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Research paper

The mediating role of organizational complexity between enterprise resource planning and business model innovation

Rocío Rodríguez[a,*], Francisco-Jose Molina-Castillo[b], Göran Svensson[a]

[a] Kristiania University College, Oslo 0107, Norway
[b] Universidad de Murcia, Campus de Espinardo, Murcia 30100, Spain

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ABSTRACT

Almost any firm faces a change during its life that requires a redefinition of the business model to be more innovative, namely business model innovation (BMI) that designs an architecture to create, capture and deliver value to customers in the marketplace and society. These changes are a great opportunity to improve revenue and costs, but the associated organizational complexity also has drawbacks, due to the set of interrelationships and linkages within the firm. This situation could be even more relevant for firms that implement Enterprise Resource Planning (ERP), due to the complexity of the software and also the difficult implementation process in the organization. In order to fill this gap, this study analyses 104 firms that have implemented ERP and deal simultaneously with BMI. The research objective is therefore to test the role of organizational complexity between ERP and BMI. Specifically, the aim is to test the mediating role of organizational complexity between ERP and BMI. Our findings reveal that organizational complexity mediates between ERP and BMI. Important implications for researchers and managers are provided to optimize ERP implementation so as to obtain a higher return on the costs and revenue associated with BMI.

1. Introduction

The initial contribution by Bellman, Clark, Malcom, Craft, and Ricciardi (1957) describing a business game was the trigger for a new research stream around business model innovation (BMI), which is frequently referred to in the literature as a change in the business logic of the firm (Teece, 2010). But it was not until 40 years later that business models were regularly cited during the late 1990s, following the dotcom crisis (Osterwalder & Pigneur, 2010). Nowadays, the topic of BMI has become highly cited in the context of designing how a firm creates, proposes and captures value (Taran, Boer, & Lindgren, 2015). Since then, a plethora of definitions by researchers and managers (Spieth & Schneider, 2016) have been suggested in terms of business model conceptualization (Massa, Tucci, & Afuah, 2017). One of the most widely acknowledged definitions of what comprises a business model was proposed by Teece (2010; p. 172), who described a business model as: "…*the design or architecture of the value creation, delivery, and capture mechanisms of a company*…".

BMI is essential to the survival of any firm (Velu, 2015) and helps to define how an organization creates value and captures value from its customers (Clauss, 2017). But apart from the conceptual abstraction of the phenomenon (Foss & Saebi, 2017), the different components of BMI should be accounted for (Taran et al., 2015) in order to clarify the object under study. This study focuses on how firms deal with the organizational complexity of BMI (Chamberlin, Doutriaux, & Hector, 2010). Specifically, the approach selected focuses on the antecedents (ERP) and consequences (BMI) of organizational complexity. Such studies are popular among academics (Lambert & Davidson, 2013) wishing to obtain a clear picture of the relationships among variables inside the firm (Cortimiglia, Ghezzi, & German, 2016), which in turn impact on performance (Karimi et al., 2016).

One of the elements closely linked to organizational complexity is the implementation of an ERP. There has been a growing research stream focusing on the need to adapt technological advances to BMI (Martins, Rindova, & Greenbaum, 2015) at multiple levels (Chesbrough & Rosenbloom, 2002). For example, Mohnen and Hall (2013) focus on how technology could affect the innovation of an organizational business model. By contrast, Mason and Spring (2011) analyse how a software tool or system could be incorporated into firms' business models. In this sense, the ERP is a crucial technological application in today's B2B markets as a means of developing firms' business models regarding profitability and competitiveness. In particular, ERP is a crucial software solution that affects the entire organization (Chung, Skibniewski, Lucas, & Kwak, 2008) and subsequently, the business

* Corresponding author.
E-mail addresses: rocio.rodriguez@kristiania.no (R. Rodríguez), fjmolina@um.es (F.-J. Molina-Castillo), goran.svensson@kristiania.no (G. Svensson).

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model itself, when it comes to inbound and outbound flows of information and products as well as services.

The business intelligence capabilities of the ERP have been changing the manner in which firms conduct their business (Chou, Bindu Tripuramallu, & Chou, 2005) The link between ERP and BMI provides the B2B marketer with extended, more accurate and immediate market information about changing market criteria (e.g. about suppliers, customers, competitors or other market information). Managers need to analyse and understand complex business situations, and business intelligence tools provide the solutions and techniques to help them (Rouhani, Ashrafi, Zare Ravasan, & Afshari, 2016). Therefore, the B2B marketer will be able to make more appropriate strategic decisions related to the variable B2B markets.

However, the technological changes in term of processes and activities for creating value (Sorescu, Frambach, Singh, Rangaswamy, & Bridges, 2011) also increase the complexity of the organization as a whole and translate into a new competitive situation (Martins et al., 2015). Therefore, although ERP could improve the perceived usefulness of the technology itself, it is also a two-sided coin, as the need to manage all this information in an appropriate manner slows down the organization. In line with this argument, Skok and Doringer (2001) suggest that technical factors and behavioural ones could influence the proper balance between a technological tool such an ERP and the organizational model. New technologies nowadays promote business changes in which many firms are engaged but it is important to evaluate the final impact on performance (Aspara et al. 2010). Thus, it is a challenge to combine not only the components of ERP and BMI (Taran et al., 2015), but also the set of linkage mechanisms between them (Chesbrough, 2010) that transform into either cost or value.

Fortunately, this innovative way to combine the components of the business model also enable generating new value (Johnson, Christensen, & Kagermann, 2008) to achieve an ideal configuration that contributes to organizational performance (Zott & Amit, 2008). Ideally, any firm should be able to leverage the organizational complexity of business models as well as the implementation of an ERP, so as to increase value and reduce costs. As stated by Morris, Schindehutte, and Allen (2005), firms often fail to capture value and make profits out of BMI. There is a broad previous literature which focuses mainly on the factors which lead to the success of ERP implementation (Acar, Tarim, Zaim, Zaim, & Delen, 2017; Hong & Kim, 2002) and the BMI process (Amit & Zott, 2012; Chesbrough, 2010) in organizations. However, even though ERP is one of the most important technological tools for an organization (Chung et al., 2008) there is almost no research about the influence of ERP on BMI.

In consequence, there is still a research gap on how organizational complexity is handled for those firms which introduce an ERP system into the organization in order to support BMI. The research objective of this study is therefore to test the role of organizational complexity between ERP and BMI. Specifically, the aim is to test the mediating role of organizational complexity between ERP (i.e. constructs of technological complexity and perceived usefulness of technology) and BMI (i.e. constructs of innovation costs and innovation revenues). Accordingly, the aim of this research is to examine the outcome of the costs and revenue associated with BMI considering the organizational complexity itself and the precursors of complexity and perceived usefulness of ERP.

We continue with the following structure. First, the theoretical framework is established through the main stream literature, including the core concepts treated in this study. Next, the hypotheses are justified, after which, the methodology is detailed through the main steps used to test the research model. We then analyse reliability and potential bias, and finally, discuss the results as well as the implications for both managers and researchers.

2. Theoretical background

In a technological market, relationships between companies have been changing, but “the relationships a firm has with its customers, its suppliers or with other actors of the business networks remain unclear” (Pagani & Pardo, 2017; p. 185). Even decades ago, it was well known that the technological core in an organization is its ERP, which provides a robust infrastructure to support the connection of external applications and integrate the information appropriately (Oliver, 1999). The importance of the infrastructure provided by ERP in supporting capabilities of all information tools and processes used by an organization (Bendoly & Schoenherr, 2005; Palaniswamy & Tyler, 2000), including the applications to interact with other buyer or seller companies is widely recognised and emphasized in previous literature. In the same way, the success of a firm's business model depends on controlling its resources and adapting them (innovating) over time to ensure its continued relevance, not only for its customers (which generate revenue), but also for its suppliers (which generate costs) (Gambardella & McGahan, 2010). However, and although in a practical B2B context it is extended the knowledge about the relationship between technology and in particular the ERP and the Business Model Innovation of a firm, no previous literature related both concepts, despite their importance for an organization. Understanding how technologically oriented a firm is and how this technology influences its business model constitutes a step before studying the current relationship between companies in B2B markets.

The following literature review reveals that business model development is a complex process and could have important precursors and outcomes for organizations that implement ERP. The study therefore contributes to filling this gap by showing how technological complexity (Thompson, Higgins, & Howell, 1991) and the perceived usefulness of technology (Davis, 1989) of ERP influence the costs (Lindgardt, Reeves, Stalk, & Deimler, 2009) and revenues of BMI (Johnson et al., 2008), through organizational complexity (Christensen & Raynor, 2003; Zott & Amit, 2007). Communication and technology have been evolving intensively, extensively and rapidly. The internet expansion in last decades has constituted an important and veritable revolution for companies. For example, in the communication field, Internet of things (IoT) has been an extended and accepted concept (Metallo, Agrifoglio, Schiavone, & Mueller, 2018), Oriwoh et al. (2013; p. 122) who define IoT as “the interconnection of objects or ‘things’ for various purposes including identification, communication, sensing, and data collection”. This new concept of infrastructure has enabled identifying, tracking, measuring or monitoring things, enabled connectivity between sensors and other newer technologies (Uckelmann, Harrison, & Michahelles, 2011) and by extension, enabled connexion between companies. The IoT can be applied to transportation and logistic or healthcare among others (Kim & Kim, 2016; Suwon & Seongcheol, 2016; Yang, Yang, & Plotnick, 2013). Firms need to be connected with other firms (e.g. customers and suppliers) in the market to improve their reciprocal communication ability, so as to enable an integration of firms' systems (e.g. ERP), which can strengthen relationships between organizations and help in making deals (Knockaert & Spithoven, 2014; Lichtenthaler & Lichtenthaler, 2009). However, and although communication between organizations is fundamental in the B2B market context, the key for a firm wishing to automatize, control and integrate the other technologies tools and advances is located in the ERP technology. Nowadays the use of ERP is almost a requirement for organizational competitiveness in both the marketplace and society, so that firms invest substantial resources in this type of software (Rajan & Baral, 2015). However, a poor ERP implementation can also lead to failure of the tools itself (Chang, Cheung, Cheng, & Yeung, 2008). In a similar manner, firms face the challenge of transforming their business models so as to improve business processes (Clausen & Rasmussen, 2013) or improve products (Cheng, Shiu, & Dawson, 2014). Accordingly, the implementation of new technologies, such as ERP systems, can offer an opportunity to experiment with new business models, but complex changes in business models also mean conflicts with traditional configurations of resources and in turn negative consequences for organizational performance (Sosna, Trevinyo-Rodríguez, & Velamuri, 2010).

In short, researchers and practitioners are seeking for a milestone in dealing with the implementation of ERP, the complexity of changes that take place in business models due to its implementation and in turn the final impact in terms of revenue and cost. Therefore, there is an obvious gap in this area that requires further study in order to provide meaningful recommendations for practitioners.

2.1. Enterprise resource planning (ERP)

The degree of technological advances has grown remarkably over the last century Prahalad (2009) in line with new technological tools (Rajan and Bara, 2015). Johnson and Bharadwaj (2005) and Román and Rodríguez (2015) examine how technology can improve performance and efficiency in organizations. Information integration through technology is studied by Nazir and Pinsonneault (2012), and Román, Rodríguez, and Jaramillo (2018) focus on how the use of mobile technology can improve salesforce performance. Davenport, Harris, and Cantrell (2004) assert that technology increases communication fluency which improves the decision-making agility of an organization. Enterprise Resource Planning (ERP) (Chung et al., 2008) is described as one of the most powerful business information technologies that enables organizational adaptation to new business opportunities (Seethamraju & Sundar, 2013).

ERP is a software that can integrate firms' information needs across different areas and functions that compound organizational complexity. Acar et al. (2017, p 704) describe ERP as follows: *"…ERP is a crucial information system/technology tool for corporations to manage… …processes by means of identifying, capturing, integrating and storing the flow of data information created by means of executing their business transactions, with both entities inside and outside of the firm. Essentially, achieving integration and coordination among departments within the firm as well with as vendors and contractors outside the firm…"*.

The value of the ERP software is unquestionable, in relation to information treatment and promoting competitive advantage (Kalling, 2003). The capability of ERP regarding the complete integration of a firm's departments and business processes, portability of or a reduction in the volume of data entry are sufficient reasons for the implementation of this kind of software in organizations (Saatcioglu, 2007). The main aim for firms in B2B markets is to achieve profitable deals with satisfactory margins, mainly with suppliers in terms of reducing procurement costs, and with customers in terms of increasing revenue. However, the opportunities offered by a satisfactory ERP implementation are not exploited successfully in more than two thirds of ERP implementation processes (Chang et al., 2008).

Substantial effort has been devoted to analysing the success of the ERP implementation in an organization (Ngai, Law, and Wat (2008). Without a satisfactory ERP implementation process, the benefits promised, such as competitive advantage and improved productivity, will not be achieved (Addo-Tenkorang & Helo, 2011). A deeper analysis of the factors that affect ERP implementation shows that these factors are not only technological, but also behavioural (Skok & Doringer, 2001). Following the same stream, Gargeya and Brady (2005) highlight the capability of ERP to work out as expected. But, system complexity and implementation can drive organizations into high costs and difficulties in implementing and maintaining this tool.

Continuous technological changes are forcing companies to adapt their business models to gain (new), or at least maintain, their competitive advantages. Traditional business models (Chandler, 1962) are evolving towards what are currently called 'triadic business models' (hereafter referred to as T-model) (Hagiu & Wright, 2015). The main idea of the T-Model is the creation of value through facilitating interactions and transactions (via a technological platform) between two or more actors or entities (e.g. customers and suppliers) (Andreassen et al., 2018; Benoit, Baker, Bolton, Gruber, & Kandampully, 2017; Gatautis, 2017). Lancastre and Lages (2006) reveal that relationships between suppliers and customers in a B2B electronic marketplace are positively influenced by information and communication exchange. Independently of the position of the firm in the market (i.e. customer, platform provider or supplier), all are benefiting from improvements in technological connections, in terms of the bargaining costs of interaction, and of interaction costs (Coase, 1937; Williamson, 1981). In particular, the supplier can easily promote its business and gain access to an extended market. Furthermore, the customer has a greater variety of elements (products or services) from which to select and has more information available. The products or services are also better tailored to firm needs, and the firm which has the platform has the core of its business in facilitating interactions and transactions of the other two components (Andreassen et al., 2018).

Nevertheless, the T-model does not replace the traditional one, but is more about an integration of both models (Andreassen et al., 2018). The T-model facilitates networks creation, flexibility, integration between companies or information sharing. Aligned with this, companies in the network have more opportunities to create value (value co-creation) (Brodie et al., 2006). Nowadays, companies do not just consider value creation oriented towards their customers, but also try to capitalize on the knowledge of their collaborators and employees (De Silva, Howells, & Meyer, 2018). The organizational capability outside of its own boundaries to explore, capture, integrate and exploit information is essential to being competent in value creation (Knockaert & Spithoven, 2014; Lichtenthaler & Lichtenthaler, 2009). In this line of research, most authors agree about the positive relationship between supplier and customer communication in B2B contexts and value creation. Studies such as Wang, Pauleen, and Zhang (2016), confirm that Social Media Apps (SMA) are also useful as communication media in a B2B context. However, Salomonson, Åberg, and Allwood (2012) draw attention to and describe three elements (attentiveness, perceptiveness and responsiveness) as part of this communication, as a means of creating value. The conclusion is that not all the communication elements can nowadays be stimulated automatically. Furthermore, "The degree of transition from traditional business models to T-models will likely depend on the digitalization of the industry, on customers and on the company" (Andreassen et al., 2018; p. 899). The network is compounded by companies which must be supported by their technological systems (mainly ERP software solutions) and business models, in order to achieve the advantages that technology offers in terms of creating value. The network must understand the relationship between the core of technology for the companies (ERP) and the potential innovation through their business models (BMI)."

This study highlights the value of two of these factors for a satisfactory ERP implementation, namely '*technological complexity*' and '*perceived usefulness of technology*'. These factors have been selected following Skok and Doringer (2001) in the sense that technological complexity can be considered more related to technical factors and the perceived usefulness of technology rather than to behavioural ones. This study details and justify the relevance of both factors in paragraphs below.

2.1.1. Technological complexity

Complexity is a reality which firms must deal with daily. Technological complexity has been studied for roughly half a century. Rogers and Shoemaker (1971; p. 154) define it as: "*…the degree to which an innovation is perceived as relatively difficult to understand and use…*". Technology systems for organizations in general and ERP systems in particular are usually perceived as highly complex (Xue, Liang, Boulton, & Snyder, 2005). More recently, Aiman-Smith and Green (2002; p. 423) define technological complexity as: *"…the extent to which a new technology is more complicated for its user than the previous technology used for the same or similar work and represents an increase in the number of things the user must do at once…"*. In this sense, Yi and Davis (2003) point out that the complex nature of a ERP system limits the knowledge that users can learn before daily use of the tool. More complexity leads to more stress for users (Sokol, 1994). Therefore, user attitudes towards the use of ERP could be affected negatively by complexity (Chang et al., 2008).

2.1.2. Perceived usefulness of technology

The process of implementing technology into an organization is troublesome and familiar from previous studies. The underlying research model examines the potential influence of perceived usefulness of ERP on organizational complexity. To effectively analyse the above mentioned influence, it is necessary to deal with the real use of the ERP by the employees and what affect its use. An important stream of research related behavioural factors with the ultimate use of technology tools. In particular, one of the original related model was the Technology Acceptance Model (TAM) of Davis (1989) that is widely acknowledged (Ahearne, Bhattacharya, & Gruen, 2005; Jelinek, Ahearne, Mathieu, & Schillewaert, 2006*)*. This model explains that behavioural intentions to use a technology are determined in part by the perceived usefulness of the technology (Venkatesh & Davis, 2000). To understand the TAM model one needs to know that it is based on two theories focusing on behavioural intentions, such as the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980) and the Theory of Planned Behaviour (Ajzen, 1991). Davis (1989; p. 320) define the perceived usefulness of technology as: *"…the degree to which a person believes that using a particular system would enhance his or her job performance…"*. Previous studies find that the perceived usefulness of technology is positively related to the usage of technology (Fusilier & Durlabhji, 2005; Thompson et al., 1991).

2.2. Business model innovation (BMI)

In recent years, particular attention has been paid to the taxonomy or definition of the concept of a business model (Morris et al., 2005; Osterwalder & Pigneur, 2010), questioning what is and what is not a business model (DaSilva & Trkman, 2014). Business models are frequently described as structural templates of how firms develop their business (Amit & Zott, 2001), connect the different systems and activities (Amit & Zott, 2012) and configure the logic of the organization as a whole (Teece, 2010). Sorescu et al. (2011; p. S4) offer an integrative definition of business models: "*…a well-specified system of interdependent structures, activities, and processes that serves as a firm's organizing logic for value creation (for its customers) and value appropriation (for itself and its partners)*".

BMI can manifest itself in a change of a single or multiple components of the business model or the mechanism linking them (Foss & Saebi, 2017). Similarly, the topic of BMI has received considerable attention in several fields such as entrepreneurship (Trimi & Berbegal-Mirabent, 2012), innovation (Sorescu et al., 2011), strategic management (Mezger, 2014) and information systems (Schneider & Spieth, 2013).

An important effort has been dedicated lately to properly defining the multiple dimensions of BMI (Spieth, Schneckenberg, & Ricart, 2014), instead of using a single indicator (Bock, Opsahl, George, & Gann, 2012). This has helped researchers to conduct more sophisticated empirical studies in a comprehensive manner (Wirtz, Pistoia, Ullrich, & Göttel, 2016).

Among all these contributions, one stream has focused on how to describe the business model (DaSilva & Trkman, 2014) and what an innovation of such business models entails (Taran et al., 2015). BMI might be pursued for a variety of reasons (Leiponen & Helfat, 2010) requiring the firm to reformulate and redefine its resources and capabilities (Mezger, 2014) in order to achieve goals or objectives (Damanpour, 2010). In this process, it is crucial for any organization to define how value is to be captured and transformed into increased revenue and or cost reduction (Baden-Fuller & Haefliger, 2013).

This study highlights three main elements of BMI, namely '*organizational complexity*', '*revenue of innovation*' and '*cost of innovation*'. These factors have been selected following Clauss (2017) in the sense that researchers and practitioners struggle to find ways of evaluating the impact of BMI in terms of value creation, value proposition and value capture. This study details and justifies the relevance of both factors in ensuing paragraphs.

2.2.1. Organizational complexity

The organizational complexity of change is often mentioned as a new avenue for combining an organization's resources to achieve such innovation within the logic of an organization (Foss & Saebi, 2017). Thus, firms experiment with their business model to find the most appropriate configuration for launching their products and services in the market and to society (Chesbrough, 2010). This experimentation also requires a new combination of activities and resources inside the organization (Cortimiglia et al., 2016).

These changes also bring about new ways to distribute components within the firms, which Henderson and Clark (1990) describe as a level of complexity caused by the fact that each component is connected to another in the organization. Therefore, the more unknown these changes, the more complex the transformation of the business model (Krishnan & Ulrich, 2001). Although the organizational complexity domain that reflects BMI is more or less accepted by researchers and practitioners, there is a need for further research on the precursors and outcomes of these changes.

2.2.2. Revenue of innovation

Value creation describes how a firm uses its resources and capabilities to create value (Achtenhagen, Melin, & Naldi, 2013). Thus, a firm might transform its business model for a variety of reasons (Guan, Yam, Tang, & Lau, 2009). Clauss (2017) contributes on how firms can create value in terms of revenue of innovation. Thus, the organization can add new revenue sources by defining new pricing mechanisms with cross-selling initiatives (Clauß, Laudien, & Daxböck, 2014) in order to be more profitable in the market (Baden-Fuller & Haefliger, 2013). As described by Clauss (2017), new revenue opportunities are defined in terms of new ways to be profitable (additional sales, cross-selling) or by obtaining long-term financial returns with a new pricing mechanism (e.g. maintenance contracts).

2.2.3. Cost of innovation

Similarly, the costs of innovation can also create value with a new cost structure. A change in the cost structure of a firm's business model also needs to be aligned with the market strategy (Zott & Amit, 2008) and could be either directly or indirectly associated with the way business is running (Johnson et al., 2008). Clauss (2017) explains that new cost structures can enable firms to seek opportunities in both variable and fixed manufacturing costs. For example, Leiponen and Helfat (2010) explain that if the firm looks for a process innovation, manufacturing flexibility is necessary.

In a similar manner, if the firm wants to reduce the delivery leadtime to be more competitive in terms of organizational, cost business processes must then be aligned (Damanpour, 2010). Therefore, if the firm's offering is to be effective in terms of product/services for the customer (Ghezzi, Cavallaro, Rangone, & Balocco, 2015) it must analyse how to rethink costs (Johnson et al., 2008).

3. Hypotheses and research model

This study focuses on the influence of the selection of ERP constructs (i.e. technological complexity and perceived usefulness of technology) on organizational complexity and in turn on a selection of BMI constructs (i.e. costs and revenues of innovation) in organizations.

Mason and Spring (2011) state that technology management in firms is one of the fundamental pillars for explaining BMI. However, information technology is a broad field of research and to the best of our knowledge, no previous study has focused on the relationship between the implementation of ERP and the results of BMI. Furthermore, we are not aware of any study that examines the mediating role of organizational complexity between ERP and BMI. Thompson et al. (1991) assert that each technological tool had itself a degree of inherent complexity. Previous studies generally explore how technological complexity creates various barriers between users and their job performance. For example, Aiman-Smith and Green (2002) argue that technological complexity increases the time needed and number of other things that a user needs to run a task. Regarding users' mental state, technological complexity also increases the stress on individuals (Sokol, 1994). Thus, technological complexity may in fact reduce the potential for enhancing job performance.

According to Davis (1989), the perceived usefulness of technology is the degree to which users believe that a tool could improve their job performance. Therefore, it is reasonable to assume that higher technological complexity leads a lower perceived usefulness of technology. In this sense, Chang et al. (2008) assert that technological complexity can affect user attitudes technology. More recently, Rajan and Baral (2015) support this argument, providing evidence that technological complexity has a significant negative effect on the perceived usefulness of ERP systems. Thus, following the findings reported in previous studies we formulate our first hypothesis as follows:

H1. Technological complexity relates negatively to the perceived usefulness of technology.

On the one hand, technological complexity may lead to difficulties in implementing and using the technology. Technological complexity decreases the relative level of knowledge that a user can gain before regular usage of the technological tool (Yi & Davis, 2003). Technological complexity obliges to users to spend more time and do more things to perform their regular tasks (Aiman-Smith & Green, 2002). Leonard-Barton (1990) state that excessive technological complexity reduces user ability to perform competently. Sokol (1994) relates technological complexity with an increase in stress devolving on users of the system.

On the other hand, organizational complexity may lead to more opportunities for an organization, and in several ways. For example, Barney (1995) and Hart and Banbury (1994) state that an organization with various different goals keeps its options open and this may lead to confusion on decisions as to which goal to pursue. Miller (1992) supports the notion that an organization can use multiple strategies and not necessarily decrease overall organizational performance. Galbraith (1973) state that organizations can manage more information when they have more flexibility in their rules and are more decentralised. Accordingly, Ashmos et al. (2000; p. 578) assert that: "…*when organizations recognize themselves as the complex adaptive systems they are, and arrange themselves in complexity-absorbing ways, successful performance is more likely*…". Consequently, previous studies point out that *technological* complexity affects employees negatively, while *organizational* complexity is considered as a promoter of business, founded on interlinked components within a business model (Sorescu et al., 2011). Therefore, our second hypothesis is formulated as follows:

H2. Technological complexity relates negatively to organizational complexity.

Buonanno et al. (2005) assert that it seems that firms are ignoring ERP in order to deal with the organizational complexity. The reality is that ERP is a technological tool that has the capability to organize, share and manage large volumes of information in an organization (Acar et al., 2017). ERP is a software that can connect the entire organization (Nazir & Pinsonneault, 2012). In this sense, a satisfactory implementation of ERP can help firms to deal with its organizational complexity. However, the ERP implementation process is not without challenges and therefore the failure rate is high (Saeed et al., 2017). In fact, there are also behavioural factors that lead to the failure of ERP implementations (Skok & Doringer, 2001).

Personal beliefs determine behavioural intentions to use a technological tool. One of the most important personal beliefs is the perceived usefulness of technology. Venkatesh and Davis, (2000) detail how individual behavioural intentions determine the ultimate usage of the technology. Thus, this study posits that a higher perceived usefulness of technology will lead the usage of the ERP system and this will help to manage organizational complexity. Consequently, our third hypothesis is formulated as follows:

H3. The perceived usefulness of technology relates positively to organizational complexity.

Firms may look for new solutions resulting from changes in the business logic in order to simplify operations or create easier access to resources (Johnson et al., 2008). Pires, Sarkar, and Carvalho (2008) state that changes in the business model are the outcomes of continuous improvements. Firms often change their business model in response to changes in the marketplace and society (Bohnsack, Pinkse, & Kolk, 2014). Thus, competitive pressure (Johnson et al., 2008) forces firms to rethink their cost structures to maintain and improve their competitiveness and market share. It may be even more relevant for firms involved in complex technological changes, because, through these changes new ways to be more effective in terms of costs may arise.

Business models have also proven to be important in analysing the influence of the supply chain on the innovation process (Zimmermann, D.F. Ferreira, & Carrizo Moreira, 2016), so as to be more competitive through the cost structure of the organization. For example, Doloreux, Shearmur, and Guillaume (2015) find in the wine industry that adequate changes in collaboration with suppliers and consultants can help firms to obtain an optimal configuration and reinforce their market share. However, Halecker, Bickmann, and Hölzle (2014) also find that changes in business models are not always beneficial and could have negative effects on performance (Halecker et al., 2014). To shed light on this aspect, we formulate the following hypothesis:

H4. Organizational complexity relates positively to the costs of innovation.

There is evidence that innovations in digital technologies contribute to a sustainable competitive advantage in the market. In general, it is assumed that new business models play an important role in helping firms achieve competitive advantages (Amit & Zott, 2012) which in turn improves financial performance (Aziz & Mahmood, 2011). Prior research finds that introducing new pricing methods is especially significant for start-ups that innovate their business models (Schneckenberg, Velamuri, Comberg, & Spieth, 2017). Thus, business models which are correctly oriented to meet customer expectations raise revenue (Baden-Fuller & Haefliger, 2013).

Although previous studies in the field of BMI demonstrate the positive effects that business models may have on firms' financial performance (Zott & Amit, 2008), other researchers find inconclusive evidence of this relationships (Patzelt, Zu Knyphausen-Aufseß, & Nikol, 2008). Sosna et al. (2010) argue that external forces could make existing business models obsolete and compel firms to look for new ways to generate revenue. Based on this argument, we formulate the following hypothesis:

H5. Organizational complexity relates positively to revenue of innovation.

Firms need to face changes in the marketplace and society, all of which may force them to reduce their cost structures (Johnson et al., 2008). An organization can reduce its cost not only by reducing fixed or variable economic costs (Clauss, 2017), but also by reducing the use of resources (i.e. time and human) dedicated to essential tasks of the firm.

Teece (2010) contends that a business model is a description of how an organization acquires economic value through its resources and capabilities. An organization must continuously evaluate its objectives to raise efficiency (Leiponen & Helfat, 2010) and achieve its goals, so as

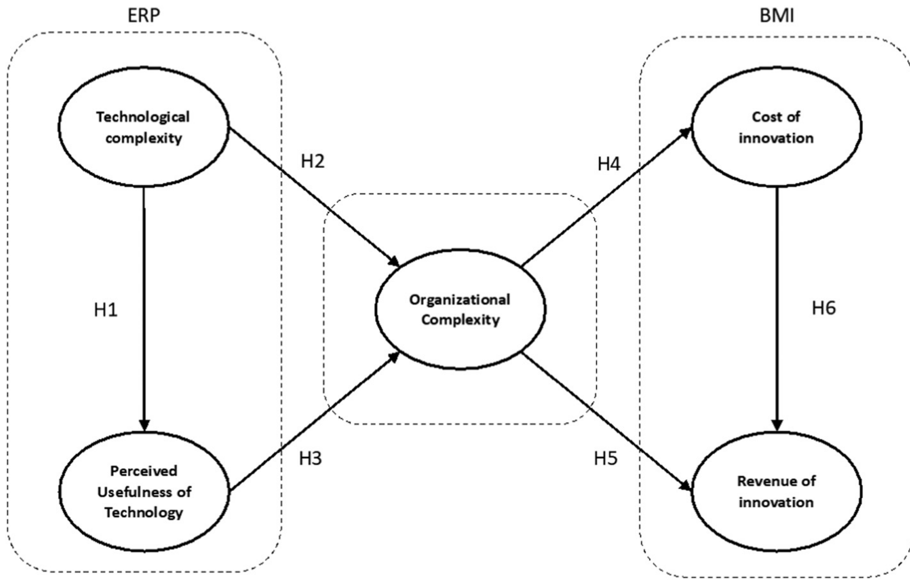

Fig. 1. Research model.

to survive and grow (Guan et al., 2009). In this sense, if the organization can change its cost structure by doing things more efficiently, the resources assigned to older tasks would be free to run new profitable tasks for the organization, thus increasing financial revenue. Aligned with this argument, we formulate our final hypothesis as follows:

H6. Cost of innovation relates positively to revenue of innovation.

The hypothesized relationships are shown in Fig. 1.

4. Methodology

4.1. Data collection and sample

This study comprises quantitative research on firms that have implemented an ERP and have been dealing with BMI. Potential contextual bias is avoided by focusing on one technological tool commonly labelled ERP (Hartline & Jones, 1996). One main reason to select the ERP instead any other technological tool is that it is software solution which covers the entire organization and helps firms to run their activities appropriately (Uwizeyemungu & Raymond, 2012). Therefore, the selection of one ERP system, permits controlling the research design and avoiding product-related bias, which may threaten the validity of the results. A cross-industry sample of organizations (in contrast to just one industry) with experience in the implementation of an ERP system, was adopted.

The methodological approach is based on a mixed method offering the chance to use several perspectives to verify the results (Teddlie & Tashakkori, 2009). Silverman (2010) points out that this methodology allows for data triangulation. The mixed method enabled the research team to compare different perspectives along the various phases of this study. Thus, the use of this methodology improved the comprehension of how factors (technological complexity and perceived usefulness of technology) that affect the ERP implementation, influences organizational complexity and ultimately the outcome of BMI (i.e. cost and revenue).

The data collection is divided into three inter-connected phases, namely, pre-study, main study and follow-up study.

4.1.1. Pre-Study

We initiated this study with a series of semi-structured and in-depth interviews with four firms. The Chief Executive Officer (CEO) and the Information Technology Manager (ITM) were selected for the interviews. The main reasons to target them were: i) the CEO is the final decision-maker on the BMI and the ERP software solution; ii) the ITM is in charge of the ERP software (implementation, training and maintenance), possess detailed information and offers technical support to the entire organization. Importantly, the selected firms in the pre-study allowed the research team full and unhindered access to corporate artefacts and current business observations with the purpose of developing a research model that matches the studied firms in a practical manner.

The research team requested the respondents of the studied firms to answer honestly and to highlight the most important issues confronting their organizations, related to the complexity of their business, the ERP implementation process, changes as well as innovations in their business models and data about the costs and revenues of their firms. The research team promised that all information gathered and observations made would be strictly confidential.

The research team took notes during each interview, and some were recorded with the aim of resuming and comparing with the information collected later on. For example, as reported in the results section, CEO2 asserts that: "… *although at the beginning dealing with complex innovation could be hard, but once it is implemented, it could offer a competitive advantage because it could be difficult imitating it* …" The main purpose of this phase was to create robust pillars for the study (Dubois & Gadde, 2014).

4.1.2. Main-Study

The firms selected to participate in the survey have one common denominator, namely an implemented ERP system. After the pre-study, the outcome of BMI, the organizational complexity and the ERP implementation process, were the main subject areas considered in the questionnaire. The research team sent an email to selected managers. Respondents were requested to open a hyperlink in order to access and fill in the online survey.

The email instructions also stated clearly that the survey results were solely for research purposes and ensured the anonymity of each participant (Cascio, Mariadoss, & Mouri, 2010). The total number questionnaires returned was 132, of which 28 were deleted due to the respondents indicating that the firms did not use the ERP tool. Therefore, the final sample consists of 104 completed questionnaires.

4.1.3. Follow-up study

The data obtained from the online survey were contrasted with a series of in-depth interviews in a follow-up study with three firms (i.e. three CEOs and three ITMs), not included in the initial sample of the pre-study (i.e. four CEOs and four ITMs), with the aim of validating the information obtained. Subsequently, current business observations, corporate artefacts and in-depth interviews validated the results collected from the main study.

4.1.4. Respondent characteristics

Subsequently, the research team interviewed the CEOs and the ITMs of four firms in the pre-study. The age range of the CEOs is between 45 and 60 years, and all of them were men. The CEOs offered a comprehensive view of the organization and let the research team access important corporate artefacts, and the observation of the internal organizational flows.

Information obtained from ITMs was also relevant and valuable, due to the highly technological era in which the studied firms have been competing in the marketplace and within society itself. The ITMs interviewed were not only in charge of the ERP implementation process, but also have access to the entire information bank of the organization. The ITMs were all men, their age ranged between 40 and 50 years. The number of meetings with each executive was not predetermined (Liu, Chen, & Ralescu, 2015), but the research team continued arranging meetings until it had obtained the information required for this study. The duration of each interview, both the formal and informal ones, was one hour on average. Each interview had a standardized structure based on open-ended questions, with the aim of obtaining relevant and sufficiently detailed information from the interviewees.

4.2. Measures

This study used scales previously applied in previous studies. The participants were asked to indicate their degree of agreement on a seven-point scale from 1 (I totally disagree with this statement) to 7 (I totally agree with this statement). The items used in the research model are shown in Table 1.

The construct of technological complexity was modified from Thompson et al. (1991), and that of perceived usefulness of technology from Davis (1989). We used several sources with regard to the constructs of BMI (i.e. organizational complexity, and the costs and revenues associated withi innovation. To measure organizational complexity, we modified items from Christensen and Raynor (2003) and Zott and Amit (2007). On the other hand, the items related to the costs of innovation were modified from Johnson et al. (2008). Finally, the items related to the revenue derived from innovation were modified from Lindgardt et al. (2009). All construct measures were pre-tested and validated through several in-depth interviews with relevant managers.

Three firms that were not included in the initial sample agreed to share their internal information with the research team. The research team had access to a large number of internal reports and documents, such as ERP offers from the suppliers, technical and operational manuscripts, financial reports and sales offers from the firms.

The research team studied not only the corporate artefacts, but also undertook direct observations with the aim of going beyond the documents and assessing the fit between the respondents selected and the questionnaire (Yin, 2009). Accordingly, these firms allow a member of the research team to observe the usual business activities of the organizations. "This was a valuable source of information planning for this study and creating the research model. The main focus of this part of the study was to observe how the firms act, by ourselves keeping a passive role. The research team attended diverse types of internal meetings (e.g. brown-bag meetings, stakeholder meetings, 360-review meetings, kick-off meetings, stand-up meetings and board meetings) inside the observed firms. These live sessions helped the research team to make the appropriate link between theoretical propositions in the pre-planning of this study and practical issues raised in firm meetings." In this sense, the research team attended internal meetings in the organization and visited it whenever this was deemed relevant and necessary (Zikmund, Babin, Carr, & Griffin, 2012).

The results were validated using this information. Bias in the interpretation of results could be minimized thanks to this follow-up phase of the main study. The follow-up consisted of interviews with three additional organizations.

The methodology of the follow-up study was the same as in the prestudy. Subsequently, the CEOs and the ITMs of these firms were also interviewed. These firms were selected according to their relevance to this study in the same way as the four initial ones in the pre-study. The aim of these meetings was to validate the results of the survey for the main study.

We are aware that the main study (i.e. the online survey) could suffer from common method bias. Therefore, we followed several recommendations from the literature to test for the existence of bias. As a first step, we used the Harman one-factor test and the confirmatory method suggested by (Podsakoff & Organ, 1986). As a second step, we

Table 1
Questionnaire items and their sources.

Enterprise Resource Planning	
Construct (Source)	Item
Technological Complexity (Thompson et al., 1991; p.132)	Using the ERP system in my job:
1)	… is difficult to understand what is going on
2)	… involves much time doing mechanical operations
3)	…takes too long to learn how to use it
Perceived Usefulness of Technology (Davis, 1989; p.324)	Using the ERP system in my job
1)	…increases my productivity
2)	…enhances my effectiveness
3)	…is very useful
Business Model Innovation	
Organizational Complexity (Zott & Amit, 2007;p. 196)	During the last year, your organization has made changes in its business model that:
1)	…have not been implemented before by competitors.
2)	…transform the way to interact with clients.
3)	…modify the way to organize the relationships with clients.
Cost of innovation (Lindgart et al. 2009; p.2)	During the last year, your organization has made changes in its business model to:
1)	…introduced new ways to reduce fixed costs
2)	…introduced new ways to reduce variable costs
Revenue of innovation (Johnson et al., 2008; p-67)	During the last year, your organization has made changes in its business model that:
1)	…introduced new ways to be profitable
2)	…introduced new pricing mechanisms

Table 2
Confirmatory factor analysis.

	Loading	SCR	AVE
Technological complexity			
1)	0.76 (7.23)	0.73	0.50
2)	0.54 (5.16)		
3)	0.76 (7.28)		
Perceived usefulness of technology			
1)	0.90 (11.61)	0.94	0.84
2)	0.58 (13.22)		
3)	0.88 (11.13)		
Organizational complexity			
1)	0.57 (6.04)	0.84	0.65
2)	0.94 (11.42)		
3)	0.86 (10.18)		
Cost of innovation			
1)	0.87 (9.43)	0.90	0.81
2)	0.94 (10.21)		
Revenue of innovation			
1)	0.56 (5.08)	0.70	0.50
2)	0.72 (6.13)		
Overall adjustment	$\chi 2$ (55) = 83.76 CFI = 0.95 NNFI = 0.93 RMSEA = 0.07		

T-value in brackets.

used a more sophisticated test such as the common latent factor from (Podsakoff, MacKenzie, Podsakoff, & Lee, 2003). None of these tests revealed that the main study suffered from any common method bias.

4.3. Reliability and discriminant validity

Once the several types of potential bias had been assessed and clarified, we conducted a confirmatory factor analysis of the multi-item measures. Since we used multi-item measures, we evaluated the psychometric properties of the multi-item measures according to the recommendations in the literature. Convergent validity was confirmed, as all items were significant and with t-values above the recommended cut-off points. The scales deal with reliability (Bagozzi & Yi, 1988), and average variance extracted (Fornell & Larcker, 1981) was also included (see Table 2) and exceeded the recommend values of −60 and 0.50 respectively.

There is also some debate about a more rigorous test to analyse discriminant validity among multi-item measures. Although the traditional techniques of the square root of Ave with correlations (Fornell & Larcker, 1981) and confidence intervals (Anderson & Gerbing, 1988) are still recommended in most studies, there are more advanced tools that can evaluate the potential problems associated with the measures. Henseler, Ringle, and Sarstedt (2015) and Voorhees, Brady, Calantone, and Ramirez (2016) conducted an in-depth analysis of the different techniques used to evaluate discriminant validity. Their conclusions suggest that the hetero trait-monotrait (HTMT) test is a particularly useful analysis. Accordingly, we obtained results that complied with the recommendations, as all the ratios were below the cut-off point of 0.90 recommended in the literature.

Based on this evidence, we can confirm that the multi-item measures used in this study do not suffer from convergent or discriminant validity problems. A summary of reliability of all the multi-item measures is reported in Table 3.

5. Results and discussion of results

5.1. Pre-study

The pre-study helped to frame the research model of this study shown in Fig. 1. In this sense, all interviewed firms agreed regarding the complexity of its organization. All also considered that it is necessary to treat organizational complexity with the appropriate tools. They praised the ERP software for its to provide the top staff with the key information required to face the challenges encountered in the marketplace and society.

In this sense, the CEO of Firm 1 stated that: *"…we are not a common organization, our main activity is related to a few really big projects… …the main challenge and complexity is trying to maintain the balance between resource costs and income..."* The ITM of Firm 1 also commented that: *"… we need a complete system that can automatize all information flows of the organization and provides the necessary reports…however, our users do not use the system 100%... …one reason according to the users is the effort required to learn and use it …".*

By extension, the ITM of Firm 3 commented that: *"…in our case, the main issue is that the ERP is really complete, but it doesn't really fit with the flows and activities of organization…". Similarly, the* CEO of Firm 4 stated that: *"… too many changes in the market have led to an unavoidable period of internal reorganization, which includes changes in the ERP system… … before thinking about how to innovate, I have to know the position for us…".* In conclusion, the pre-study revealed a series of issues, such as a number of challenges and complexity issues that either limit firms' innovative ability or in fact provide innovative opportunities.

5.2. Main study

After checking for the measurement model adjustment and establishing the reliability of the multi-item measures, we estimated a structural model with the hypothesized paths from our theoretical model. We included two control variables in our tests: a) number of employees, b) sales volume. Fig. 2 shows that the overall adjustment indexes were within the recommended levels. The overall adjustment fit demonstrates adequate levels in each of the indicators considered (2(69) = 101.925 CFI = 0.95 NNFI = 0.94 RMSEA = 0.06). The results thus confirmed all the hypotheses except H3, which was not significant.

5.2.1. Alternative models

We acknowledge that our model should be tested with rival models, as suggested by Anderson and Gerbing (1988). In our case, we tested several alternative models regarding interaction effects, non-linear effects and partial/full mediation tests.

An interaction effect could arise with a rising number of product lines inside the organization. Thus, a large number of product lines will make it more difficult to handle the technological complexity that ERP introduces and in turn will increase the negative impact on organizational complexity (Ngai et al., 2008). Similarly, a large number of product lines will also have a negative impact on the relationship between organizational complexity and cost innovation. Consequently, the firm will have to deal with the complexity of the organization, as well as the difficulty of managing several product lines, which in turn will decrease the impact on the cost of innovation. For example, if the firm follows an approach of bundling the products, the complexity that the bundle implies should be evaluated so as not to affect the performance outcome of the organization (Simonin & Ruth, 1995). The interaction effects were modelled using Ping Jr.'s (1995) approach. This approach is conducted in several steps. First the raw scores must be centered. This procedure also simplifies many of the mathematical relations between variables and solves the effects of several of the constraints that the SEM model imposes. In summary, this procedure helps the researchers to introduce the latent construct of the interaction effect into the model. Accordingly, the Ping approach was used to estimate the aforementioned interactions. Surprisingly, the significance level of the interaction terms did not confirm such interactions.

Non-linear effects could also be possible. Specifically, the relationships between organizational complexity and cost of innovation as well as the relationship between organizational complexity and revenue of innovation. Some authors such as Maidique and Zirger (1984) or Goldenberg, Lehmann, and Mazursky (2001) have suggested that this complexity might not be strictly linear. Instead, when the level of

Table 3
Discriminant validity (AVE-Correlations and HTMT).

AVE Correlation Comparison	SCR	AVE	1	2	3	4	5
1. Technological Complexity	0.73	0.50	0.71				
2. Perceived Usefulness of Technology	0.94	0.84	−0.31***	0.91			
3. Organizational Complexity	0.84	0.65	0.30***	0.21**	0.81		
4. Cost of innovation	0.90	0.81	0.04	0.07	0.25***	0.90	
5. Revenue of innovation	0.70	0.50	−0.10	0.05	0.51***	0.64***	0.71

HTMT Test	1	2	3	4	5
1. Technological Complexity					
2. Perceived Usefulness of Technology	0.62				
3. Organizational Complexity	0.03	0.26			
4. Cost of innovation	0.17	0.12	0.28		
5. Revenue of innovation	0.11	0.17	0.72	0.63	

SCR = Scale compose reliability, AVE = Average Variance Extracted.
Elements in the main diagonal are the square root of the AVE.
*** $p < .01$.
** $p < 0.05$

complexity increases the cost of innovation will decrease. A similar argument is also pointed out by Lukas and Menon (2004). Thus, high level of organizational complexity might lead to slower speed to market and quality cost outcomes. In contrast, other authors such as Kleinschmidt and Cooper (1991) or Steenkamp and Gielens (2003) suggest a different type of non-linear effect. In this case, when the level of complexity increases the revenue of innovation will increase at a higher rate. Based on these arguments, we have included a square term in our model. Interestingly, the relationship between organizational complexity and cost of innovation was confirmed. That is, if organizational complexity increases too much, the positive impact on cost of innovation will be reduced. In contrast, the relationship between organizational complexity and revenue of innovation was not confirmed. Fig. 3 summarize our findings of non-linear effects.

In our case, we proposed a full mediation role of organizational complexity between ERP and BMI. There is evidence of a possible direct impact of technological complexity and perceived usefulness of technology on the two main outcomes of cost of innovation and revenue of innovation. For example, Johnson and Bharadwaj (2005) and Román and Rodríguez (2015) examine how technology can improve the performance and efficiency of organizations. Following the recommendations of Baron and Kenny (1986), this type of mediating role must be tested. Iacobucci, Saldanha, and Deng (2007) provides evidence on how structural equation modelling performs better than regression in this kind of test. Following their recommendations, we check the results which indeed confirmed the full mediating role of organizational complexity.

Once this mediation effect was confirmed, we checked the indirect and total effects of the main concepts in our research. The results obtained offered insightful results on these relationships. Thus, technological complexity of ERP has an indirect effect of −0.07 (1.70) on costs of innovation, as well as an indirect effect on revenue of innovation −0.16 (2.11). In a similar manner, organizational complexity also had an indirect effect in revenue of innovation 0.13 (1.88). In addition, we also calculated the aggregated total effect in the relationships of the research model, confirming the total effect in the

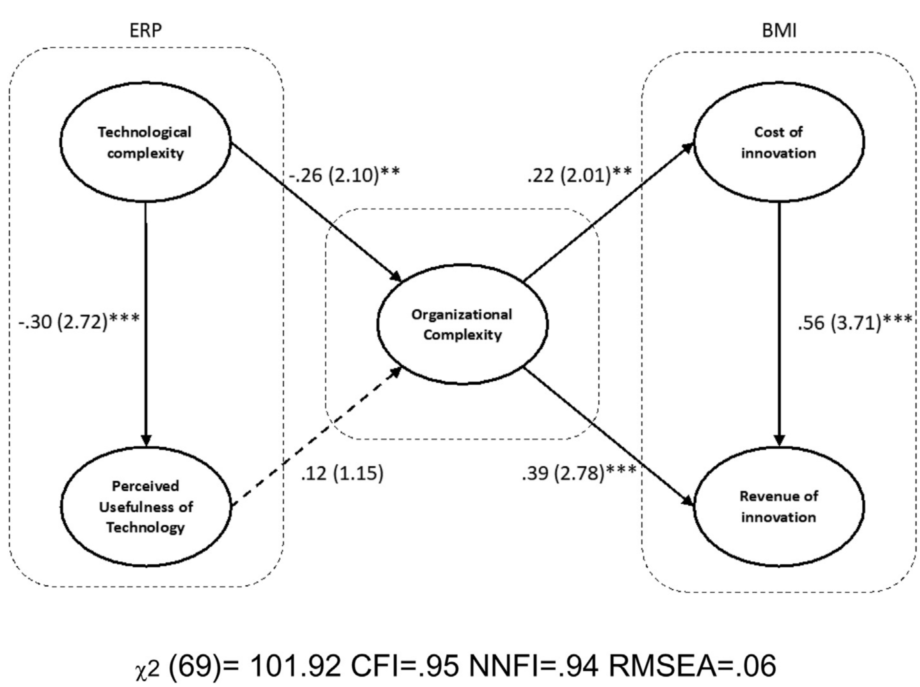

Fig. 2. Results of structural model.

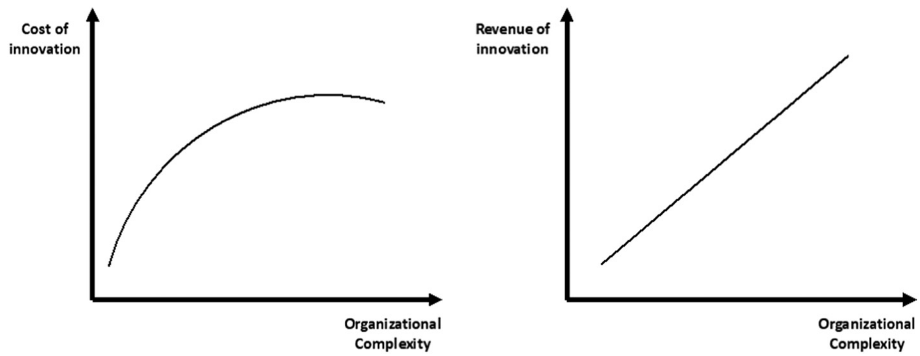

Fig. 3. Non-linear relationship between organizational complexity and cost of innovation/revenue of innovation.

Table 4
Indirect and total effects of relationships.

	Direct	Indirect	Total
Technological Complexity → Organizational Complexity	−0.26 (2.06)**	n.a.	−0.30(2.44)
Technological Complexity → Cost of innovation	n.a.	−0.07(1.70)*	−0.07 (1.70)*
Technological Complexity → Revenue of innovation	n.a.	−0.16 (2.11)**	−0.16(2.11)**
Organizational Complexity → Cost of innovation		n.a.	0.24 (2.11)**
Organizational Complexity → Revenue of innovation		0.13(1.88)*	0.52 (3.12)***

Levels of significance: ***p < .01 ** < .05 * < .10

suggested paths.

A detailed analysis of the indirect and overall results can be found in Table 4.

5.3. Follow-up study

The follow-up study confirms the previously reported results from the pre-study and the main study in relation to the research model. The correct treatment of organizational complexity can aid firms' cost reduction, raise their revenue, or both. For example, the CEO of Firm 1 commented that: *"… it is clear that when you have a basic or simple business model, each part of it is necessary… …you cannot reduce anything, so you cannot reduce cost… …in other words, you have less opportunities to combine elements to create something new…"*. The CEO of Firm 3 commented that: *"...the problem is not the complexity per se… evidently, it offers challenges and also opportunities… …the problem is if you fail to bring out the best from this complexity…"*.

ERP can help to treat organizational complexity appropriately through the correct use of available information. However, if the effort that the use of ERP requires is not handled correctly and any problems overcome by users, and the ERP use is not seen as useful, then the ERP will not be able to benefit from its capabilities and will be far from helping to solve the complexity in a satisfactory manner. Furthermore, ERP could even add negative complexity into the organization that is not converted into opportunities for the firm.

In the next sections, we provide research as well as managerial implications based on the results reported.

6. Academic implications

This study has several academic implications. In extension to the theoretical framework reported previously and the justification of the hypotheses, the results from the pre-study provided the research team with a foundation for deciding on the relevance and importance of the possible variables to use and how they were related to each other, so as to develop the research model displayed in Fig. 1. For example, the pre-study revealed that it is indeed important to distinguish between the complexity of ERP in a technological sense and the organizational complexity as an interface between ERP and BMI, because they could act in opposite directions to the firms' goals. It was also revealed that there is not only one way of reducing costs to increase revenue and that firms can also increase revenue which leads in turn to cost reduction.

The results reported, based on the research model, indicate that the construct of organizational complexity fully mediates the effect between ERP-related constructs (i.e. precursors) and BMI related ones (i.e. outcomes). Consequently, the precursors of technological complexity and perceived usefulness of technology interact through organizational complexity through the costs and revenues of innovation.

Furthermore, technological complexity relates negatively to the perceived usefulness of technology, and the costs of innovation relate positively to the revenues of innovation. However, the core construct in this study, connecting ERP with BMI is organizational complexity, which offers insights into how to manage a selection of precursors in the ERP implementation process, with a selection of outcomes in the BMI.

The results reported yield several specific academic implications based on the results and the discussion thereof. One is that other precursors than technological complexity and perceived usefulness of technology need to be tested in future research. We only tested two of the most important precursors in the research model, which therefore offers multiple opportunities for further studies. Another academic implication is to test other outcomes than costs and revenues of innovation, such as partner and network values (Velu, 2015), although cost and revenue provide a solid foundation for assessing the gross-profit margin in ERP and BMI settings.

The follow-up study confirms the results of the main study about the need to reduce ERP complexity and to increase the perceived usefulness by users. The follow-up study also confirms that firms consider organizational complexity as something positive, that offers opportunities to reduce fixed and variable costs, increasing revenue mainly through the value of correct information management or combing both. All depend on how complexity is faced and dealt with by the firm.

7. Managerial implications

The reported results also yield various managerial implications. For example, there is a need for firms to find a way to reduce the technological complexity of ERP in the implementation process, such as hiring a good supplier with experience in ERP implementation and who is able to create a ERP project-implementation team in the organization. Accordingly, the results reported highlight the need to find out how to reduce the technological complexity of ERP for users (e.g. training of final users, adapting the ERP interface to user job, explaining the flows and connections with other areas). The idea is that the complexity is relative, as users may consider the ERP system less complex when it is clearly understood what the ERP tool is supposed to solve.

It is therefore crucial to increment and reinforce the perceived usefulness of ERP technology through describing the advantages for the users´ work situation, marketing strategies (e.g. sales arguments), objective results (e.g. comparisons with competition), analysis of time per task or improvement of current job performance, compared with the job performance before the ERP implementation. Furthermore, a complex business model is not necessarily unadvisable to implement if the previous managerial implications are addressed, as it may be beneficial in terms of other business goals and the organizational structure to increase the number of options, and potential competitive advantages.

We also believe that firms should always bear in mind that technology is advancing constantly and quickly, so it may not be advisable to be updated on everything within the organization. On occasion, it may be a waste of time and resources, a better option to request technical demonstrations from suppliers or insource technological consultants.

Firms' efforts in relation to ERP and BMI may benefit from acquiring technological packages containing the options are that really needed for the firm. Packages can usually offer lower costs per item than separate items. Furthermore, the time spent on the relationship with one provider is generally less than with several providers, and this may reduce the complexity of implementing ERP and ensure that BMI turns out successfully.

Complexity comes from variety of components and elements that need to work together. In the marketplace, firms cohabit and a firm is compounded by different departments or units. One of the keys to success for a firm is the capacity to properly connect the diverse components. Dealing with complexity is at minimum a challenge, but not necessarily something negative. When a firm treats complexity through technological tools (such as ERP), which has the capability of turning complexity into opportunities, the complexity yields in something positive, namely a potential competitive advantage in the marketplace and society.

One of the most relevant key points for companies in dealing with complexity is to manage it appropriately. This means that more organizational complexity can offer more opportunities in the market, and more complexity in ERP can help to manage the organizational complexity and make it more efficient and successful. However, this advantage is diluted if, for example, the organizational structure is unsystematic or poorly structured.

B2B marketers need information to conduct their marketing campaigns, sales comparisons, production and logistic comparisons, comparative growth analyses, this information usually comes from the ERP or interconnected tools as Customer Relationship Management (CRM) or Business Intelligence (BI). This seems basic, but the real issue is that B2B markets have the information that ERP provides, but when the IT department receives an instruction to make or adapt a new flow in the organization, the IT department decides what information is recorded, organised and useful in determining the final business model and the information that B2B marketers acquire. Taking into account that ERP software is not designed specifically for marketers, the best recommendation for B2B marketers is not just to expect what the ERP provides, not to accept excuses about the complexity of the organization or ERP for not having the information B2B marketers really need, but also to request the IT department to provide the necessary developments or modifications.

Knowledge about the relation between a technological tool such as the ERP and the BMI of organizations offers great opportunities for B2B marketers. We follow with this argument: i) Nowadays the ERP is the technological base for most of companies, in particular, for those which have more complexity and for the largest ones. ii) Technological change ensures that ERP moves from a client-server set-up to a Software as a Service model (SaaS), more commonly known as a cloud, this manner of deploying ERP software has a better cost-effective rate (Haselmann & Vossen, 2011). iii) SaaS implementation enables the ERP provider to inform its customers about updates, new functionalities or technical inconveniences among others, and all of them are automatized or scheduled, and if necessary, immediately. All ERP users can receive this communication or they could be filtered by groups or profiles (ERP perfectly defines the pertinent groups and profiles of each user). It is clear that one of the most important issues for B2B markets is to reach the target client and attract its attention of.

8. Conclusions, limitations and future research

This study assesses the mediating role of organizational complexity between ERP and BMI. The tested research model indicates that organizational complexity contributes to linking the precursors of ERP with the outcomes of BMI. Accordingly, this study sheds light on how to bridge the ERP implementation process with the outcome of BMI. The study therefore shows that organizational complexity contributes to balancing the sequential logic of precursor constructs related to ERP, with outcome constructs of BMI.

B2B markets change continuously. This variability of market conditions forces firms to innovate their business models to improve or at least not lose their competitive position in the market. Nowadays, firms struggle to adapt their business models without the help of technological tools. The essential software for a firm's technological tools is the ERP (Chung et al., 2008). Therefore, firms need a continuous process of adapting the ERP software to innovate their business models to face the emerging challenges in B2B markets.

We therefore conclude that the results provide relevant and valuable insights into handle ERP implementation processes, so as to optimize the outcome of BMI in the marketplace and society. At the end of the day, the outcome of BMI relies on stakeholder reactions and responses in both the marketplace and society. BMI therefore needs to reconnect continuously to the ERP implementation process, and vice versa.

This study also indicates that the technological complexity of ERP systems is manageable if organizational complexity is handled correctly. It is necessary to ensure that users in firms understand the potential of an ERP system in the organization. Otherwise, users may become an obstacle to successful implementation and eventually travel down a slippery slope towards failure. The key lies in visualizing to users the advantages in relation to their job performance.

Inevitably, this study has its limitations. Specifically, two principal precursors were tested in the research model, offering opportunities for further precursors to be tested in the future. Another research opportunity is whether there are other mediating constructs between ERP and BMI that complement the results reported. Furthermore, other outcome constructs may provide additional insights into BMI. Finally, future research could analyse how affect the influence of the ERP on the BMI to the customers of the firm.

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