saving one farmer from bankruptcy.
I	ES	Mature	Product	Food	LMT	138	17365	CEO	M	45	SME website, interviewee' LinkedIn profile, Amadeus database	Turnover between 2005 and 2012 went from 8 million to 28 million.
J	DE	Start-up	Services	Banking	HT	57	12	Managing director	F	23	SME website, interviewee' LinkedIn profile, published case study	The SME became a serious player in the European market with considerable growth potential, low-cost acquisition of new customers via the community, developed the apps for B2B customers.
K	DK	Start-up	Product	Consumer electronics	HT	7	NA	CEO/ founder	M	67	SME website, interviewee' LinkedIn profile, online community posts, Amadeus database, published case study	Faster and more resource efficient prototype building and testing, patent application, first sales.

Appendix B: Business model canvas: changes to the business model for each case study

Key Partners			Key Activities			Value Propositions			Customer Relationships			Customer Segments		
Old	New		Old	New	Old	New	Old	New	Old	New	Old	New		
Governmental bodies	A	BC	Consulting services	A	A	Local farm products	H		Transactional	ABCD FGHIJK	H	SMEs	AC	AC
Other SME	A	BDE HIK	Community-development		AHI JK	Tailored customer service	A	AI	Peer-to-peer learning	E	ACD FGIJK	Individual clients/ users	BJ K	
Large Corporation	D	BEF GJ	Game development	B		New product/ technology	BEK	EG K	Customer-led developments		BEFG IJK	Automotive, nuclear multinationals	D	
Research organisations		CEF GK	IT services	CG		Energy savings	D	D	Educating customers		CJK	Wireless networks consumers	F	
Individual experts		ABIJ K	Selling farm products	H	H	IT services, IT infrastructures	CFG	F				Mass market	I	
Lead customers/ users		ABIJ K	R&D	DE	DEF GIK	Cluster trainings, certification		C				Cosmetic industry players	E	E
Crowdsourcing/ community		BJK	3D visualizations development		B	Large variety of the regional fam products		H				Individual & business farm products consumers	H	H
NPO		I	Cluster services		C	Community-based content/ product/ service		IJK				Municipalities, construction companies & architects		B
						3D visualizations w. gamification		B				Cluster organizations		C
												Production plants		D
												Customers with high demands in networks (events, nuclear power stations)		F
												Hospitals		FG
												Premium segment		I
												Business customers		JK
			Key Resources	Old	New				Channels	Old	New			
			People	AB CK	ABI				Advertising and media partners	A	A			
			Capabilities	G	CG				App stores	B				
									Business networks	ACDE FGK	ACD FJK			
			Technology/ IP	DE FIK	DEG IJK				Joint projects		BCF G			
			Infrastructure	CF	FH				Trade fairs		E			
			Land & single selling points	H					Single selling points		H			
			Community		IJK				Distribution network		H			
									Discount stores, large chains, catalogues	I				
									Specialized shops		I			
									Community		JK			
Cost Structure						Old	New	Revenue Streams				Old	New	
Staff costs						ABC FGH	B	Customer service fees				AC FG	AJ	
Infrastructure						CJ	H	Games sales				B		
Manufacturing						I	DEI	IP-outlicencing				E	E	
Product & technology development						DEI K	FGI J	Product sales				IK	EK	
Freelance, contract-based costs							AB	Single-point sales				H		
Service developments							CF HJ	B2B contracts					BCD FGJK	
Community development							IJK	Distributing-network sales				H		
								Selling experiences & content				I		
								Selling infrastructure & services through tech. subsidiary				J		

Appendix C: Business model (BM) change and triggers for it in the studied cases

Case	The main trigger for the BM change	Quote (case templates)	BM change/ New BM creation	Quote (case templates)
A	market turbulence	<i>The business model innovation on the company level, in this case, are driven by industry [digital products & services] requirements and market change [market turbulence].</i>	Community-based BM (shift towards it)	<i>...case of an agile company, relying almost exclusively on contract employees and freelancers. ... The independent consultants are bonded together by shared policy, vision and strategic objectives and exploit the company's brand and invoicing system.</i>
B	*lack of profit (competition) *new opportunities appeared & *timing	<i>It was going well games wise, but it was an unprofitable success. That is why, a decade later, Case [B] company has changed its focus towards developing game-like applications for visualizing urban planning process.</i> <i>'...we came to realizing that neither of the games are really doing kind of money wise, not good enough, and everyone was just completely tired from the push (offs) for so many years' '...right at the time [2013] when we were peeking with the games and putting them out [in] a kind of new [application] we got [invited] in the [collaborative project]'</i>	change of the focus_market, sector, industry, etc.	<i>change its business focus from games development to 3D visualizations of the city development plans and architectural projects [which also implied a change from B2C towards B2B sectors]</i>
C	market turbulence	<i>...Due to the dot com bubble in 2003, when 80% of the case company' clients went bankrupt, the case company team sensed the need among small players in consultancy on innovation process, business model development and facilitation of their collaboration with other parties.</i>	change of the focus_market, sector, industry, etc.	<i>... changed their domain from IT services to innovation process consultancy, business model development and facilitation of collaboration between various parties... [which also implied a change from a rather high-tech to a low-to-medium-tech focus]</i>
D	unsuccess of prior open innovation projects	<i>In all these cases, open innovation did not lead to commercialisation because the large corporations were not prepared to consider more radical solutions, which will involve additional costs like helping the value chain to adjust, lobbying standard bodies to accommodate new solution through the change of regulations etc.</i>	change of the focus_market, sector, industry, etc.	<i>... in 2013, [the case company] decided to change its focus by embarking on the development of a technology for heat recovery from residual waste</i>
E	value chain challenges (production)	<i>To manufacture its products, it required out-sourced production or to license to other organisations.</i>	change of the focus_market, sector, industry, etc.	<i>The company focussed on an out-licensing business model for the technology and intellectual property it develops. In recent years the company has started to adopt a more flexible approach to enable it to get products to market. This is expected to continue and may also lead the company to need to build its own production facilities as part of its ... joint venture to need to manufacture products in the volumes required by customers.</i>
F	competition	<i>over time market got saturated with competition offering exactly the same solution</i>	change of the focus_market, sector, industry, etc.	<i>They decided to explore opportunities of use cases with high-density wireless data communication requirements. Unique selling point was the technological strength to represent real-time smartphone videos on large screens during happenings.</i>
G	competition	<i>The competitive landscape was saturated. [The case company] had no particular USP. They needed to re-invent themselves and develop a new strategic business offering.</i>	change of the focus_market, sector, industry, etc.	<i>the company went from a service company to a product company (laid a number people off and focussed 100% on the development, co creation and commercialization of their product</i>

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H	value chain challenges (distribution)	<i>They saw the opportunity from customer feedback (to have more local products available from the regional farmers at their sales point) and wanted to spread their points of sale but couldn't find a solution. Individually managed distribution proved to be very time consuming and wasn't scalable. To achieve it at a competitive price level was a challenge.</i>	Community-based BM (shift towards it)	<i>They joined hands to distribute their products to each other's shops by jointly investing in a distribution body to upgrade their point-of-sales network and logistic efficiency. They set up the business from scratch, found partners and steadily grew to a group of 11 farmers</i>
I	competition	<i>...as products for other brands from cheaper competition from elsewhere finally caught up with them, their retailers fell away.</i>	Community-based BM (shift towards it)	<i>...new strategic plan recently finished, they have recovered the innovative vision of the company that puts the user at the centre, working with consumers and other key stakeholders to co-create new content, not just products.</i>
J	technology development and market unreadiness	<i>Developments in information technology and social media allow changing the traditional banking system fundamentally.</i>	Community-based BM (new BM)	<i>The case company was the first European digital bank with an entirely new business model based on a community model.</i>
K	technology development and market unreadiness	<i>... the market was not ready for the case product in 2011 – there was a strong lack of knowledge and information on neurostimulation both in the scientific and user communities. ... Around 2014-2015 some intensive activities in the neurostimulation domain started to happen globally... All these movements both in business and society became a sign for the case company co-founders that maybe that's the right moment and the story has begun.</i>	Community-based BM (new BM)	<i>The case SME is not just a company, but it's a crowdsourcing project, which runs a community of neuroscientists, engineers, developers and creatives.</i>

Appendix D: Challenge(s) along the business model shift and strategies to cope with them

Challenge	Strategy	Cases	Exemplary Quote(s)
MARKET-DRIVEN CHALLENGES			
1. Customer unreadiness			
<u>Educating users & monitoring competition</u>		K J	<p><i>'It took them nearly 3 years to commercialize well, because at first no-one believed that silicone could be used for cooking – people thought of it like plastic which would melt in the oven – until they were able to get a couple of clients who took and promoted the products.'</i> (case I)</p> <p><i>'We, we've had the idea since 2011, but we've been waiting for the market to be ready... back in 2011 it was so new that we never thought any consumers would ever understand what it was... We have to educate the users, about what it is, how to use it, if it's safe, what are (expected), negative consequences... The only... external factor that sparked our incentive to start the project was, that one...company launched ...a similar product. ...they have a lot of funding and, we decided if they have spent all their marketing budget that this is a good time then that might be a good time for us as well.'</i> (case K)</p>
<u>Partnerships</u> for internationalization, new distribution channels		G	<p><i>'The problem is that the healthcare model in Flanders is not very positive, our market potential ...is rather limited. ... We have now identified a number of core countries for commercialization to create scale, but... we encounter a number of problems such as regulatory requirements, modifications to the local model, finding the right distributors, other legislation. We now have an X group on board that has two subsidiary companies... These subsidiaries operate internationally and provide expensive dialysis treatments tailored to the hospitals. ...They are our entry point in this international dialysis world...'</i></p>
2. Intensified competition			
<p><u>Differentiation:</u> * high quality & price segment * conquering unsaturated market with a hard-to-copy community-based USP</p> <p>* decreasing dependency on external parties/acquiring the competitor</p> <p>*establishing own brand</p>		A C H I J	<p><i>'We aimed to be the more expensive product on the market, and based on quality. So, we made sure that we complied with all of the different EU country regulations for safety – not cutting any corners: Germany, France, Switzerland and Japan safety regulations which are the strictest in the world...'</i> (case I)</p> <p><i>'I insisted that the company should have its own branding... We also changed the sales points – to specialized shops which would value the products and have the knowledge to advise and sell the products well, and this required a change in the way working of the sales-people.'</i> (case I)</p> <p><i>'There is so much room in the market that having competitors doesn't hurt actually because it evangelizes what we do... there are some markets in Europe that haven't known at all-digital banking or are at the very beginning; so, there are really big room of for us to go. I think the community itself is a very strong model that is difficult to replicate. Growing the community, knowing about how to animate it...'</i> (case J)</p>
ORGANIZATIONAL CHALLENGES			
3. Leap of faith			

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<p><u>Learning externally</u> through networking/ communities/ competitors</p>	<p>B C E J K</p>	<p>'...to be completely honest we were doing kind of a leap of faith... I think (a big) element there is, this kind of network of companies, competition and partners... .. this for us has been kind of learning to understand what are they doing, what do they have and how can we add something to that.' (case B)</p> <p>'I think one of the reasons we were able to pull it through is that we, have a lot of contacts, all across Europe with people who was working with, cluster and cluster policy development. So, we have access to the right people... (case C)</p> <p>'It [The strategic partnership with another SME] has developed us very much, from a company... that was focused on the very early stages of development... only able to take that up to a certain point, not being involved or thinking about how do we actually manufacture that product... The benefit [of this strategic partnership] is that we have learned a great deal about process engineering and process development, so, we can take what we do in the lab and take it to the... pilot scale...and have a workable production system.... That has been a great learning for us and has extended the range of our R&D capability' (case E)</p> <p>'...Reddit community, and the biohacker community ...have probably been the best sources for the basic knowledge. ...and people are very quick in replying to questions...' "... there are at least four different, open communities with people who are, building these devices themselves and who are very public with their knowledge..." "... We could never have developed so quickly unless there you already had all these people who were explicit online ..." (case K)</p>
<p>Applying past <u>experience</u> to new application</p>	<p>B D</p>	<p>'We [first] put them into various places across Europe... we put them into cars, tracks... and these knowledge and experience were still useful for us when we shifted the focus...' (case D)</p>
<p>4. Liability of <u>smallness</u>: lack of *financial & human resources *capabilities</p>		
<p>Combining int. resources & capabilities with ext. complementary ones through joint projects/<u>partnerships</u> with strategic convergence (small/medium-sized partner has a greater chance to fit)</p>	<p>B C D E F G H I</p>	<p>'...Trouble is that [Case D company] is a very small company... we are constantly running out of cash... But now, we have a lot of interest...and we are expecting a lot of orders... .. And finding somebody who is willing to take the risk to build a system... The difference with [the picked partner company CEO] is... that he wants to make the company sustainable, look for new technology... a lot of companies in the UK are risk-averse... they don't want to put a head above the parapet... They just want to carry on, how they are... unless their particular products stop bringing revenue, they are not going to change... while the [the picked partner company CEO] recognizes that there is an issue on the back-end of their machines, he recognizes that he needs to solve that, and he solves that by finding us...' (Case D)</p> <p>'The contact with that company actually came by chance through a financial expert I knew. So, this is really via networking.'</p> <p>(case G)</p> <p>'Where we weren't able to go it alone, we sought alliances, partners...people with whom we had shared values and ideals. They are companies of a similar size to ours. And you create subsidiaries together... One of the things which I want to say about our experience with innovation, or open innovation in collaboration with other big companies, is that it hasn't been very positive. We've had projects with large companies who have approached us because they saw us as an opportunity to innovate and understand our way of working ...We started working with them, we started working on joint projects, and finally we've got nowhere. Why? Because they are companies which are extremely slow, not at all agile; they value results above anything else; they changed people and contacts frequently, which meant we kept having to restart and re-explain things...' (case I)</p>
<p>externalization of core functions (inbound open innovation)</p>	<p>J K</p>	<p>'...the community manages itself by itself...since the beginning they have built it very openly, and the reason for that is that as a start-up you cannot do everything by yourself...' (case J)</p> <p>'..., ...the fewer people we are on the team the more depend we are on externals. We do, short workshops with external designers, ...we iterate with user involvement in between. We've done the same with electronics. So, instead of making a whole department inside, we basically hire one outside... .. One of the first things we did was to start building the advisory board of experts. ... If we didn't have that from the beginning we would've, still have been on prototyping stage.' (case K)</p>

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technology subsidiary (outbound open innovation)	J	'B2B partners came to us saying "oh, we are ...interested in what you do, the bank, can you launch it for us or can we use your infrastructure?" And it's how the technology subsidiary developedthe technology subsidiary and the B2B companies are totally enabled by open infrastructure ... we enable banking organizations, ...retail organizations as well as telecom to deploy a digital banking solution in the retail and SME sector.'
5. Liability of smallness : lack of *financial & human resources *capabilities		
Applying past experience & learning / benchmarking	A C I H	<p>...the invoice per hour or per day is like the law firm invoicing model. We have been trying to find a way for all these years [2009-2017] to go away from this because for customer, they don't want to pay for somebody just to sit there for some hours ... (case A)</p> <p>Through all these projects that we were involved we got a good understanding of, where individual clusters were struggling. This benchmarking means that you travel from the best from one, leading cluster in one country one region to the next one and by benchmarking you spend two days, to really understand how they work. As we did all (these gold label) cluster certificates we got a good understanding of the situation of the leading clusters in Europe. That influenced our ideas about what they needed.' (case C)</p>
user/ community feedback/involvement	F G H I K J	<p>'... ..We wanted to ensure that there was a great saving of time, that the different actors could communicate better with each other, that we could work paperless and that fewer mistakes were made. This was the concrete need of the client... The company then made a preliminary study, and personnel of our firm followed the dialysis sessions for several months. We have spoken to various actors, etc. Based on this, we as developers have created a concept how such an innovation could work... Every two weeks there was consultation with the doctors and nurses to clarify and deepen the various processes. There really was a co-creation with them for one and a half year to develop a solution to digitalize a dialysis service. You should actually see it as a collaboration between three parties: our company, the doctors and nurses, and the IT department of the hospital....'(case G)</p> <p>'We're working on this with users to get content, digital offer and interact with them.... We want to be a reference point for them – from advice, to habits, to recipes, etc. ... We observed how people cooked: through workshops and classes, not only in the act of cooking, but also in the preparation and consumption... We found another way of working and set up practical workshops based on design thinking methodologies. These workshops... involved many different kinds of people from different backgrounds: cooks and chefs, nutritionists, consumers. (case I)'</p> <p>'...we had a quite good iterative process with users and in verifying the proof-of-concept prototype.... We had feedback from all the users, we've had hundreds of users testing [it] in various stages of development....'(case K)</p> <p>'...in the close future, our clients or those clients with high "Karma" get better conditions in rates as well as access to products... Those members are the most valuable to us, because they are helping out others... community ... is a very efficient customer acquisition channel.... We can acquire people and convert them over time to community banking customers.... They are really involved in the decision making as well as product design' (case J)</p>

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6. Increasing scale & scope		
<p>Business consolidation through <i>shared infrastructure</i>: *invoicing *service development *brand *distribution channels *ICT system & establishing rules of sharing</p>	<p>A H</p>	<p><i>'The [new] financing model is such that I am selling consultancy now and [Case A firm] will invoice it from the customer and they will pay to my company and a commission X%... In addition to that, I pay a monthly fee to the [Case A firm]. This money are used to develop the services and to pay for invoicing ...for me as a consultant this beneficial because I get to use the brand and... I get the major part of the consultant fee to myself. ...Then we decided that we need to have more consultants to make this even more profitable' (case A)</i></p> <p><i>'...joint investment in a cooling van and ICT system to enable planning & coordination of the new 'pick, drive and deliver' concept... The competitiveness of offerings was the cost efficiency that was achieved with the collective and shared distribution network.' (case H)</i></p> <p><i>'The consortium came up to speed and new members wanted to join. Nevertheless, the founding SME and our SME of focus had already invested in the software license and other business risks. ...new members could also not bring 'competing product portfolio' to the cooperation. As some members became more successful in sales (in other channels, apart from the cooperation), they tended to leverage this position in decision-making. ...' (case H)</i></p>
<p>Digitalization</p>	<p>C H I</p>	<p><i>'Our main challenge is move from being a consultancy company to, a company that has scalable business model, that is not dependent on selling man hours. One of the key areas that we have identified, ... So, in order to be scalable, we plan to start working at digitizing the content – moving from traditional, physical training sessions into a combination of e-learning and, learning sessions...' (case C)</i></p> <p><i>'We didn't have any online business, and today online sales represent an important part of our turnover. Habits of consumers, shops have changed: lots of the traditional, specialized shops have closed down (especially in the USA and France), and so we've lost an important number of shops and clients.'</i> (case I) '</p>