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Impact of Business Model Implementation on Performance

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Implementing Business Models into Operations: Impact of Business Model Implementation on Performance[1]

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Abstract

Business models help firms to translate abstract strategic decisions into their daily operations. Because business models mediate between strategy and operations, business model innovation involves both high-level strategic experiments and low-level implementation into operations and technologies. However, most existing empirical studies regarding business model innovation focus exclusively on strategic management and marketing theory. This paper examines whether the performance implications of business model experimentation are mediated by the time and effort spent on implementing business models into operating models and enterprise architectures. We adopt an empirical approach, by analyzing the results of a large-scale, representative survey among European small and medium-sized enterprises (SMEs). In line with existing literature, the research confirms that spending time and effort experimenting with new business models has a positive impact on firm performance. An important new finding is that that impact is in part mediated by business model implementation (i.e. translating new business models into operating models and enterprise architectures). The study provides empirical support for the argument that business model innovation is *not* just a matter of strategic thinking

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and experimenting with BM components and BM architecture, but that is also involves aligning business models to operations and enterprise architectures. Our findings call for future research into the process of business model innovation from a business modelling, an enterprise architecting and engineering management perspective, with a focus on information exchange, business processes, and supporting IT applications and infrastructure.

Managerial relevance statement

Business models help managers translate abstract strategies into daily operations. Existing studies primarily emphasize that managers should spend time and resources on experimenting with new business models. This paper suggests that it is equally important to spend time and resources on implementing new business models and adjusting the applications and IT infrastructure of the firm in question. Only then canmanagers fully reap the benefits of their new business model. As such, managers should treat business model innovation not only as a matter of strategy led experiments, but also as a matter of implementing new practices that have repercussions for operations and business-IT alignment. Structured approaches that deal with information exchange, operational processes and IT applications and infrastructures, such as enterprise architectures, can help to smoothen the process of business model implementation. At the same time, existing enterprise architectures can also constrain the freedom for firms to experiment with new business models. The main takeaway for firm managers is that business model innovation should not be the exclusive domain of strategists, managers and marketing, but should involve IT engineers and architects in order to align business model innovation with operations and enterprise architectures.

Keywords: business models, enterprise architecture, operating model, business model innovation

1 Introduction

While established firms increasingly spend time and effort innovating their business models (BMs) [1]–[3], they often struggle to implement their new BMs in their daily operations [4]. BMs describe how firms create, deliver and capture value from their (technological) resources and operations [5]. A BM can be seen as a snapshot implementation of a firm's strategic direction [6]–[8], whereas a BM in itself is implemented into the operations and processes of the firm [9]. In other words, BMs mediate between high-level firm strategy on the one hand, and low-level technical implementation on the other. Earlier studies show that established firms often struggle to align their operations, architectures and technologies to their newly designed BMs [4], [10], [11]. These problems become more evident when digital transformation forces firms to reconsider their BMs [12].

To understand why BM innovation (BMI) may not produce the desired outcomes, it is important to understand the implementation process of new BMs. Given the mediating role of BMs between strategy and processes, such an understanding should include everything from strategy inception to low-level implementation. However, BMI strategic management literature focuses only on the first part (i.e. translating strategies into BMs) and largely ignores how BMs are implemented into processes and operations, e.g. [6]. Furthermore, as suggested by Van Putten et al. [13] and Lindner et al. [14], most studies adopt a static perspective on BMI, and rarely consider BMI as a dynamic process [15]. It is only recently that scholars have begun to explore the process of BMI, focusing on the dynamic interplay between high-level strategy and BMs [16]–[19]. Those studies that do adopt a dynamic perspective on BMI tend to focus exclusively on the strategic aspects, e.g. [20], [21], as they analyze the process through which firms come up with new, creative BMs [22], [23]. As a result, there are very few studies that adopt both a dynamic or process perspective on BMI *and* consider the implementation of BMs into processes and operations.

The aim of this study is to examine the effect of BMI on the business performance of small and medium-sized enterprises (SMEs), with a particular focus on the analysis of the performance implications of (strategy-level) activity in BM experimentation (BMEX) versus (operational-level) BM implementation (BMIM). Within BMIM, two interrelated aspects of a firm's operations are taken into account, i.e. (1) the operating model (OM), which revolves around the translation of operational strategy on process levels within and between involved key partners in BMI, and (2) the enterprise architecture (EA), which focuses on the implementation of a technical strategy [24]. As such, the main research question is:

RQ: To what extent does BMI engagement enhance business performance in European SMEs, and what is the relative importance of BM experimentation and BM implementation?

To answer the research question, data is analyzed from a survey among a representative sample of SMEs that recently changed their BM. SMEs are firms with fewer than 250 employees and a turnover below € 43 million. Although they represent a relatively heterogeneous group, SMEs contribute to job and wealth creation and economic performance. However, unlike large companies, they have limited financial, technical and human resources, limited access to relevant knowledge and R&D facilities, skills and learning capabilities, and often struggle to align information technology with business practices. As a result, they have a hard time implementing common applications, like social media and Big Data (Analytics), as well as more complex innovations related to digitalization, for instance robotics, Internet of Things, augmented reality and deep learning, in their business models, daily operations and Information Technology.

This paper sheds light on how strategic-level BM experiments and operational-level BM implementation efforts contribute to firm performance, which is important to justify new studies into issues involving BM implementation, in addition to existing research on BM experimentation and strategy-making. The paper also provides an empirical contribution, in light of the fact that the increasing interest in BMI in SMEs (e.g. [20], [21], [25]–[28]), by collecting and analyzing primary data on a large, representative sample of European SMEs engaged in BMI, where existing quantitative empirical studies on the process of BMI rely on proxies from available secondary data [29], [30] or retrospective expert validation [31].

A theoretical background on BM, BMI, EA and OM is provided in Section 2, while hypotheses are developed in Section 3. Section 4 addresses the method of the study, followed by the results in Section 5. The findings are discussed in Section 6, and the conclusions are presented in Section 7.

2 Background

2.1 Business models and business model innovation

Despite more than twenty years of BM research, the debate is still ongoing as to what constitutes a BM and what are its components [32]–[36]. Several scholars have attempted to come up with an overview of existing literature and provide insights into different BM typologies and classifications [34], [36]. A central element in most definitions is that BMs describe how a firm creates value [37] and captures value [38], [39]. Some authors mention value delivery as an additional element [5], [40]. In this paper, a BM is defined as the description of how a firm creates, delivers and captures value.

The notion of BMI is also ambiguous. Foss and Saebi [32] mention four ways in which BMI is being discussed. First, scholars see BMI as a new source of innovation, in addition to process, product and organizational innovation (e.g. [41]). A second approach views BMI as an organizational change process comprising different phases [42], while a third approach focuses on the outcome of BMI, describing examples of innovative BMs within a certain context [43], and the fourth approach addresses the performance-related implications of BM [44], which is also the approach adopted in this paper. Against this background, BMI is defined as "the activity of designing — i.e., creating, implementing and validating — a BM that is new – *to the firm*" [3]. Within this definition, BMI is seen as a process rather than a single act producing a discrete change (i.e. the redesigned BM). BMI is a continuous, dynamic innovation process that requires companies to invest time and resources in changing their BM [45].

Table 1 provides an overview of related work that studied BMI as an innovation process.

Table 1. Related work addressing BMI as a process.

BMI activities	Approach	Reference
Design, Implementation	Linear	[46]
Idea generation, Model articulation, Risk identification and task prioritization, Experimentation	Linear, Stage-gate	[47]
Six-step approach	Linear	[48]
Concept design, Detail design, Implementation	Linear	[49]
Design, Execution, while considering the "Three A's": Aligned, Analytical, Adaptable	Semi-structured	[50]
Experimentation based on BM CANVAS elements	Semi-structured	[51]
Execution innovation development	Semi-structured	[52]
Experimentation	Semi-structured	[53]
Experimentation, in front-end (externally-oriented) and back-end (internally-oriented) innovation	Mixed approach	[54]
Tooling, Idea generation	Method and tool oriented	[55]
Multi-step, through "Drifting" and "Leaping"	Learning trajectories	[56]

Within an innovation process-perspective to BMI, scholars consider different activities and resources to constitute BMI dimensions [53], [57]. Although most studies describe distinct phases of activities, others have argued that, in practice, these activities take place in parallel [56] and there are many iterations [19]. Relatedly, there is still debate on whether BMI occurs through cognition, action or both [56]. Our study considers BMI as a forward-looking, innovative learning process, in which experimentation forms the basis for implementation [57]. While this may be a simplification of reality [16], [56], this approach is in line with the dominant discourse in literature [32].

Within the forward-looking process perspectives on BMI, some studies conceptualize BMI as a linear process. Enkel and Mezger [46] distinguish a *design* and an *implementation* phase, while others separate the design phase into *concept design* and *detail design* [49]. Mentink proposes a circular BMI framework consisting of *initiation*, *ideation*, *integration*, and *implementation* [58].

Another set of studies adopt a semi-structured approach to guide the BMI process. This can involve questioning techniques and experimental trial-and-error loops [59]. In this regard, scholars have argued in favour of active *experimentation* and propose the use of the nine elements of BM CANVAS as a template [51]. Sinfield and colleagues [53] discuss questions that can be used to guide the creative BMI process. Günzel and Holm [54] divide BMI into two innovation activities, which they refer to as *front-end* and *back-end* BMI, and argue that there is a need for a mixed approach. Finally, there are some scholars who focus on the methods and tools that facilitate the BMI process [55], [60]. The latter proposes tools to evaluate the feasibility of BMs, creative methods that can be used for systematic idea generation and tooling with a focus on the implementation of BMI.

Although there are various ways in which the BMI process can be conceptualized, there are two phases that appear to reoccur in most of the work: (1) a design/experimentation phase, followed by (2) an implementation/execution phase. These are also two distinct phases that are core elements of the conceptualization of BMI in this paper.

2.2 Business model experimentation

McGrath [16] argues that it is necessary to experiment to discover new BMs. Others argue that experimentation is a phase that precedes actual changes in the BM [23], which helps generate new BM ideas [61]. It is argued that experimentation encourages firms to start with business transitions and helps evaluate established business components [23]. Christensen [62] emphasizes the importance of allocating resources to new innovative projects with new experimental BMs, leaving the core business of the company untouched. Osterwalder and colleagues [63] compare BM experimentation to playing with a box of Lego blocks, which can lead to new designs that are "limited only by imagination and the pieces supplied". Chesbrough [1] argues BM experimentation helps to overcome barriers to change in the process of BMI. In short, BM experimentation is an important step in the BMI process, in which firms experiment with ideas and concepts before implementing the redesigned BM.

Empirical work shows that BM experimentation includes a number of activities. Some scholars adopt a narrow view on BM experimentation and only include experiments the involve new product formats in a market, without reference to experiments with BM components or their configuration [64], while others discuss activities involving initial designs and trial-and-error improvements more extensively [22] or examine whether there are certain communalties and pathways in the way SMEs experiment with BM components, depending on the goal of the company [19]. And there are those who distinguish experimentation from learning, defining BM experimentation as researching technical challenges and performing new practices, and BM learning as acquiring new knowledge, discussing new ideas and interacting with and contacting others [23]. In one empirical study, BM experimentation is found to consist of three activities: retrieving information about the environment, encouraging new ideas and learning from mistakes [19], [65].

BM experimentation can be viewed as examining alternative BMs [53], and as such is closely related to the innovation process rather than the discrete outcome (i.e. the innovated BM that needs to be implemented). An extensive analysis of several cases shows that there are many iterations, fallbacks and redefinitions of BM components, as well as changes in the BM architecture during the BM experimentation phase, and that innovation paths and processes are far from linear [19], [56]. Baden-Fuller and Morgan [61] argue that BM experimentation has a purposive character and their comparison of relevant studies shows that BM experimentation contains both theoretical and practical experiments. As a result, BM experimentation is defined as the purposive effort to methodologically examine changes in BMs and (the configuration of) BM components, which means that there is a need to allocate budgets for experimentation, to enable an activity that may be carried out by a specific team. In turn, these experimentations can lead to the identification of potentially fruitful opportunities that can evolve into efforts of BM implementation.

2.3 BM implementation

Experiments may lead to new BM designs. To benefit from these new designs, the new BM should be put into practice. Whether or not an intended BM can be realized depends on the alignment between the BM and the business processes and supporting IT applications and infrastructure [4], [66]. Whereas BMs describe what a firm should do to create value, the how-question is addressed during the implementation of the BM [39]. Although BM experimentation and BM Implementation can been seen as discrete steps, the activities involved may be closely related, since practical consideration of implementation may play a role in discussions and experiments during the experimentation phase.

BM implementation to a large extent depends on the operational business activities and processes at various organizational levels [39], [67], which together have been referred to as business operations [4], [68]. These activities are complex and depend very much on the context of the firm [4]. The activity involved in BM implementation is captured by changes in a firm's Operational Model (OM) and Enterprise Architecture (EA). The EA reflects the company's OM and formalizes the organizing logic for business processes and IT infrastructure [10], [24], [69], [70]. Together, these domains explain how operational business processes are managed and executed. As argued by Ross and colleagues [24], the OM defines the integrations and standardization of requirements that serve as input for how the EA is formed.

Work involving EA concerns the design and realization of the firms' organizational processes, (infra)structure and systems [71]. EA has been defined as "the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the company's OM" [24]. While early work on EA focuses on the technology architecture [72], later work focuses on the broader information, application and business architecture [73], and on visualization, giving EA a multidisciplinary scope that incorporates strategic concepts [74]. Because of the detail required for full-scale implementation, existing EA models tend to be very large and complex [75]. Ross and colleagues [24] conceptualize EA at a high level of abstraction with regard to its different aspects: business processes and structure; business process standardization and integration; internal controls to monitor processes; ICT, application and infrastructure, which is leading in our empirical research.

3 Hypotheses development

In this section, our hypotheses, which are based on the background as discussed in Section 2, are presented, starting with the core hypothesis. BM experimentation, being the initial process involved in BMI, leads to new BMs, which in turn can improve performance. BM experimentation allows firms to redefine their core BM and identify new business opportunities [42], [63]. As such, the relationship can be hypothesized as follows:

H1: BM experimentation does lead to discrete, redesigned BMs that affects firm performance in a positive way.

Next, the discrete and redesigned BM has to be implemented. As discussed earlier, in the BM implementation phase, there are two important concepts that interact with each other: OM and EA. There is partial overlap between these concept, because of their similar role in implementing BM changes. As argued by Ross and colleagues [24], the OM defines the business process integrations and standardization requirements that serve as input for forming the EA, whereas the EA represents the logic for business processes, IT applications and infrastructure reflecting the OM. At the same time, the EA postulates the core capabilities that guide further execution of the BM at an application and IT infrastructure level. Hence, it is proposed that:

H2: Changes in the OM lead to changes in the EA.

BM experimentation is viewed as a source for the implementation of redesigned BMs. Earlier studies on BM experimentation suggest that these efforts can lead to changes in information exchange and processes within the organization under examination or the ecosystem within which the core firm operates, as well as in IT-infrastructure, as part of both the OM and the EA [9]. Consequently, it is hypothesized that:

H3a: BM Experimentation leads to changes in the OM.

H3b: BM Experimentation leads to changes in the EA.

Like BM experimentation, BM Implementation plays an important role in the BMI process [46], [49]. Research shows show that paying attention to the way BMs are implemented at an operational level is a prerequisite to benefiting from BMI [9]. The correct implementation of BM changes allows a firm to adapt and improve its existing BM, which can have beneficial consequences firm, both in terms of reducing operational problems and creating new opportunities, thanks to increased modularity and flexibility, which in turn lead to growth and increased profit, as argued by Heikkilä et al. [19]. Hence, this relationship can be hypothesized as:

H4: BM Implementation positively affects firm performance.

BM implementation is translated into two interrelated activities in relation to the OM and the EA (see Section 2.2). As a result, it is expected that BM implementation has a positive impact on the outcome of BM experimentation in terms of firm performance, based on the mediating effects of the OM and EA:

H5a: Changes in the OM mediate the positive effect of BM Experimentation on firm performance

H5b: Changes in the EA mediate the positive effect of BM Experimentation on firm performance

Figure 1 summarizes the hypotheses in a conceptual model.

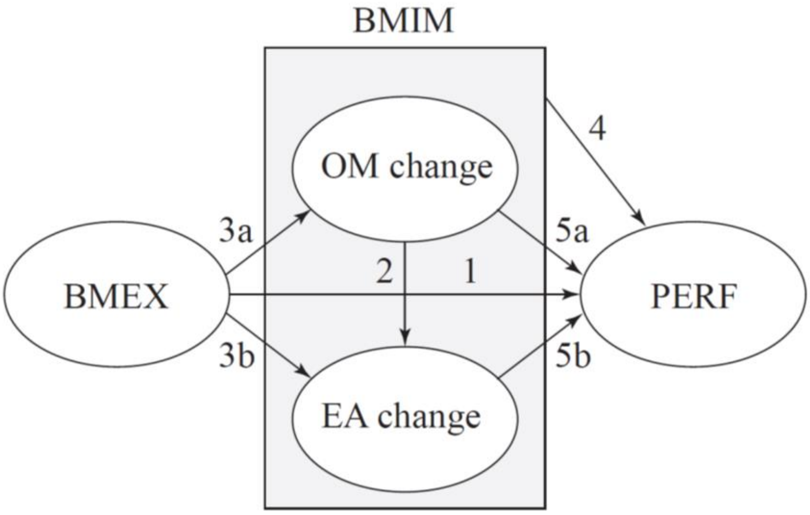

Figure 1. *Conceptual model.*

4 Methodology

4.1 Sample

The data used in this study was collected in 2016 by a professional research agency, as part of a Horizon 2020 project, in compliance with European and national privacy regulations. The research agency involved used native speakers to gather data in thirteen different European countries to obtain a representative data set regarding European SMEs. The countries involved are Sweden, Finland and Lithuania, UK, France and the Netherlands, Spain, Italy and Portugal, Poland and Slovenia, and Austria and Germany. To begin with, the Dun and Bradstreet database directory, which contains all SMEs in Europe, was used as a sample frame, from which 5,704 usable entries were collected. The research team used cluster sampling to guarantee an even distribution across the continent and to include large and smaller countries, and based on an equal proportional sampling approach with country quota, and quota for micro-enterprises, small and medium-sized enterprise (33%-33% -33%) to have a representative sample for each company size. However, no quota was defined for industry sectors and some of sectors were initially excluded from data collection, e.g. agriculture, public administration and non-market household activities. The survey gathered information regarding size and industry sector, to make sure the companies being approached were indeed part of our intended population.

In a second step, the SMEs willing to participate were screened at the start of each interview, because the study focuses exclusively on the population of companies that made changes to their BM *during the last two years*. That period of two years was used to assure that a longer-term assessment of performance and lagged effects could be tracked. Since most managers in SMEs are not aware of the BM concept, in addition to a generic question regarding BMI, four filter questions formulated in a way that made them easy to understand, were asked. Each filter question reflects one dimensions of BMs, i.e. value proposition and product offering (24% made this change), the role of the firm's eco-system in value creation (69% made this change), the enabling role of information technology in value delivery (58% made this change), and the role of pricing mechanisms and revenue models in capturing value (50% made this change). Finally, a total of 1,604 companies matched the selection criteria and the data collection process resulted in 584 usable responses, representing a response rate of 34%, which is acceptable according to other academic studies. Companies that did not respond indicated that they had no time or the responsible manager was not available. Responses were collected through a telephone interview from the firm's owner or BMI manager, with the respondent being the manager, owner of or another core manager within the SME. The respondents were pre-dominantly males. For reliability reasons, we tried to contact a second interviewee in each company, but only succeeded in doing so in 40 cases. These responses were excluded from further analyses.

The final sample consists of 584 SMEs. The oldest firm was founded in 1836, the youngest in 2016, the year of the data collection, so there was a broad range in terms of maturity. While the firms were distributed across the range between the two extremes, most of them were established around 2000, with 1994 being the median of the sample size, which indicated a median age of 22. The distribution across industries was relatively skewed. While there was only one company actively engaging in BM innovations in the mining and quarrying sector, the service industry, including financial services, manufacturing, wholesale and retail and construction were represented by 22%, 15%, 13% and 11%, respectively, of the sample. Because of the meagre low response from some industries, it was decided nog to use industry as a control variable.

4.2 Operationalization

Table 2 provides an overview of items used for construct operationalization. The list of questions is the result of an iterative process with managers and academics giving input to improve the understanding of the questions. Most items were measured on seven-point Likert scales (from 1 = totally disagree to 7 = totally agree) and, as indicated, were based on the literature on innovation, entrepreneurship and strategic management. Alternative scales for BMI, as developed by Clauss [76] and by Spieth and Schneider [33], were published while questionnaire design and pre-testing were finalized and data collection was already ongoing.

Business performance can be studied along different dimensions, such as customer performance, market performance and financial performance. However, since our data include a very heterogenic set of firms, that can use BMI in various ways, the focus is exclusively on financial criteria as a measure of business performance. The heterogeneity of our population of firms engaged in BMI makes it difficult to directly compare financial figures across companies. To accommodate this, perceived business performance, where measures for financial growth rely on the managers' evaluation of the financial situation, are used as a proxy. Firm performance is often measured as relative firm performance (the performance of a firm in relation to its competitors) [77], [78] and as McDermott and Prajogo [79] suggest, using subjective measures of performance is a valid proxy for objective performance measures. The use of these perception-based performance measures is, however, heterogeneous across studies, based on either Likert or Semantic differentiation scales. The advantage of using indicators that rely on perception is that figures can be compared and that there are no outliers that may upset results. Furthermore, managers can take historical growth into account, while this kind of information cannot be gleaned by looking at the financial ratios of one year. On a practical level, combining our data to performance data available from national statistical and tax offices was not allowed, due to European privacy regulations.

BM Experimentation (BMEX) was measured using scales derived from Sosna and colleagues [22]. In line with the conceptualization of BMEX as an activity, scales were used that measure the resources and efforts involved. OM (OPMO) and EA (ENAR) were measured with scales from Ross et al. [24] and Lindgardt et al. [80], with the addition of some scales developed by Op't Land et al. [81] and Bernus et al. [82]. The dependent variable was measured along two scales to capture overall business performance, which have long been recognized in strategy research [77], [83].

Table 2. Measures.

Construct	Question-wording	Reference
BMEX	*During last year, our enterprise …*	
	Experimented with the (implementation of) their BM	[22]
	Had a specific team to manage BM changes	[22]
	Allocated budgets for BM experimentation	[22]
OPMO	*To what extent did changes in your BM lead to new ways of…*	
	Standards how you deliver products/services to customers	[24]
	Division of work between your enterprise and external partners	[24]
	Ways to manage cost to deliver products/services profitably	[80]
	Ways to execute processes	[80]
	Organizational structures	[80]
ENAR	*To what extent did changes in your BM lead to changes in your…*	
	Key Business processes	[24]
	Information Technology	[24]
	Internal controls to monitor processes	[24]

	Business processes standardization	[24]
	Business processes integration	[24]
	ICT applications	[24]
	ICT infrastructure	[24]
	Social media usage	[82]
	Business/organization structure	[82]
PERF	*What is the level of agreement? I am satisfied with ...*	
	the sales growth of the enterprise	[83]
	the profit growth of the enterprise	[77]

4.3 Measurement model

Exploratory analysis shows that the items for EA and OM are strongly correlated (>.7), which is understandable when we consider their overlapping role in the implementation process of new BMs. That is why BMIM is modelled as a second-order reflective construct constituted by EA and OM as first-order reflective latent factors. A confirmatory factor analysis (CFA) for the resulting model shows good fit (X^2: 82.17, df: 48, CFI: 0.99, SRMR: 0.026, RMSEA: 0.035). A configural invariance test revealed adequate goodness of fit when analyzing a freely estimated model across the groups of firms differing in firm characteristics.

Convergent validity was obtained as evidenced by the average variance extracted (>0.5), and reliability as indicated by Cronbach's alpha are all above .70, while the composite reliability values (>0.7) and maximal reliability values (>0.8) fulfil normative requirements. Discriminant validity is sufficient since the square root of the average variance extracted exceeds any of the inter-factor correlations (see diagonals in Table 3).

Table 3. *Validity and reliability in the measurement model.*

		Factor loadings	Cronbach' salpha	Composite reliability	Average variance extracted	Maximal shared variance	Maximal reliability	PERF	BMEX	BMIM
PERF	PERF1 PERF2	0.945 0.717	0.816	0.816	0.689	0.164	0.816	**0.830**		
BMEX	BMEX1 BMEX2 BMEX3	0.706 0.713 0.782	0.784	0.785	0.550	0.445	0.891	0.358	**0.742**	
BMIM	OM1 OM2 OM3 OM4 OM5	0.756 0.601 0.787 0.790 0.634	.0850 (OPMO)	0.820	0.696	0.445	0.930	0.405	0.667	**0.834**
	EA2 EA6 EA7	0.722 0,884 0,883	0.886 (ENAR)							

Next, a test was applied to determine common method bias, comparing the unconstrained common latent factor (CLF) model to the fully, zero-constrained common method factor model. In the presence of the CLF, the regression weights of the indicators to the CLF did not exceed values above 0.5. However, in the chi-square difference test, the shared variance came out to be significant (ΔX^2: 35,1; Δdf: 12; P: 0,000). To accommodate this bias, the CLF was retained in the CFA model.

4.4 Outlier analysis

After validation of the measurement model, factor scores were imputed using linear regression in AMOS, in order to detect outliers. Firms reporting low (or high) satisfaction or activity in certain items would receive a low (or high) score for the variable. To identify potential influential records in the imputed data set, linear regressions and investigated Cook's distances for the two latent variables that relate to the dependent performance variables, were used. Although the outliers for BMEX to PERF were the same as they were for BMIM to PERF, none of these relations resulted in observations having Cook's Distances greater than 0.1 (max 0.038), indicating the imputed data did not contain abnormal records. Likewise, analysis of the Mahalanobis distance did not reveal severe abnormalities with an average value of 2.0 and a max of 11.3. Collinearity diagnostics revealed variable inflation factors of 2.35 and tolerance values above 0.42. Considering these numbers, no respondents were removed, and subsequent analyses were performed on the remaining 584 firms.

5 Results

The structural model of the overall sample (N = 584) was fitted in AMOS 23. The model explained 44% and 18% of the variance, as indicated by the squared multiple correlations of BMIM and PERF, respectively (Figure 2). Direct effects were examined by their regression weights and significance levels. Evidence was found that BMEX has a positive effect on PERF (beta = 0.16, P = 0.043). Likewise, BMIM was found to have a strong effect on PERF (beta = 0.30, P < 0.001).

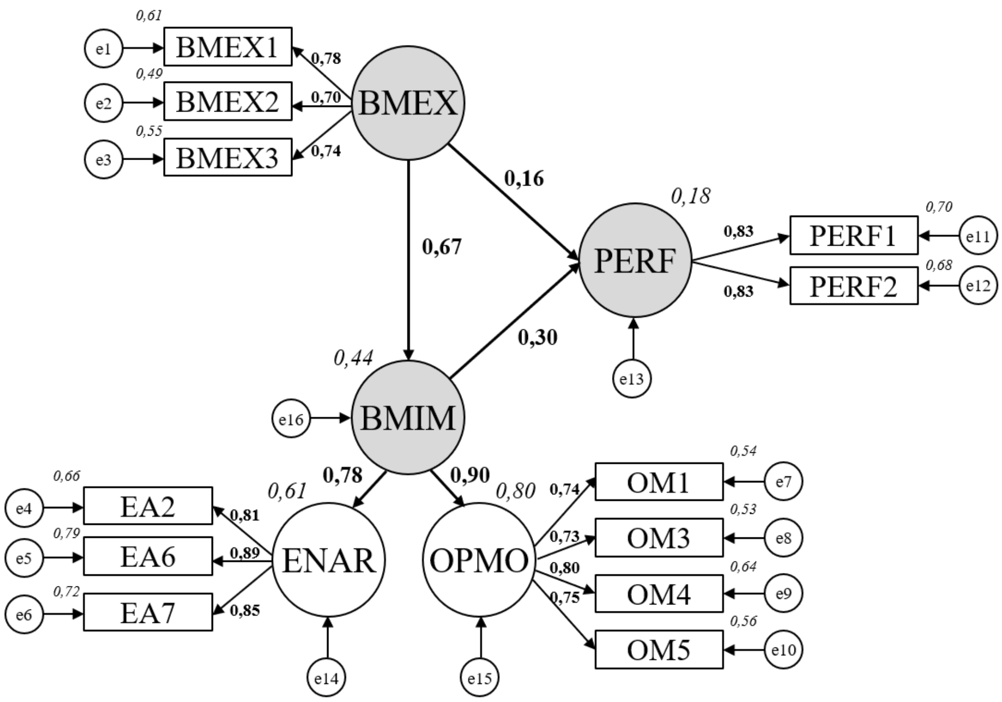

Figure 2. SEM model results.

The mediation effect of BMIM was tested following the Bootstrapping method. The indirect effect measured in a bias-corrected 90% confidence interval was 0.17 and appeared to be significant (P = 0.001).

The results support all hypotheses, with the exception of H2 (see Table 4), which was not measured since OM and EA were modelled as first-order constructs belonging to BMIM, which meant their individual impact on firm performance could not be tested. As a consequence, hypotheses 3a-3b, 4a-4b and 5a-5b could also not be tested for the original distinction between OM and EA. Both constructs are now summarized under BM implementation.

Table 4. Evidence found for hypotheses.

	Type	Hypothesis	Evidence	Conclusion
H1	Direct	BMEX -> PERF	$\beta = 0.16$, $P = 0.043$	Supported
H2	Direct	OM changes -> EA changes	-	Not tested
H3	Direct	BMEX -> BMIM	$\beta = 0.67$, $P < 0.001$	Supported
H4	Direct	BMIM -> PERF	$\beta = 0.30$, $P < 0.001$	Supported
H5	Mediation	BMEX -> BMIM -> PERF	$\beta = 0.17$, $P = 0.001$	Supported

The robustness of our findings was examined by conducting multi-group analysis on relevant background characteristics of the SMEs in the dataset. To that end, four firm characteristics were selected: the size of the SME (i.e. micro, small or medium-sized); the gender of the CEO; the age of the firm (distinguishing firms founded before 2000 from those established later); and the label denoting whether or not an SME was a family business. Controls for industry, technology-intensity or relevance of IT infrastructure for processes were not possible. For the multi-group comparisons, a chi-square difference test was used where the two models except constraining the main paths (BMEX -> PERF, BMEX -> BMIM, BMIM -> PERF) were freely estimated. None of the moderators was found to show significant differences in this test.

Since a post-hoc power analysis was used to detect significant effects that may have existed beforehand, we are confident that non-significant effects were truly not significant. Both for PERF as BMIM the statistical power was above 0.99 based on the R^2, the number of predictors, sample size and probability level (0.001).

6 Discussion

This paper shows that engaging in BMI has a positive impact on firm performance. For firms that have recently changed their BM, the more resources and time they commit to the process of innovating their BM, the better their perceived performance. This main finding is important, as few studies consider the performance implications of the BMI process [32], and it is consistent with the handful of prior studies [20], [84] that do.

Our primary contribution is that the distinction between two fundamental processes within BMI, e.g. BM experimentation and BM implementation, in operations and enterprises architectures are confirmed, confirming insights from Al-Debei and Avison [9] and others. There is a direct relationship between BM experimentation and BM performance, but this relation is also mediated by BM implementation and the assumption that BM implementation consists of two distinct processes (operations and implementation) in the enterprise architecture is confirmed by the measurement model, which provides empirical support to our assumption that these are in fact two distinct processes. In other words, spending effort and resources on implementing BMs into the operation models and EAs of a firm amplifies the impact of BM experimentation. This finding is important, as it lends support to ideas in IS literature that BMs mediate between high-level strategy and daily operations and technology [9] and that it is worthwhile to extended BM thinking with a focus on operations and processes, as both are also part of Enterprise Architecture thinking. Practical approaches by Iacob et al. [69] and Fritscher & Pigneur [10] and intermediate solutions, as advocated by Solaimani et al. [4], are valuable.

To summarize, it can be concluded that both the process management community and information systems (IS) scholars play an important role in advancing the understanding of the link between BMs and operations, architecture and technology, among other things in the perspective of digital transformation. Thus far, more engineering-oriented research on BMI has provided important contributions, including approaches involving brainstorming about new BM ideas [85] and revelatory case studies on how firms deal with BMI in practice [4], [86], [87]. In the BM field, which at the moment is dominated by strategy scholars, it is important for engineering and IS scholars to convey the message that a formalized and structured implementation of BMs into architectures and operations is at least as important as high-level strategic brainstorming.

Contrary to our expectations, we found that BMIM activities cannot be empirically divided into paying attention to OM and EA. Instead, BMIM is modelled as a second-order construct that includes both OM and EA. One explanation for this is that, in practice, OM and EA overlap. Conceptually, however, the EA should support the OM and, vice versa, the OM poses requirements to the EA, while EA may impose limitations on OM. Future qualitative research may want to examine the interplay of changing the OM and EA and the catalyst role that BM experimentation plays.

This study was based on a broad and large sample of European SMEs that recently changed their BM. A multi-group analysis shows that our findings are robust across our sample, regardless of the age and size of the enterprise, the question whether or not a firm is a family business, or the gender of the CEO. The effect sizes of our findings are likely underestimated, since we did not focus on viable versus non-viable BM ideas in our sample, or on the likelihood that positive performance effects may come later [88]. Alternatively, it could be argued that paying more attention to the implications of BM ideas on OMs and EAs helps managers to identify potential implementation problems and recognize unfeasible BMs at an early stage.

From a practical point of view, our findings suggest that BM innovation and implementation are helpful if tooling is used related to processes and Enterprise Architecture, Because BM are developed with a view to improve communication when handling changes in business logics, EA methods and tools can help improve the implementation of redesigned BM in operations, provided they are simplified for SMEs, and connect changes to applications and IT infrastructure. BM innovation can be supported by meta-models for communication and representation purposes. Integration of BM ontologies into Enterprise Architecture thinking can help explain if, and which, BM components in combination with business processes and supporting IT, can be reused in BM innovation. Such an approach can also indicate whether the same BM, or certain BM components, can be used for alternative customer segments. Insights derived on BM components and their implementation in operations and EA can contribute to modularization, re-use and flexibility.

Our paper is a first to show empirically that consecutive activities in BMI have a separate positive impact on firm performance. The mediating role played by BMIM suggests that BMI involves separate yet causally linked practices. Next steps would be to further zoom in on more advanced phases or sub-steps, such as testing a specific BM and its implications on EA and OM, paying attention to processes within the frim and between partners in the eco-system. Alternative theorizations and empirical research may also be further developed, especially regarding reverse causality and feedback loops. For instance, higher performance may free up resources or legitimize the BMI process, which creates a positive feedback loop. In addition, lagged effects can be theorized and examined, as the lag between BMI and performance may be substantial, depending on contextual variables [32], [81]. In particular investments in changing the EA and OM typically pay off in the form of better performance after some time, and initially may even have a negative impact on performance because, for instance, employees need to learn new routines. Longitudinal panel studies and case studies would help to understand these complex causal processes.

One of the limitations of this study is the use of perceived performance as a dependent variable. As mentioned earlier, due to European privacy regulations, it is not allowed to use unique identification-tags, so matching data with the data from statistical offices is not allowed. Moreover, since most SMEs are not publicly traded, annual reports or financial statements are rarely available. Using actual performance figures as provided by respondents directly has important downsides. In addition to creating a high likelihood of non-response for reasons of confidentiality, it is difficult to compare SMEs in particular with regard to their performance. Focusing on profitability levels would, for instance, have problematic effects, as scale-ups and even a company like Amazon would be treated as low-performing cases. Using perceived performance scales means these issues are avoided and it adheres to standard practice in literature, as discussed above. A related limitation is that single informants were used, although we tried to obtain alternative responses from the same firms. However, in most cases, SMEs have only one contact available, often the core manager/owner, or only a limited number of people are involved with BMI, which is addressed by testing and correcting for common method bias.

Since the focus is on companies that experimented with changing their BM, there is no control group of companies that do not engage in BMI. The main focus of this study was on the behavior of SMEs engaged in BMI, which is why no conclusions are drawn with regard to the European SME population in general. A related limitation is that not all SMEs use formal procedures and tools for EAs, depending on their size and the maturity of their (information) technologies. Similarly, the importance of using formal procedures and tools for EAs varies between industries. When controlling for the use of formal procedures and tools for EAs, the effect sizes identified may be affected. Moreover, although start-ups and scale-ups may be part of our sample, there is no specific focus on these types of companies. Since the average age of the SMEs is 22 years, survivor bias may play a role. It is a limitation of this paper that other relevant control variables, like focus on industry sector, technology or geographical, i.e. country level, dispersion due to limited sample size, could not be executed and therefore controls are limited to size (i.e. micro, small or medium); gender of the CEO; the age of the firm, and family versus non-family business. Tests for control variables are restrained mainly due to small and skewed sub-samples.

A final limitation involves the cross-sectional nature of our data. Using panel design, which was our original intention, would be more appropriate, butthe sample sizes and response rates required would have been considerably higher. A panel design would require, in principle, even more excessive funding.

7 Conclusions

Our analysis shows that engaging in BMI has a positive effect on the (perceived) performance of SMEs. BMI is comprised of two related activities: BM experimentation and BM implementation into a firm's EA and OM. Both activities have a positive effect on firm performance, and

BM implementation partly mediates the effect of BM experimentation. This finding is important in understanding the connection between BMI, operations, architecture and technology [89]. Specifically, to reap the full performance gains from BM experimentation, firms should also engage in BM implementation.

This paper is a first to theoretically divide BMI into two separate yet interrelated activities. It is also one of the first to provide evidence of the distinct performance benefits that arise from implementing BMs into EA and OM. The paper provides a basis for future research into the interplay of strategy, BMs, operations and technology. Our findings also suggest that BMI should not only be a concern of strategy researchers, but of engineering management scholars as well. They have a role to play, especially in executing longitudinal (case) studies designed to uncover the complex, lagged and reverse causal interplay, and in qualitative studies for disentangling more subtle sub-activities that compose these activities.

References

[1] H. Chesbrough, “Business model innovation: Opportunities and barriers,” *Long Range Plann.*, vol. 43, no. 2–3, pp. 354–363, 2010.

[2] C. Baden-Fuller and S. Haefliger, “Business Models and Technological Innovation,” *Long Range Plann.*, vol. 46, no. 6, pp. 419–426, 2013.

[3] L. Massa and L. C. Tucci, “Business Model Innovation,” *The Oxford Handbook of Innovation Management*. pp. 420–441, 2013.

[4] S. Solaimani, M. Heikkilä, and H. Bouwman, “Business Model Implementation within Networked Enterprises: A Case Study on a Finnish Pharmaceutical Project,” *Eur. Manag. Rev.*, 2018.

[5] D. J. Teece, “Business models, business strategy and innovation,” *Long Range Plann.*, vol. 43, no. 2–3, pp. 172–194, 2010.

[6] R. Casadesus-Masanell and J. E. Ricart, “From strategy to business models and onto tactics,” *Long Range Plann.*, 2010.

[7] T. Clauss, M. Abebe, C. Tangpong, and M. Hock, “Strategic Agility, Business Model Innovation, and Firm Performance: An Empirical Investigation,” *IEEE Trans. Eng. Manag.*, 2019.

[8] X. Wu, R. Ma, and Y. Shi, “How do latecomer firms capture value from disruptive technologies a secondary business-model innovation perspective,” *IEEE Trans. Eng. Manag.*, 2010.

[9] M. M. Al-Debei and D. Avison, “Developing a unified framework of the business model concept,” *Eur. J. Inf. Syst.*, 2010.

[10] B. Fritscher and Y. Pigneur, “Business IT Alignment between Business Model and Enterprise Architecture with a Strategic Perspective,” *Int. J. Inf. Syst. Model. Des.*, 2015.

[11] B. Fritscher and Y. Pigneur, “A visual approach to business IT alignment between business model and enterprise architecture,” *Int. J. Inf. Syst. Model. Des.*, 2015.

[12] H. Bouwman, S. Nikou, and M. de Reuver, “Digitalization, business models, and SMEs: How do business model innovation practices improve performance of digitalizing SMEs?,” *Telecomm. Policy*, 2019.

[13] B. Van Putten, M. Schief, H. Berlin, and T. U. Darmstadt, “The Relationship Between Dynamic Business Models and Business Cases,” *Electron. J. Inf. Syst. Eval.*, vol. 15, no. 1, pp. 138–148, 2012.

[14] M. A. Lindner, L. M. Vaquero, L. Rodero-Merino, and J. Caceres, “Cloud economics: Dynamic business models for business on demand,” *Int. J. Bus. Inf. Syst.*, vol. 5, no. 4, pp. 373–392, 2010.

[15] R. Dunford, I. Palmer, and J. Benveniste Jodie, “Business model replication for early and rapid internationalisation. The ING direct experience,” *Long Range Plann.*, vol. 43, no. 5–6, pp. 655–674, 2010.

[16] R. G. McGrath, “Business models: A discovery driven approach,” *Long Range Plann.*, vol. 43, no. 2–3, pp. 247–261, 2010.

[17] B. Demil and X. Lecocq, “Business model evolution: In search of dynamic consistency,” *Long Range Plann.*, vol. 43, no. 2–3, pp. 227–246, 2010.

[18] J. Aspara, J. A. Lamberg, A. Laukia, and H. Tikkanen, “Corporate business model transformation and inter-organizational cognition: The case of nokia,” *Long Range Plann.*, vol. 46, no. 6, pp. 459–474, 2013.

[19] M. Heikkilä, H. Bouwman, and J. Heikkilä, “From strategic goals to business model innovation paths: an exploratory study,” *J. Small Bus. Enterp. Dev.*, 2018.

[20] M. Cucculelli and C. Bettinelli, “Business models, intangibles and firm performance: evidence on corporate entrepreneurship from Italian manufacturing SMEs,” *Small Bus. Econ.*, vol. 45, no. 2, pp. 329–350, 2015.

[21] R. K. Pati, M. K. Nandakumar, A. Ghobadian, R. D. Ireland, and N. O'Regan, "Business model design–performance relationship under external and internal contingencies: Evidence from SMEs in an emerging economy," *Long Range Plann.*, 2018.

[22] M. Sosna, R. N. Trevinyo-Rodríguez, and S. R. Velamuri, "Business model innovation through trial-and-error learning: The naturhouse case," *Long Range Plann.*, vol. 43, no. 2–3, pp. 383–407, 2010.

[23] S. A. Cavalcante, "Understanding the impact of technology on firms' business models," *Eur. J. Innov. Manag.*, 2013.

[24] J. W. Ross, P. Weill, and D. Robertson, "Define your operating model," *Enterp. Archit. as Strateg. Creat. a Found. Bus. Exec.*, 2006.

[25] H. Guo, J. Tang, Z. Su, and J. A. Katz, "Opportunity recognition and SME performance: the mediating effect of business model innovation," *R&D Manag.*, vol. 47, no. 3, pp. 431–442, 2017.

[26] M. Anwar, "Business model innovation and SMEs performance-Does competitive advantage mediate?," *Int. J. Innov. Manag.*, 2018.

[27] A. Arbussa, A. Bikfalvi, and P. Marquès, "Strategic agility-driven business model renewal: the case of an SME," *Manag. Decis.*, vol. 55, no. 2, pp. 271–293, Mar. 2017.

[28] D. Ibarra, A. Z. Bigdeli, J. I. Igartua, and J. Ganzarain, "Business Model Innovation in Established SMEs: A Configurational Approach," *J. Open Innov. Technol. Mark. Complex.*, 2020.

[29] H. Brea-Solís, R. Casadesus-Masanell, and E. Grifell-Tatjé, "Business model evaluation: Quantifying walmart's sources of advantage," *Strateg. Entrep. J.*, vol. 9, no. 1, pp. 12–33, 2015.

[30] S. K. Kim and S. Min, "Business model innovation performance: When does adding a new business model benefit an incumbent?," *Strateg. Entrep. J.*, vol. 9, no. 1, pp. 34–57, 2015.

[31] C. Velu, "Business model innovation and third-party alliance on the survival of new firms," *Technovation*, vol. 35, pp. 1–11, 2015.

[32] N. J. Foss and T. Saebi, "Fifteen Years of Research on Business Model Innovation," *J. Manage.*, 2017.

[33] P. Spieth and S. Schneider, "Business model innovativeness: designing a formative measure for business model innovation," *J. Bus. Econ.*, 2016.

[34] C. Zott, R. Amit, and L. Massa, "The Business Model: Recent Developments and Future Research," *J. Manage.*, vol. 37, no. 4, pp. 1019–1042, Jul. 2011.

[35] T. Clauss and P. Spieth, "Treat your suppliers right! Aligning strategic innovation orientation in captive supplier relationships with relational and transactional governance mechanisms," *R&D Manag.*, vol. 46, no. S3, pp. 1044–1061, Oct. 2016.

[36] B. W. Wirtz, A. Pistoia, S. Ullrich, and V. Göttel, "Business Models: Origin, Development and Future Research Perspectives," *Long Range Plann.*, vol. 49, no. 1, pp. 36–54, 2016.

[37] J. Kallio, M. Tinnilä, and A. Tseng, "An international comparison of operator-driven business models," *Bus. Process Manag. J.*, 2006.

[38] A. Osterwalder and Y. Pigneur, "Business Models and their Elements," 2002.

[39] H. Bouwman, H. De Vos, and T. Haaker, *Mobile service innovation and business models*. 2008.

[40] A. Osterwalder and Y. Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challangers*. 2010.

[41] R. Amit and C. Zott, "Creating Value Through Business Model Innovation," *MIT Sloan Manag. Rev.* , vol. 53, no. 3, pp. 41–49, 2012.

[42] M. de Reuver, H. Bouwman, and I. MacInnes, "Business models dynamics for start-ups and innovating e-businesses," *Int. J. Electron. Bus.*, vol. 7, no. 3, pp. 269–286, 2009.

[43] J. Karimi and Z. Walter, "Corporate Entrepreneurship, Disruptive Business Model Innovation

Adoption, and Its Performance: The Case of the Newspaper Industry," *Long Range Plann.*, 2016.

[44] C. Zott and R. Amit, "Business Model Design and the Performance of Entrepreneurial Firms," *Organ. Sci.*, vol. 18, no. 2, pp. 181–199, 2007.

[45] E. Giesen, E. Riddleberger, R. Christner, and R. Bell, "IngentaConnect When and how to innovate your business model," *Strateg. Leadersh.*, vol. 38, no. 4, pp. 17–26, 2010.

[46] E. Enkel and F. Mezger, "Imitation processes and their application for business model innovation: An explorative study," *Int. J. Innov. Manag.*, vol. 17, no. 1, 2013.

[47] K. Girotra and S. Netessine, "Business Model Innovation for Sustainability," *Insead*, vol. 15, no. 4, pp. 1–18, 2013.

[48] M. Eurich, T. Weiblen, and P. Breitenmoser, "A six-step approach to business model innovation," *Int. J. Entrep. Innov. Manag.*, vol. 18, no. 4, p. 330, 2014.

[49] M. Geissdoerfer, P. Savaget, and S. Evans, "The Cambridge Business Model Innovation Process," *Procedia Manuf.*, vol. 8, pp. 262–269, 2017.

[50] E. Giesen, S. J. Berman, R. Bell, and A. Blitz, "Three ways to successfully innovate your business model," *Strateg. Leadersh.*, vol. 35, no. 6, pp. 27–33, 2007.

[51] M. Hoveskog, F. Halila, and M. Danilovic, "Early Phases of Business Model Innovation: An Ideation Experience Workshop in the Classroom," *Decis. Sci. J. Innov. Educ.*, vol. 13, no. 2, pp. 177–195, 2015.

[52] A. Tuulenmäki and L. Välikangas, "The art of rapid, hands-on execution innovation," *Strateg. Leadersh.*, vol. 39, no. 2, pp. 28–35, 2011.

[53] J. V. Sinfield, E. Calder, B. McConnell, and S. Colson, "How to identify new business models," *MIT Sloan Manag. Rev.*, vol. 53, no. 2, pp. 85–90, 2012.

[54] F. Günzel and A. B. Holm, "One Size Does Not Fit All—Understanding The Front-End And Back-End Of Business Model Innovation," *Int. J. Innov. Manag.*, vol. 17, no. 1, pp. 134002-1-134002–34, 2013.

[55] M. J. Eppler and F. Hoffmann, "Does method matter? An experiment on collaborative business model idea generation in teams," *Innov. Manag. Policy Pract.*, vol. 14, no. 3, pp. 388–403, 2012.

[56] H. Berends, A. Smits, I. Reymen, and K. Podoynitsyna, "Learning while (re)configuring: Business model innovation processes in established firms," *Strateg. Organ.*, vol. 14, no. 3, pp. 181–219, 2016.

[57] Q. Wang, C. Voss, X. Zhao, and Z. Wang, "Modes of service innovation: a typology," *Ind. Manag. Data Syst.*, vol. 115, no. 7, pp. 1358–1382, 2015.

[58] B. Mentink, "Circular Business Model Innovation: A process framework and a tool for business model innovation in a circular economy," TU Delft, 2014.

[59] B. W. Wirtz, V. Göttel, and P. Daiser, "Business Model Innovation: Development, Concept and Future Research Directions," *J. Bus. Model*, vol. 4, no. 1, pp. 1–28, 2016.

[60] H. Bouwman, M. de Reuver, M. Heikkilä, and E. Fielt, "Business model tooling: where research and practice meet," *Electronic Markets*. 2020.

[61] C. Baden-Fuller and M. S. Morgan, "Business models as models," *Long Range Plann.*, vol. 43, no. 2–3, pp. 156–171, 2010.

[62] C. M. Christensen, "The Innovator's Dilemma," *Business*, pp. 1–179, 1997.

[63] A. Osterwalder, Y. Pigneur, and C. L. Tucci, "Clarifying business models: Origins, Present and Future of the concept," *Commun. AIS*, vol. 15, 2005.

[64] F. Vendrell-Herrero, G. Parry, M. Opazo-Basáez, and F. J. Sanchez-Montesinos, "Does business model experimentation in dynamic contexts enhance value capture?," *Int. J. Bus. Environ.*, 2018.

[65] L. Achtenhagen, L. Melin, and L. Naldi, "Dynamics of business models - strategizing, critical capabilities and activities for sustained value creation," *Long Range Plann.*, 2013.

[66] R. Lueg, L. Malinauskaite, and I. Marinova, “The vital role of business processes for a business model: The case of a startup company,” *Probl. Perspect. Manag.*, vol. 12, no. 4, pp. 213–220, 2014.

[67] A. H. Bask, M. Tinnilä, and M. Rajahonka, “Matching service strategies, business models and modular business processes,” *Bus. Process Manag. J.*, vol. 16, no. 1, pp. 153–180, 2010.

[68] J. Gordijn, H. Akkermans, and H. Van Vliet, “Business Modelling is not Process Modelling,” *Model. Ebus.*, vol. 1921, pp. 40–51, 2000.

[69] M. E. Iacob, L. O. Meertens, H. Jonkers, D. A. C. Quartel, L. J. M. Nieuwenhuis, and M. J. van Sinderen, “From enterprise architecture to business models and back,” *Softw. Syst. Model.*, 2014.

[70] R. C. Beckett and J. Dalrymple, “Business Model Architecture by Design,” *Technol. Innov. Manag. Rev.*, 2019.

[71] M. M. Lankhorst, H. A. Proper, and H. Jonkers, “The architecture of the ArchiMate language,” in *Lecture Notes in Business Information Processing*, 2009, vol. 29 LNBIP, pp. 367–380.

[72] J. A. Zachman, “A framework for information systems architecture,” *IBM Syst. J.*, vol. 26, no. 3, pp. 276–292, 1987.

[73] G. Versteeg and H. Bouwman, “Business architecture: A new paradigm to relate business strategy to ICT,” *Inf. Syst. Front.*, 2006.

[74] R. Malan, D. Bredemeyer, R. Krishnan, and A. Lafrenz, “Enterprise Architecture as business capabilities architecture,” 2006.

[75] M. Bernaert, G. Poels, M. Snoeck, and M. De Backer, “CHOOSE: Towards a metamodel for enterprise architecture in small and medium-sized enterprises,” *Inf. Syst. Front.*, vol. 18, no. 4, pp. 781–818, 2016.

[76] T. Clauss, “Measuring business model innovation: conceptualization, scale development, and proof of performance,” *R D Manag.*, vol. 47, no. 3, pp. 385–403, 2017.

[77] N. Venkatraman and V. Ramanujam, “Measurement of Business Performance in Strategy Research: A Comparison of Approaches,” *Acad. Manag. Rev.*, vol. 11, no. 4, pp. 801–814, 1986.

[78] P. L. Drnevich and A. P. Kriauciunas, “Clarifying the conditions and limits of the contributions of ordinary and dynamic capabilities to relative firm performance,” *Strateg. Manag. J.*, 2011.

[79] C. M. McDermott and D. I. Prajogo, “Service innovation and performance in SMEs,” *Int. J. Oper. Prod. Manag.*, 2012.

[80] Z. Lindgardt, M. Reeves, G. Stalk, and M. S. Deimler, “Business Model Innovation: When the Game Gets Tough, Change the Game,” *Bost. Consult. Gr.*, no. December, p. 9, 2009.

[81] M. O. L. Land, E. Proper, M. Waage, J. Cloo, and C. Steghuis, “Enterprise Architecture: Creating Value by Informed Governance,” *Springer*, vol. 7, no. 3, p. 145, 2009.

[82] P. Bernus, L. Nemes, and G. Schmidt, “Handbook on Enterprise Architecture,” *Strategy*, pp. xxi, 787, 2003.

[83] Y. S. Su, E. W. K. Tsang, and M. W. Peng, “How do internal capabilities and external partnerships affect innovativeness?,” *Asia Pacific J. Manag.*, vol. 26, no. 2, pp. 309–331, 2009.

[84] J. Aspara, J. Hietanen, and H. Tikkanen, “Business model innovation vs replication: financial performance implications of strategic emphases,” *J. Strateg. Mark.*, vol. 18, no. 1, pp. 39–56, Feb. 2010.

[85] A. Osterwalder, Y. Pigneur, G. Bernarda, and A. Smith, *Value proposition design: how to create products and services customers want: get started with ...* 2014.

[86] M. Heikkilä, H. Bouwman, and J. Heikkilä, “From strategic goals to business model innovation paths: an exploratory study,” *J. Small Bus. Enterp. Dev.*, p. JSBED-03-2017-0097, 2017.

[87] A. Ojala, “Business models and opportunity creation: How IT entrepreneurs create and develop business models under uncertainty,” *Inf. Syst. J.*, 2016.

[88] T. Haaker, H. Bouwman, W. Janssen, and M. de Reuver, “Business model stress testing: A practical approach to test the robustness of a business model,” *Futures,* 2017.

[89] S. Solaimani and H. Bouwman, “A framework for the alignment of business model and business processes: A generic model for trans-sector innovation,” *Bus. Process Manag. J.*, 2012.