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Uncovering the Role of IS in Business Model Innovation - A Taxonomy-driven Approach to Structure the Field

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UNCOVERING THE ROLE OF IS IN BUSINESS MODEL INNOVATION – A TAXONOMY-DRIVEN APROACH TO STRUCTURE THE FIELD

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Abstract

Business model innovations (BMIs) are one of the key activities organizations must undertake to survive and thrive. As information systems (IS) penetrate more and more aspects of life, they become an important factor affecting both the process and the outcome of business model innovations. The increased importance of IS in a growing number of industries has led various researchers to focus on examining the role of IS in innovation. However, these insights concentrate on process, product, and service innovations, while business model innovations encompass characteristics that are fundamentally different from these. Therefore, in this paper we use a rigorous taxonomy-building approach to uncover the distinct roles IS play in this important endeavor, employing a meta-perspective and drawing from documented empirical research on business model innovations. We found that IS act, first, as enablers of business model innovation, second, as capabilities in the business model innovation process, and third, as frames of reference for business model innovations. Our findings indicate that IS are thus both operand and operant resources in business model innovations. Hence, business managers must be aware of all of these roles, as they could have transformative impacts in every industry.

Keywords: Business Model, Business Model Innovation, Digital Transformation, Taxonomy.

1 Introduction

Since the beginning of the twenty-first century, researchers from various disciplines have recognized that variances in such outcome variables as value creation, innovation, or firm performance depend substantially on a firm's business model (e.g., Chesbrough and Rosenbloom, 2002). While fundamentals of the concept – e.g., definitions (e.g., Amit and Zott, 2001), taxonomies (e.g., Rappa, 2004), descriptions (e.g., Bouwman et al., 2008), and components (e.g., Hedman and Kalling, 2003) – have been described, there still exists a void in the literature concerning the dynamics of business models (Burkhart et al., 2011).

Within the last 15 years, we have witnessed the rising importance of both the business model concept for the information systems[1] (IS) research domain as well as IS themselves for innovating business models in business practice. The increasing penetration of IS into everyday life (Yoo, 2010) has recently been reported to affect, explicitly or implicitly, business models of various industries, including primarily physical ones. Moreover, as IS have made their way into nearly every kind of business process, they

[1] In line with Watson et al. (2010), we consider an information system as an "integrated and cooperating set of people, processes, software, and information technologies to support individual, organizational, or societal goals" (Watson et al., 2010, p. 24).

are also an important factor in the BMI process. Veit et al.'s (2014) recent categorization of IS research on business models highlights these different aspects. According to the authors, prior research has dealt with a wide array of IS-related influences on business models, ranging from new business models in IS industries (e.g., Bonaccorsi et al., 2006) and the transformative impact of IS innovations on established business models (e.g., Lucas and Goh, 2009) to the role of IS as tools for the management of business models (e.g., Bouwman et al., 2012). This spectrum indicates that the role of IS in BMIs has been steadily enlarging and becoming more differentiated. The impact of IS on business models is also currently debated in practitioner literature (e.g., Porter and Heppelmann, 2014; Casadesus-Masanell and Ricart, 2011), highlighting the importance of BMIs for today's firms in leveraging the chances of emerging IS innovations: "Unleashing digital value entails going beyond internal process automation to innovation of all parts of the business model, while focusing on digital leadership. IT and information used in new ways can radically change how businesses operate and win" (Aron, 2012).

Prior research has made some progress in identifying and evaluating the role of IS in product, process, and service innovations (e.g., Kleis et al., 2012). As Nambisan (2013) points out, IS can be described as influencing, first, the innovation process and, second, the innovation outcome; there have been empirical investigations proving the impact of IS on both. Moreover, IS innovations have sometimes been categorized according to their impacts on, e.g., business processes (e.g., Lyytinen and Rose, 2003). However, due to the increasing pervasiveness of digital technologies, there has been a change in the role of IS in innovations. While in the past IS enabled innovation or innovation processes in non-IS contexts, IS themselves have now begun to trigger innovations by, e.g., creating digital platforms that allow for new businesses (El Sawy and Pereira, 2013). Thus, IS no longer act solely as operand resources that are used to innovate but can increasingly be considered as operant resources that initiate product or service innovation (Nambisan, 2013).

Despite the progress made in the field of IS in process, product, and service innovation, research has neglected the specifics of BMI. The findings, categorizations, and roles that have been uncovered in, e.g., the field of product innovations cannot simply be transferred to the domain of BMI as it is a distinct field (e.g., Amit and Zott, 2012; Bucherer et al., 2012; Schneider and Spieth, 2013; Fichman et al., 2014). The business model concept encompasses not only the product/service offering, its financial foundations, and the resources and activities involved in producing them but also the relationships with various actors, such as customers and partner firms (Osterwalder et al., 2005). This complexity, however, also bears great potential for firms: "[C]ompetitors might find it more difficult to imitate or replicate an entire novel activity system than a single novel product or process" (Amit and Zott, 2012, p. 42). Because of these differential characteristics of the business model concept, existing categorizations of the role of IS in product, process, and service innovations might not apply precisely to the case of BMI.

In this paper we employ a rigorous taxonomy-building approach to derive a classification of the different roles of IS in BMIs from empirical research. By doing so, we aim to collect knowledge of in-depth investigations on single cases and provide aggregated insights into the phenomenon of IS-driven BMI, thus using a meta-perspective. With this approach and focus, we go beyond prior works that concentrate on the impact of single IS innovations on business models (e.g., Kamoun, 2008) or generally classify the foci of research on business models in the IS domain (e.g., Burkhart et al., 2011 and Veit et al., 2014), thus enabling substantial contributions for practice and research. The taxonomy's purpose is to deliver a standardized frame of reference for both audiences by providing ground for further theorization about the enlarging role of IS in value creation while at the same time capturing and supplying practitioners with a template for analyzing how IS can be used to keep their business models relevant through innovation. In doing so, we provide insights on the following research question: *What are the roles of IS in business model innovation?*

The remainder of the paper is organized as follows. First, we lay out our theoretical foundation by summing up prior IS-related research on business models and the general role of IS in innovation. Afterwards, we describe our methodological approach of taxonomy building and present our results. Finally, we discuss the implications of our findings for both future IS research and business practice.

2 Theoretical Background

2.1 Business model research

Al-Debei and Avison (2010) reveal that – due to the increased turbulence of the business environment and the rapid pace of change – there is a growing gap between the relatively stiff layer of business strategy and the increasingly dynamic layer of business processes as well as the IS deployed within them. Hence, the authors describe the business model as an intermediary construct connecting business strategy and business processes (Al-Debei and Avison, 2010). According to Teece (2010), a business model "defines how the enterprise creates and delivers value to customers, and then converts payments received to profits" (Teece, 2010, p. 173). Apart from idiosyncratic views on the concept, there is a broad consensus that business models comprise interlocking components that together create and deliver value (Burkhart et al., 2011). According to Al-Debei (2010), the four key elements of a business model are (1) its value proposition (i.e., how a product/service creates value for customers), (2) the value finance (cost structure and revenue stream), (3) the value network (actors, channels, and relationships), and (4) the value architecture (technological and organizational infrastructure).

The IS research community has a special relationship with the business model concept as its increasing presence is closely connected with the emergence of such areas as e-business (Amit and Zott, 2001). These IS-related industries, due to their fundamental differences from traditional ones (Teece, 2010; Veit et al., 2014), have served as relevant contexts for examining the role of the business model in, e.g., firm performance. Furthermore, with the rising diffusion of IS throughout everyday life (Yoo, 2010), the impact of IS on existing business models and the resulting transformative developments towards digital business models have been observed in various industries (e.g., Kamoun, 2008). Finally, as IS have a long history of improving business processes (e.g., Melville et al., 2004), they have also been reported to serve as important tools in the process of BMI (e.g., Kijl and Boersma, 2010). Summing up these effects, Veit et al. (2014) derive three areas of business model–related IS research: business models in IT industries, IT-enabled or digital business models, and IT support for developing and managing business models.

The business model concept can be viewed from a static or dynamic perspective (Burkhart et al., 2011; Aspara et al., 2011; Demil and Lecocq, 2010). The former deals with describing or classifying business models, while the latter addresses the dynamics of business models (e.g., Burkhart et al., 2011; Demil and Lecoq, 2010). Today, there is a broad consensus that companies must change their business models to stay successful (Demil and Lecocq, 2010; Wirtz et al., 2010).

BMI is thus a crucial task for today's managers (Amit and Zott, 2012); it can be defined as "the search for new business logics of the firm and new ways to create and capture value for its stakeholders" (Casadesus-Masanell and Zhu, 2013, p. 464). Schneider and Spieth (2013), after a concise literature review on the topic, identify three important streams of research. The first deals with the prerequisites of BMIs. This includes studies that deal with the role of managerial cognition (e.g., Aspara et al., 2011), organizational capabilities, or other factors (e.g., organizational inertia) that drive or inhibit BMIs. The second stream of research on BMI deals with the process itself and includes work that concerns exploring or describing the phases of a developing business model (e.g., McGrath, 2010). Finally, the third research stream, and also the least frequent, comprises works addressing the impact of BMIs on the industry and the focal firm's performance or capabilities (Schneider and Spieth, 2013).

Research on BMIs and IS has largely concentrated on the consequences of specific IS innovations for business models. Wirtz et al. (2010) focus on the adaptations of business models that Internet firms must undertake due to the rise of Web 2.0 technologies. The authors first define four types of Internet business models (content, commerce, context, and connection), then derive the impact that certain empirically tested Web 2.0 factors (social networking, interaction, user-added value, and customization) would have on them, and finally advise how firms should adapt their current business models in order to stay competitive. It turns out that the relevance of specific Web 2.0 trends differs greatly among the distinct business model types, as do the implications for the necessary changes to be conducted by management

(Wirtz et al., 2010). Focusing on web technologies, Keller and Hüsig (2009) analyze whether these innovative technologies are a disruptive threat to incumbents' business models in the business software industry. The authors use trajectory maps, finding a minor disruptive threat to incumbent business models but sufficient entry barriers to currently prevent entrants from invading the market. Moreover, the results reveal that incumbents reacted in adapting business models by copying certain aspects of the potential entrant's offerings, e.g., integrating web technologies in their solutions (Keller and Hüsig, 2009). Pateli and Giaglis (2005) examine the impact of mobile applications on existing business model components in the exhibition industry. Based on related literature, the authors derive a model for technology-induced business model change, including a contingency approach for assessing several scenarios for incorporating a new technology, and then apply it to the specific industry and technology context. It becomes clear that new technology offers alternative ways to adapt established business models, each favored by certain internal and external environmental factors (Pateli and Giaglis, 2005). Kamoun (2008) explores the impact of RFID on several existing business models. By combining the potential benefits of the technology on a component level with external developments, he presents the possible impacts for different business models. Clemons (2009) discusses potential business models for Internet applications other than advertising, describing the consequences of the Internet for traditional advertising models and associated industries. It becomes clear that incorporating the old business model of broadcast media advertising with the new technology is not promising. Furthermore, the developments around the web also endanger the traditional model because of changed user behaviors (Clemons, 2009). Dealing with the well-known case of Kodak, Lucas and Goh (2009) demonstrate the disruptive impact of information technology (IT) on business models. The emergence of digital photography threatened the traditional and successful business model, but organizational factors such as culture, structures, and managerial mindsets hindered a rapid response (Lucas and Goh, 2009). Finally, Juntunen et al. (2010) consider the technology of near-field communication (NFC) for ticketing services. Focusing on the case of using NFC with smartphones for mobile ticketing, the authors employ a literature review and expert interviews to systematically analyze the business model for such a service and identify several critical requirements for the successful deployment of the respective business model (Juntunen et al., 2010).

Apart from this, initial research has focused on the role of IS as tools in the BMI process. Following a design-oriented approach, Kijl and Boersma (2010) develop a business model–engineering tool that provides support for innovation-related aspects such as experimentation or future scenario planning. The tool was deployed and evaluated in a single case study of an online investment research startup (Kijl and Boesma, 2010). Bouwman et al. (2012) provide an overview of business model tools in the areas of roadmapping, stress testing, agile development, and financial decision support. The authors present exemplary tools for each area as well as illustrative cases for every tool. Their findings indicate that the tools would assist in innovation processes by, e.g., reducing uncertainties. However, due to the diversity and complexity of the business model concept, more research in this field is necessary to evaluate the actual impact on, e.g., firm performance (Bouwman et al., 2012).

To sum up, much work has been conducted to describe new business models stemming from various kinds of IS innovations or paradigms and how innovative developments in IS have changed the rules in established markets. Moreover, important progress has been made in describing the conceptual relation of IS and business models and systemizing business model research in the IS community. However, to the best of our knowledge, there is no comprehensive understanding from a meta-perspective –i.e., drawing on these important insights from prior research – of the different roles IS play in BMIs. As it is clear that IS have increased enormously in importance for BMIs in almost all contexts, even those that were previously untouched by IS, a general framework describing the distinct roles and their functioning, independent of specific technologies or paradigms, is needed in order to systemize the phenomenon.

2.2 The role of IS in innovation

When reasoning about the role of IS in innovation, one can generally distinguish between its impacts on the innovation outcome and the innovation process (Nambisan, 2013). Concerning the latter, Kleis et al.

(2012) describe three ways in which IS influences the innovation process: First, it supports knowledge management around the innovation initiative. Second, it provides important support functionalities with, e.g., computer-aided design. Third, it facilitates interorganizational collaboration in innovation processes (Kleis et al., 2012). A number of studies have therefore examined the specific impact of IS on the innovation process. For instance, Durmuşoğlu et al. (2011) investigate the impact of various IS (e.g., web meetings, decision support systems, virtual prototyping) on the effectiveness and efficiency of product-innovation processes. Their findings indicate that the actual influence on performance measures depends on the respective innovation context (e.g., the phases in which they are deployed) (Durmuşoğlu et. al, 2011). Barczak et al. (2008) empirically investigate the influence of IT use on the success of new product developments and find a positive (though context-sensitive) impact of IT use on the speed to market and market performance (Barczak et al., 2008). Moreover, Banker et al. (2006) prove the beneficial effect of collaboration software use on product design and development through quality and cycle time improvements and cost reductions (Banker et al., 2006).

As these findings demonstrate, IS have been important for innovation processes since their emergence in business contexts. Moreover, recent research has indicated that they will become even more important in the future due to transformations in the innovation processes. Fichmann et al. (2014) point out that "[d]espite the relative lack of attention, there are good reasons to believe that innovation processes are indeed being transformed in many organizations, and that new IT is playing a critical role" (Fichmann et al., 2014, p. 348). This change goes hand in hand with the increased importance of the business model as a locus of innovation. As Sandström and Björk (2010) describe, innovation processes are evolving towards open, discontinuous, and BMIs. Therefore, IS tools such as idea management systems must also transform and account for the changing specifics of the innovation processes (Sandström and Björk, 2010). In contrast to solely product or service innovations, the innovation process of business models can involve changes in components that go beyond the core product or service, such as customer interfaces, partner networks, or revenue models (e.g., Osterwalder et al., 2005). Therefore, BMI processes are often non-linear and iterative (Bucherer et al., 2012). Schneider and Spieth (2013) explain that BMI processes have been described as continuous and evolutionary endeavors that therefore require ongoing learning, discovery-driven planning, and trial and error–based processes rather than an analytical approach. The vast majority of prior research on IS and innovation processes focuses on product or service innovations and thus does not account for these specifics.

Research on the influence of IS on the outcome of innovation processes has mainly centered on the direct impact of IS innovations. In this regard, the IS research community has provided typologies that have been used to categorize IS innovations (e.g., Swanson, 1994). Lyytinen and Rose (2003) describe three sets of innovation, categorizing IT innovations by their technological or business process consequences. The first set, IT base, is rather technically conceptualized and comprises new software and hardware. The aim of this type of innovation is to increase technical, i.e., computational, capabilities. The second set, system development, aims to make changes in the system development process through either administrative or technological process innovations. The third set, services, describes the outcome of these system development processes, leading to new solutions for both internal (e.g., an accounting system) and external services (e.g., new customer-service systems). In sum, the typology of Lyytinen and Rose (2003) categorizes IT innovations by their technological or business process consequences (Lyytinen and Rose, 2003). The aforementioned innovation types can be further related to the subcategories developed by Swanson (1994). More recently, Nambisan (2013) describes four distinct roles of IT in product/service innovations that can be defined according to the impact of IT (either on the innovation process or on the innovation outcome) and IT's role in the product/service innovation (as either an operand or operant resource). As an operand, IT is described as a direct input into either the innovation process ("digital tool as an innovation enabler"), e.g., by delivering decision support in product innovation processes, or the innovation outcome ("digital component as an innovation enabler"), e.g., by being an integral part of service innovations. In contrast, IT as an operant resource is a rather new perspective that describes IT as a trigger of innovation. With reference to the impact on the innovation

process ("digital tool as an innovation trigger"), digital technologies allow for novel processes and routines in new product/service development. Concerning the outcome of the innovation process ("digital component as an innovation trigger"), the characteristics and affordances of digital technologies themselves lead to product/service innovation (Nambisan, 2013).

It is apparent that much work has been conducted to investigate the role of IS in innovation and that the role of IS seems to be enlarging and differentiating. However, existing insights into the role and changing nature of IS apply only to process and/or product/service innovations; they do not account for the specifics of business models. Due to the multi-faceted nature of the concept described above, BMIs go beyond product/service or process innovations and are thus a separate class of innovation (Fichman et al., 2014). As Bucherer et al. (2012) point out, "[n]ew business models are affecting organizations usually in a broader manner and enforce organizational restructuring more often" (Bucherer et al., 2012, p. 194). The examples in Section 2.1 reveal that significant IS-related research has been conducted on the impacts of specific IS innovations on particular business models. However, what is still missing is a classification from a meta-perspective that allows one to differentiate the distinct roles of IS and investigate the characteristics and impacts of these roles.

3 Methodological Approach

To investigate the roles of IS in BMI, we conducted a two-stage research approach. First, we carried out an extensive literature search process based on the guidelines published by Cooper (1982) and vom Brocke et al. (2009). Second, we developed a taxonomy based on Nickerson et al. (2013) to classify the different roles IS can take in the field of BMI.

Taxonomies are used in various domains in order to classify objects of interest into mutually exclusive and collectively exhaustive sets or categories by means of classificatory schemes (Doty and Glick, 1995), thus providing a foundation for structuring and organizing the knowledge of a field (e.g., Glass and Vessey, 1995) and allowing researchers to study the relationships among concepts (Nickerson et al., 2013). Furthermore, taxonomies can reduce the complexity of reality, resulting from, e.g., the vast number of objects in a population, by aggregating them based on underlying characteristics into so-called dimensions (Bailey, 1994). Finally, Williams et al. (2008) state that taxonomies can be used in the process of theory development.

In business model research, taxonomies have been used in areas such as classifying e-business models (Rappa, 2004) or proposing classification schemes for mobile business models (Leem et al., 2004). Furthermore, taxonomies have been applied within the IS domain to, e.g., analyze and classify mobile and pervasive applications (Dombroviak and Ramnathm, 2007), IS applications in general (Farbey et al., 1995), or software development methods (Blum, 1994). However, drawing on a detailed analysis of literature using taxonomies, Nickerson et al. (2010) state that the development of taxonomies has largely followed an ad hoc approach. Many papers lack transparency concerning the taxonomy-development method employed, and a formal procedure is not always used (Nickerson et al., 2010).

Applying a holistic view of empirical research on BMI, we gauge the taxonomy development approach as an appropriate means of capturing the complex interdependencies between IS and the concept of BMI from a meta-perspective.

3.1 Literature analysis

When investigating the phenomenon of BMI from an IS perspective, it must be made clear that IS *can* affect the way in which business models are created or revised but do not necessarily have to. Baden-Fuller and Haefliger (2013) point out that the business model construct is inherently separable from technology. As such, a BMI could also take place as a result of (external) environmental pressure, e.g., regulatory matters (e.g., Hall and Wagner, 2012). Based upon an initial exploratory and unsystematic literature analysis, we found that BMI can be influenced by IS, though these are not the primary focus of the respective research. Therefore, we did not limit our research by presuming an explicit IS focus

beforehand but applied a more generic approach by considering literature in the broader field of BMI. Thus, the initial keywords were combinations of the term "business model" with "innovation" and "design". The search process encompassed titles, abstracts, and keywords. Drawing on Webster and Watson (2002), the initial set of keywords was expanded in a second step by reviewing the citations of our initial hits (backwards search). Because, according to Cooper (1982), a literature review allows for evaluating the relevance of search terms and revising the search strategy, the search terms "business model reconfiguration" and "business model change" were added to the initial set.

We collected our data in May 2014 and based our search process on databases relevant to the IS community (Knackstedt and Winkelmann, 2006). Furthermore, we added the AIS Electronic Library. As research on business models and BMI is rooted in a variety of research disciplines (Nemeth 2011), we focused on multi-disciplinary databases for the data-collection phase: ScienceDirect, ProQuest, Ebsco, Emerald, JSTOR, Wiley and AIS Electronic Library.

As a result of the search process, 218 potentially relevant articles were identified. These articles were then reviewed to assess their suitability for describing the phenomenon of BMI through empirical research. Contributions of a purely conceptual nature were excluded, as were articles that do not investigate the process of BMI. Applying these filters, 113 contributions were identified to be irrelevant for answering the research questions at hand. We conducted an in-depth assessment of each of the remaining 105 research contributions to determine whether their empirical results indicate that IS plays an essential role in BMI. Subsequently, we concentrated on articles describing the process of BMI fostered by specific types of IS in detail. Investigations characterizing this relationship too generally or abstractly do not help us derive profound insights into the role of IS in this specific context. Applying vom Brocke et al.'s (2009) claim for reliability and validity, relevant articles were analyzed by at least two researchers, each writing down his individual interpretation of the relevant aspects of IS usage. To assess interrater reliability, we compared the results and calculated Cohen's Kappa (1960). The resulting value of 0.91 indicates a good strength of agreement. In case of non-agreement, the relevant article was discussed in detail until a consensus was reached. Finally, we obtained a list of 21 papers to be included in our analysis. All remaining articles derive insights on reality through empirical investigations, two of which are mixed methods (qualitative and quantitative), while the rest are qualitative (mainly interviews or case studies). Empirical analyses are used not only for inductive reasoning but also in the context of deductive or conceptual studies (Wilde and Hess, 2007). Therefore, empirical research can be used for either theory verification or theory building (Flynn et al., 1990). Accordingly, for each article we determined whether a conceptual approach was considered in addition to the empiricism; this applies to 57.14% of our cases.

3.2 Taxonomy development

According to Glass and Vessey (1995), developing a taxonomy involves three major considerations. First, the *purpose* of a taxonomy must be defined as either specific or general; while a specific taxonomy classifies distinct objects, a general taxonomy allows for a broader use and generalization. As we aimed to investigate the roles of IS within the broad field of BMI and derive universally valid insights, we chose a general approach. Second, the *operational description of dimensions and characteristics* must be provided after the taxonomy-development process (i.e., after all dimensions and characteristics of the taxonomy have been determined) (see also Doty and Glick, 1995). The description is used as a decision rule in order to assign objects to categories in a complete and unambiguous manner (Glass and Vessey, 1995). Our qualitative description is provided below. Third, the *dimensions and characteristics for describing, differentiating, and classifying objects* must be defined. While Glass and Vessey (1995) themselves do not describe a structured approach for achieving this, Nickerson et al. (2013) advances the most recent process of taxonomy development. In contrast to Bailey (1994), who states that taxonomy development can be based on an inductive, deductive, or intuitive (ad hoc) approach, Nickerson et al.'s (2013) method uses an iterative development process, involving both conceptualization/deduction and empiricism/induction. Figure 1 visualizes all necessary steps.

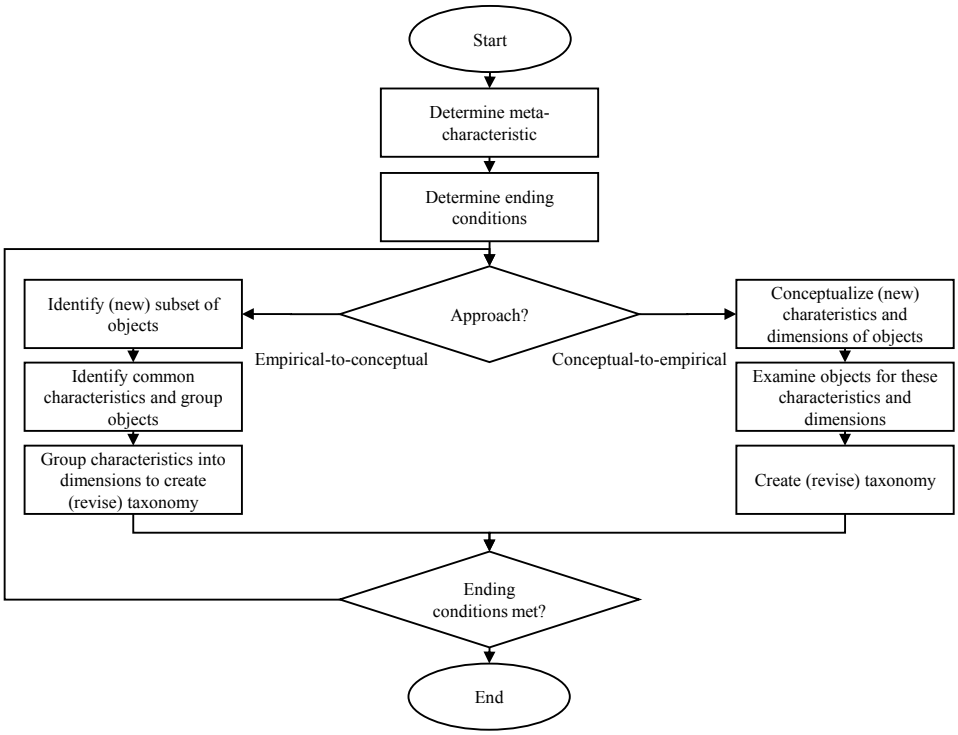

Figure 1. Taxonomy development procedure (Nickerson et al. 2013, p. 345)

In a first step, and based on the aforementioned purpose of the taxonomy as well as its target user group, the meta-characteristic must be defined. This is particularly important as the meta-characteristic is a "comprehensive characteristic that will serve as the basis for the choice of characteristics in the taxonomy" (Nickerson et al. 2013, p. 343), meaning that all characteristics of a taxonomy should be a logical consequence of this meta-characteristic (Nickerson et al., 2013). Our meta-characteristic is theory driven (see Section 2.2) because we aimed to capture the roles of IS in BMI with a holistic approach. In a next step, we adopted the objective and subjective ending conditions suggested by Nickerson et al. (2013) (see Appendix A). The following iterative procedure ends when all ending conditions are met. At each pass through, Nickerson et al. (2013)'s method allows us to decide whether to use a conceptual/deductive or an empirical/inductive approach. In each iteration process, three articles were investigated by at least two researchers, discussing the specific IS-driven phenomenon of BMI in detail. For the first iteration process, the empirical-to-conceptual approach was used to examine the first investigations in detail and base our taxonomy on these findings. Thus, we distinguished between IS and non-IS industries, as various industries are examined in our research articles. In line with Al-Debei's (2010) definition of the business model concept, we included the components that were mainly affected by innovation: value proposition, value network, value architecture, and value finance. We further found that the BMI can be either an add-on or a substitute, depending on its relation to the previous business model. We followed the empirical-to-conceptual approach again for the second and third iterations to get a clearer picture of the phenomenon of our research. Hence, we recognized that the BMI can also result in a completely new business model where there previously was none. We also found that the focus of BMI can rely either on IS (e.g., a new software tool) or on non-IS business models (e.g., commercializing mechanical engineering products that are equipped with ICT innovation) (e.g., Björkdahl, 2009).

For the next iteration process, we used the conceptual-to-empirical approach, aiming to obtain a different perspective on our objects and their characteristics. We determined that IS can lead to BMI either directly or indirectly, with the latter describing a contextual factor that fosters the outcome of the BMI or process indirectly. In contrast, a direct influence can be characterized as a trigger; in other words, the BMI would not take place if the specific IS would not exist. Considering the type of influence, we were

unable to verify this differentiation by investigating our objectives. Building on Nambisan (2013), another possible dimension to analyze is whether IS are part of the innovation outcome itself or whether they influence the innovation process (as described in Section 2.2). Because we did not find evidence of this occurrence in our data, we were unable to incorporate this dimension to our taxonomy. Therefore, we applied the conceptual-to-empirical approach for our fifth iteration process, and finally identified instances of this differentiation in our objectives, as Bocken et al. (2013) describe a software mapping tool that helps firms create value propositions better suited for sustainability, referring to the process of BMI. In addition, we conducted two more iteration processes applying the empirical-to-conceptual approach to analyze the remaining articles but were unable to identify any new dimensions or characteristics. Having examined all objects after the seventh iteration, all objective ending conditions were met, as were our subjective ending conditions. The taxonomy is concise but robust as it contains enough dimensions to differentiate between all phenomena of BMI but does not contain any inconsequential ones. Thus, it is not susceptible to misclassification. Furthermore, the taxonomy is extendible and explanatory, in that it can be extended by future researchers and contains useful but non-redundant information on the objects. Finally, the taxonomy is comprehensive as it contains our complete sample of articles that were identified during the literature review.

4 Findings

4.1 Taxonomy

As pointed out in Section 3.2, we matched our objectives in relation to industry context, type of influence, focus of BMI, and locus of IS influence. Further, we analyzed the business model components mainly affected (value proposition, value network, value architecture and value finance) as well as the existence of a prior business model. For simplicity, Table 2 does not display the columns *affected* and *unaffected* for the business model components. However, in order to meet the mutually exclusive criterion of the taxonomy development approach, we did differentiate between affected and unaffected while developing the taxonomy, (Doty and Glick, 1994; Nickerson et al., 2013). Therefore, "x" indicates the affected characteristic for each component and a missing "x" means unaffected. Table 2 represents the final taxonomy containing all objects as well as the corresponding dimensions and characteristics. It appears that the phenomenon of IS-driven BMI has been investigated mainly in an IS industry context (14 out of 21 datasets). In most cases (17 out of 21), the focus of BMI relies on IS – such as a new software tool, platform, or service – and the locus of influence is an outcome itself rather than a process enhancement (17 out of 21). If a business model existed before the IS-driven BMI, this innovation can be either an add-on (11 of 21) or a substitute (6 of 21). A completely new business model was developed in 4 out of 21 cases. Furthermore, Table 2 reveals that all business model components can be affected by this innovation.

Article	*Object of investigation*	*Industry context*		*Type of influence*		*Focus of BMI*		*Locus of IS influence*		*Components mainly affected*				*Prior existing business model*		
		IS	Non-IS	Direct	Indirect	IS	Non-IS	Process	Outcome	Value Proposition	Value Network	Value Architecture	Value Finance	None	Add-on	Substitute
Chung et al. 2004	eBusiness platform for global sourcing		x	x		x			x		x	x			x	
Hawkins and Ballon 2007	Mobile ICT standards	x			x	x			x		x	x	x			x
Kamoun 2008	RFID-driven business models		x	x		x			x	x	x	x	x		x	
Bouwman et al. 2008	Digital television – Internet-based IPTV	x			x	x			x	x	x	x	x			x
Braet and Ballon 2008	Mobile broadcast networks and mobile television	x		x		x			x	x	x	x	x	x		
Björkdahl 2009	Equipping mechanical engineering products with ICT innovation (sensors, software, computer, signal sensing, control bus, CAN, electronics)		x	x			x		x	x					x	
deReuver and Haaker 2009	3G technologies open opportunities for context-aware mobile services	x		x		x			x	x	x	x	x	x		
Doganova and Eyquem-Renault 2009	Vehicle telematics for entrepreneurship of location-based services	x		x		x			x	x	x	x	x	x		
Dunford et al. 2010	Internet helping banks in internationalization		x		x		x		x	x	x	x	x			x
Wirtz et al. 2010	Web 2.0 for creating value on the Internet	x		x		x			x	x	x				x	
Bourreau et al. 2012	File sharing as a disruptive innovation		x	x		x			x	x	x	x	x			x
Walravens 2012	Mobile services in public contexts – evolutions in networking technology (e.g., Wi-Fi, WiMAX)		x	x		x			x	x	x	x	x			x
Wikström and Ellonen 2012	Social media features in online services of print media		x	x		x			x	x	x				x	
Bocken et al. 2013	Software-mapping tool to help firms create value propositions better suited for sustainability		x		x		x	x		x					x	
Delbreil and Zvogo 2013	Wireless sensor technology in the healthcare sector		x	x			x		x	x					x	
deReuver et al. 2013	Internet and social media – a service platform in the dance industry		x		x	x		x		x	x	x			x	
Desyllas and Sako 2013	Telematics-based pay-as-you-drive insurances		x	x		x			x				x		x	
Günzel and Holm 2013	Internet (WWW, Web 2.0 and the various mobile platforms) in the newspaper industry		x	x		x			x	x	x	x	x			x
Wu et al. 2013	IT application for customer knowledge management		x		x	x		x			x		x		x	
Xiaojun et al. 2013	Internet affects the education and training industry		x		x	x			x		x				x	
Cavalcante 2014	Platform as a toolbox for the BMI process	x			x	x		x		x	x	x	x	x		

Table 1. Final taxonomy describing IS in business model innovation

4.2 The roles of IS in business model innovation

Providing a structured and holistic view of prior research describing the phenomenon of IS-driven BMI for single instances or cases, the taxonomy allowed us to study the relationships among relevant concepts (Nickerson et al., 2013). In order to achieve our goal of deriving different roles of IS in BMIs, we, first, individually searched for patterns by analyzing the similarities of the cases concerning the different taxonomy-categories. We thus tried to create homogenous initial groups. Second, we, also separately, tried to subsume every instance of the taxonomy under the groups and created a new one when necessary due to a misfit with the existing groups. Third, our three individual lists were compared and discussed until a consensus on the groups (now representing the subcategories in Table 3) was reached. Finally, we, collectively, were able to derive three major role descriptions covering all of the groups. The first major role is targeting IS innovations that enable BMI outcomes, i.e., new or extended business models, while IS playing the second role can be described as influencing the process of innovating business models. The third role describes IS that provide a frame of reference with which business model innovators must comply. Whereas instances of the first two roles are relatively context specific, the third role provides space but also defines rules for a wide array of BMIs. Table 3 depicts our findings in detail.

Role	Subcategories	Explanation	Illustrative example
IS as a BMI enabler	New digital business model	IS innovations are incorporated in new business models and represent their core element. The distinctive characteristic is the designing of a whole new business model, comprising all elements.	Context-aware mobile services building upon 3G technologies: *"Design issues that affect the viability of context-aware services are present in each component of the business model"* (de Reuver and Haaker, 2009, p. 246).
	Digital business model enrichment	Existing business models are extended by IS innovations. Digital components are added. The distinctive characteristic is the addressing of only certain business model components.	Social media features in online services of print media: *"Social media features lead to online BMI, particularly linked to the firms' value propositions"* (Wikström and Ellonen, 2012, p. 63).
IS as a capability in the BMI process	Digital support capability	IS that act as a means to enhance BMI processes. The supporting feature mainly targets specific business model components. However, the underlying BMI is already essentially planned.	Software-mapping tool helping firms create value propositions better suited for sustainability: *"The value mapping tool assists companies in embedding sustainability into the core of the business model through an improved understanding of the value proposition"* (Bocken et al., 2013, p. 493).
	Digital design capability	IS helping to develop BMIs. Here, IS do not only execute or support existing plans but also explore new business models and their designs as a whole.	Platform as a toolbox for the BMI process: "*Toolbox containing software, hardware and methods that will be available to all firms interested in developing and commercializing new positioning based products and/or services*" (Cavalcante, 2014, p. 454).
IS as a frame of reference for BMIs	Digital platform	Existing IS that need to be considered additionally in the BMI. In this category, specific business model components are affected.	Internet as an additional channel in education services: "*The popularity of the Internet has made it possible to break the geographical restrictions through online education*" (Xiaojun et al., 2013, p. 8).
	Digital eco-system	Existing IS that provide the background for BMIs and thus determine the design of business models. The distinctive character of this category is that all business model components are affected for being compatible with digital ecosystems.	Mobile ICT standards as a base for new services: "*A substantial part of the standardization process is being reoriented from drafting technical specifications as such, to using these specifications in order to leverage specific product and service environments in specific markets. In this respect, a significant part of what heretofore we have viewed primarily as a standardization process has become an element in business model design*" (Hawkins and Ballon, 2007, p. 28).

Table 2. The roles of IS in business model innovation

5 Discussion and Implications

Since their initial emergence, IS has had an impact on business operations (El Sawy and Pereira, 2013). While IS initially supported business processes, they are becoming an increasingly essential factor in innovation (Nambisan, 2013). We found that IS are also of particular importance when it comes to BMIs, a context in which they play three major roles. As these roles go beyond the influence of technical innovations or their direct impact on the product/service offering, existing typologies or classifications fall short of capturing this variance. With our study, we offer three important contributions for both research and practice: First, we provide evidence for the growing importance of IS for today's businesses, as they move from being merely a support function to increasingly becoming the business itself. Second, we describe the specific roles through which this effect arises, thus providing evidence that the phenomenon of IS-related BMI is not a uniform one but instead works through diverse mechanisms. As these mechanisms must be dealt with individually, we attempted to present a differentiation. By doing so, third, we provide an empirically based common ground, including a standardized description and unified terminology for the theoretical elaboration as well as proactive use of IS in BMI. In the following, we will expand upon these three contributions.

According to Al Debei and Avison (2010), a business model connects the process and strategy layers within a firm's reasoning. With our findings, we thus provide instances of firms' emerging digital business strategies, i.e., "organizational strategy formulated and executed by leveraging digital resources to create differential value" (Bharadwaj et al., 2013, p. 472), indicating the enlarged and differentiated role IS plays in business as well as their transformative impacts. The development of a new digital business model with an add-on character or one that builds upon no prior existing business model, is a way for businesses to diversify their business model portfolio in the digital world. Interestingly, firms from previously physical industries also drive this kind of innovation. For instance, Kamoun (2008) describes the case of a RFID-based business model employed by a delivery firm. A new digital business model with a substitution approach, however, has the potential to replace an existing one. While this may be considered a radical change in IS-related industries, it can be described as a digital disruption in non-IS industries. Examples can be found in developments in the music industry. As described by Bourreau et al. (2012), file sharing changed the rules of the game in the market and led to completely different structures. Moreover, we demonstrated that IS do not only enable BMI. In the BMI process, it is apparent that IS support its execution by, e.g., enhancing information necessary for planning purposes. However, they are also involved in an earlier phase or "pre-stage" (Cavalcante, 2014) that concerns developing an initial BMI idea or direction. IS thus represent a new aspect in the strategic reasoning of a firm, regardless of whether it is an IS or non-IS industry. Furthermore, IS act as a background, a frame of reference for BMI. They either afford specific new functionalities or ways to reach out to partners and customers (Xiaojun et al., 2013) or they offer entirely new BMI spaces. These digital platforms and eco-systems determine the rules to be followed and define new digital (sub-) industries (e.g., Bouwman et al., 2008).

In sum, IS in BMIs do not solely act as technological inputs in BMI processes. They provide options for innovating business models and support management in recognizing these options and making the best out of them. To the best of our knowledge, our findings provide initial evidence of IS acting as both operand and operant resources (Nambisan, 2013) in the BMI process, thus supporting the existence of Nambisan (2013)'s typology for the case of BMI and differentiating it based on a rigorous methodological approach. With the description of the major roles and sub-categories, we contribute to the field of IS research on business models by providing a framework to categorize IS according to their relation to BMIs. Future research in the field can draw on this framework to guide, e.g. empirical investigations of their impacts or further differentiation of the roles. The examination of the transformative impact of the roles towards digitalization, which is indicated by our findings, should be subject to future scrutiny. Moreover, the concurrent appearance and thus the emergence of interdependent digital business models is of particular interest for future research.

With the description derived, we want to direct managers' attention towards the variety of influences that arise through IS. The phenomenon and therefore its associated effects proceed in a differentiated

manner. They should use the framework to proactively assess the risks associated with each role for their existing business models. However, our findings must not be misunderstood to mean that businesses should foster IS-related BMIs everywhere and anytime; instead, they should innovate these innovations mindfully, i.e., "with reasoning grounded in its own organizational facts and specifics" (Swanson and Ramiller, 2004, p. 559). Hence, organizations need absorptive capacity for targeting the differentiated roles in order to identify and profit from the existing possibilities. This applies for both IS and non-IS industries. The former type must consider not only their digital products (e.g., ERP software) but also emerging digital ecosystems, such as those stemming from mobile technology (e.g., smartphones and tablet PCs). Non-IS industries must consider the potential of IS to help leverage their core competences and assets in digital spaces (e.g., an automobile manufacturer building new business models based on sensor data). However, as these examples indicate, differentiated roles generate diversified possibilities for exploring new kinds of business models. Nevertheless, existing business models must also be executed and innovated. Therefore, organizations must improve their ambidexterity so they can innovate and deploy distinct business models simultaneously.

6 Limitations

We derived fruitful insights into the field of IS-driven BMI by conducting a rigorous taxonomy approach. Nevertheless, our research has some limitations, as we based our investigation entirely on existing literature. First, our sample was limited to journals, thus excluding conference proceedings. Second, in examining the articles, we found that the process of BMI fostered by IS is not always described in detail and that the business model concept is conceived in various forms, resulting in unnecessary differences concerning its components and characteristics. Therefore, we had to severely restrict our sample to ensure relevant information for each of our objects. This poses the danger that our investigation may not capture the entire population of possible IS-driven BMIs. While the developed taxonomy fulfills the exclusivity and exhaustivity requirements for our sample, general validity cannot be assured. As we are aware of these shortcomings, we adapted a formal and well-documented procedure of taxonomy development based on Nickerson et al. (2013), applying an iterative approach that future researchers may draw upon to extend with the inclusion of additional scopes. Third, we chose a holistic, and therefore, global approach for our analysis. The community is aware of cultural differences and how these influence the use of or perception towards IS (e.g., Pauleen et al. 2006; Srite and Karahanna 2006). Nevertheless, we did not examine these effects in our study, this may be an interesting topic for further research.

7 Conclusion

While significant research efforts have been made to describe BMIs resulting from innovative IS, a systematic description of the various roles IS play in BMIs from a meta-perspective (which has been at least partly the case for IS in process, service, or product innovations) is lacking. In this paper, we employed such a meta-perspective to investigate how IS influence both the processes and outcomes of BMIs. To do so, we applied a rigorous taxonomy-building approach. We found three major roles – (1) IS as a BMI enabler, (2) IS as a BMI capability, and (3) IS as frame of reference for BMIs – each including two subcategories. The findings indicate that IS act as both operant and an operand resources in the BMI process. The taxonomy further revealed that the roles can be found in both IS and non-IS industries and that these can drive digital transformation in various contexts. We conclude that the consideration of IS should be on the agenda of every manager contemplating BMI. However, to recognize and apply the differentiated roles of IS for the specific organizational context of a firm, i.e., to mindfully innovate business models with IS, firms require organizational and managerial capabilities distinct from those needed in the past.

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Appendix A: Ending Conditions of Taxonomy Development

No.	Objective ending conditions	Subjective ending conditions
1	All objects or a representative sample of objects have been examined	*Concise*: The taxonomy should contain a limited number of dimensions and characteristics
2	No object was merged with a similar object or split into multiple objects in the last iteration	*Robust*: Enough dimensions and characteristics should be included to clearly differentiate between the objects of interest
3	At least one object is classified under every characteristic of every dimension	*Comprehensive*: All objects used during the taxonomy development should be classified in the developed taxonomy
4	No new dimensions were added in the last iteration	*Extendible*: The taxonomy should allow for adding new dimensions and characteristics
5	No dimensions or characteristics were merged or split in the last iteration	*Explanatory*: The taxonomy should contain useful information on the object but should not describe them in detail
6	Every dimension is unique and not repeated	
7	Every characteristic is unique within its dimension	
8	Each cell (combination of characteristics) is unique and is not repeated	

Table 3. Ending conditions of Taxonomy Development (Nickerson et al. 2013)