UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

BORUT PUKLAVEC

ADOPTION OF BUSINESS INTELLIGENCE SYSTEMS: EMPIRICAL INSIGHTS FROM SMALL AND MEDIUM ENTERPRISES

DOCTORAL DISSERTATION

Ljubljana, 2016

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AUTHORSHIP STATEMENT

The undersigned Borut Puklavec, a student at the University of Ljubljana, Faculty of Economics (hereafter: FELU), author of this doctoral dissertation with the title Adoption of Business Intelligence Systems: Empirical Insights from Small and Medium Enterprises (Privzemanje poslovnointeligenčnih sistemov v malih in srednjih podjetjih), prepared under supervision of prof. dr. Aleš Popovič and co-supervision of Assistant Professor Tiago André Gonçalves Félix de Oliveira, PhD.

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ADOPTION OF BUSINESS INTELLIGENCE SYSTEMS: EMPIRICAL INSIGHTS FROM SMALL AND MEDIUM ENTERPRISES

SUMMARY

Business intelligence systems (BIS) as well as information systems (IS) adoption are individually well-researched phenomena, but a big gap still exists in the literature on BIS adoption. Although it is important that different stakeholders understand BIS adoption, particularly adopting firms and BIS providers, our knowledge about the role of determinants in BIS adoption remains limited. Moreover, limiting knowledge to merely adoption and adoption determinants leaves a gap in the BIS literature and thus in our knowledge concerning the role of BIS in creating value for the firm and leveraging firm performance. In response, we decide to research the determinants of BIS adoption and impact on firm performance in SMEs on the firm level through the construction and confirmatory testing of integral adoption and value models.

To achieve the above defined aim of the research, we conducted a four-phase study in which the first and second phases entail a literature review and exploratory research to provide the facts for modeling and propose conceptual models of BIS adoption and how BIS use impacts firm performance. The third and fourth phases are two confirmatory quantitative studies, which validate these two models. Following the described research approach, this doctoral dissertation is structured as a collection of three papers. Although each individual paper represents a distinct entity, there is a common thread running through the entire dissertation, logically pursuing the design of the research.

The first paper provides a comprehensive literature review and exploratory research studies along with their findings. The aim of this part of research is to identify for small and medium enterprises (SMEs) the specific determinants of BIS adoption at the firm level that will guide the development and testing of a BIS adoption framework in the milieu of SMEs. By leveraging semi-structured interviews involving BIS experts and adopters, and blending them with comprehensive IT/IS adoption literature, we identify instrumental candidate determinants for delving deeper into BIS adoption in SMEs.

The second paper represents the first of two confirmatory studies, namely, the BIS adoption research. In this research phase, we develop a conceptual model for assessing the determinants of the BIS adoption process comprising evaluation, adoption, and use. The model is based on two prominent firm-level adoption concepts: Diffusion of Innovation (DOI), and the Technology-Organization-Environment (TOE) framework, extended with our own previous research findings. As part of testing the conceptual model, we utilized data collected from 181 small and medium enterprises. As a result, seven determinants (i.e. *cost*, *BIS is part of ERP*, *management support*, *rational decision-making culture*, *project champion*, *organizational data environment*, *organizational readiness*) were identified as

statistically significant for different adoption stages. By introducing BIS as part of ERP as a novel determinant of BIS adoption, and by examining the direct and total effects of the determinants, this research provides a valuable insight into the adoption decisions of the firm.

In the third paper, we report the second confirmatory study of how BIS use impacts firm performance. Within this research phase, we develop a conceptual model for assessing the determinants of BIS impact on firm performance. The model is based on the Diffusion of Innovation (DOI) post-adoption phase of use, and the Resource-Based View (RBV), extended with findings from the other studied IT/IS research literature. The conceptual model encompasses two independent post-adoption variables of routine use and innovative use; three dependent variables of BIS partial impacts on firm performance (impact on marketing and sales, impact on management and internal operations, impact on procurement), and an ultimate dependent variable of impact on overall firm performance. When testing the conceptual model, we utilized data collected from 181 SMEs. The results indicate that BIS usage has a positive and significant correlation with BIS partial impacts on firm performance, and that partial impacts explain a considerably large part of the impacts of BIS on overall firm performance variance, although not all variables of partial impacts show a significant influence on overall firm performance. Further, both routine use and innovative use were identified as statistically significant for all BIS partial impacts on firm performance.

In all three papers, implications of the findings are discussed separately for both theoretical and practical purposes. Given the contributions described in the papers, and the facts about the importance of BIS, we can state that this doctoral dissertation will contribute not only to the BIS theory, but also to the general IS body of knowledge since BIS are an important part of the IS field of knowledge.

Keywords: business intelligence systems (BIS); information technology/information systems (IT/IS) adoption; IT/IS post-adoption use; firm performance; Technology-Organization-Environment (TOE) framework; Diffusion of Innovations (DOI) theory; adoption stages; small and medium enterprises (SME); firm level; exploratory qualitative research; confirmatory quantitative research

PRIVZEMANJE POSLOVNOINTELIGENČNIH SISTEMOV V MALIH IN SREDNJIH PODJETJIH

POVZETEK

Medtem ko sta poslovnointeligenčni sistemi (PIS) na eni kakor tudi privzemanje informacijskih sistemov (IS) na drugi strani posamezno dobro raziskani znanstveni področji, pa obstaja pomembna znanstvena vrzel na področju privzemanja poslovnointeligenčnih sistemov.

Čeprav je razumevanje privzemanja PIS pomembno za različne deležnike, predvsem za podjetja, ki PIS privzemajo, ter ponudnike teh sistemov, pa je poznavanje dejavnikov privzemanja PIS še vedno precej omejeno. Poleg tega omejevanje znanja na zgolj privzemanje in dejavnike privzemanja pušča vrzel na znanstvenem področju PIS in posledično v našem poznavanju vloge PIS pri kreiranju vrednosti za podjetje ter pri povečevanju uspešnosti in učinkovitosti poslovanja. Kot odgovor na zgoraj navedeno smo se odločili raziskati dejavnike privzemanja PIS ter vpliva PIS na uspešnost in učinkovitost poslovanja v malih in srednjih podjetjih (MSP) na nivoju podjetja ter razviti in potrditveno testirati integralna modela privzemanja PIS ter vpliva PIS na uspešnost in učinkovitost poslovanja.

Za dosego zgoraj opisanega namena raziskave smo izvedli štiristopenjsko študijo, kjer prva in druga faza predstavljata obširni pregled literature ter eksploratorno raziskavo, skozi kateri smo definirali dejstva za nadaljnje modeliranje in pripravo predlaganih konceptualnih modelov privzemanja PIS ter vpliva PIS na uspešnost in učinkovitost poslovanja. Tretja in četrta faza pa predstavljata dve konfirmatorni, kvantitativni raziskavi, ki oba modela preverjata. Vsled opisanega raziskovalnega pristopa je disertacija strukturirana kot zbirka treh znanstvenih člankov. Čeprav predstavlja posamezen članek samostojno enoto, pa skozi celotno disertacijo teče rdeča nit, ki sledi strukturi raziskave.

Prvi članek predstavlja celovit pregled literature ter eksploratorno raziskavo skupaj z njunimi ugotovitvami. Namen tega dela raziskave je identificirati dejavnike privzemanja PIS na nivoju podjetja, ki so obenem značilni za MSP in bodo v nadaljevanju vodili razvoj in testiranje modela privzemanja PIS v domeni MSP. Skozi izvedbo polstrukturiranih intervjujev s strokovnjaki za PIS in predstavniki podjetij, ki privzemajo ali so privzela PIS, ter kombiniranjem teh rezultatov z rezultati celovitega pregleda literature s področja privzemanja informacijske tehnologije/informacijskih sistemov (IT/IS), smo identificirali ključne kandidate za dejavnike privzemanja ter poglobljeno razumevanje privzemanja PIS v MSP.

Drugi članek je posvečen prvi od dveh konfirmatornih študij – raziskavi privzemanja PIS. V tej fazi raziskave smo razvili konceptualni model za presojo dejavnikov privzemanja PIS

v fazah evalvacije, privzemanja in uporabe. Model temelji na dveh priznanih konceptih privzemanja: *Diffusion of innovation* (DOI), ter *The technology-organization-environment* (TOE) *framework*, ki ju razširjamo in dopolnjujemo z ugotovitvami naše predhodne študije. Pri testiranju konceptualnega modela smo uporabili podatke, zbrane med 181 malimi in srednjimi podjetji. Na podlagi rezultatov smo identificirali sedem dejavnikov (*strošek*, *PIS je del ERP* (celovite informacijske rešitve), *podpora vodstva*, *racionalna kultura odločanja*, *zagovornik projekta*, *podatkovno okolje podjetja*, *pripravljenost podjetja*) kot statistično značilnih za različne faze privzemanja. Z uvedbo dejavnika PIS je del ERP kot novega dejavnika privzemanja PIS ter s proučevanjem direktnih in skupnih vplivov dejavnikov v raziskavi predstavljamo dober vpogled v odločitve podjetij glede privzemanja.

V tretjem članku poročamo o drugi konfirmatorni raziskavi, posvečeni vplivom uporabe PIS na uspešnost in učinkovitost poslovanja. V tej fazi raziskave smo razvili konceptualni model za presojo dejavnikov vplivov PIS na uspešnost in učinkovitost poslovanja. Model temelji na zadnji fazi privzemanja – uporaba, kot jo opisuje teorija DOI – ter na teoriji *Resource-based view* (RBV), ki ju razširjamo s spoznanji iz ostale preučevane IT/IS literature o privzemanju. Konceptualni model obsega dve neodvisni spremenljivki privzemanja (*rutinska uporaba* in *inovativna uporaba*), tri odvisne spremenljivke parcialnih vplivov PIS na uspešnost in učinkovitost poslovanja (*vpliv na trženje in prodajo*, *vpliv na management in interne operacije*, *vpliv na naročanje*) ter končno odvisno spremenljivko *vpliv na uspešnost in učinkovitost poslovanja* v splošnem smislu. Pri testiranju konceptualnega modela smo uporabili podatke, zbrane med 181 MSP. Rezultati kažejo, da ima uporaba PIS pozitiven in značilen vpliv na spremenljivke parcialnih dimenzij uspešnosti in učinkovitosti poslovanja ter da parcialni vplivi razlagajo značilno velik del vpliva PIS na varianco splošne uspešnosti in učinkovitosti poslovanja, čeprav vse spremenljivke parcialnih vplivov ne kažejo značilnega vpliva na uspešnost in učinkovitost. Poleg tega sta bili tako rutinska kot inovativna uporaba identificirani kot statistično značilni za vse dimenzije parcialnih vplivov PIS na uspešnost in učinkovitost poslovanja.

V vseh treh člankih so implikacije ugotovitev raziskav analizirane posebej za znanstvene in strokovne namene. Upoštevajoč v člankih opisane prispevke raziskav ter dejstva o pomembnosti PIS lahko ugotovimo, da pričujoča doktorska disertacija prispeva ne le k teoriji PIS temveč tudi k splošni znanosti na področju IS, saj so PIS pomemben del znanstvenega področja IS.

Ključne besede: poslovnointeligenčni sistemi (PIS); privzemanje informacijske tehnologije/informacijskih sistemov (IT/IS); uporaba IT/IS; uspešnost in učinkovitost poslovanja; teorija *The technology-organization-environment framework* (TOE); teorija *Diffusion of innovations* (DOI); faze privzemanja; mala in srednja podjetja (MSP); nivo podjetja; eksploratorna kvalitativna raziskava; konfirmatorna kvantitativna raziskava.

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1 INTRODUCTION

1.1 Problem description

For contemporary firms to succeed it is important to understand how information technology (IT) can create significant and sustainable competitive advantages (Popovič, Turk, & Jaklič, 2010). Information technology and information systems (IT/IS) generally entail substantial investments for firms. As such, the investments ought to create returns in various areas, e.g. in efficiency, improved decision-making, and overall firm performance (Agarwal & Prasad, 1998). Although it is generally accepted that technological innovations are a primary driver of firms' productivity, innovations must first be widely adopted before they can deliver benefits (Zhu, Kraemer, & Xu, 2006). However, limiting the focus to just adoption leaves a gap in our knowledge about the role of business intelligence systems (BIS) in creating value for the firm and leveraging firm performance. Thus, it is essential to understand the process and determinants of IT/IS adoption and use (Karahanna, Straub, & Chervany, 1999) and how BIS can contribute to value creation in various organizational value chain activities and to the overall firm performance.

While IT/IS adoption on the firm level is well researched, our understanding of the factors affecting BIS adoption and the adoption process, along with understanding of BIS value creation and the BIS impact on the firm performance, is quite limited. This is despite the fact that evaluating the adoption of BIS is vital for understanding the value and efficacy of implementing these systems.

BIS fall within innovations that can significantly contribute to a firm's performance, particularly when they operate in intensely competitive environments (Popovič, Hackney, Coelho, & Jaklič, 2012). In a decision-support context, BIS have emerged as an IT solution offering data integration and analytical capabilities that can provide valuable decision-making information to stakeholders at different organizational levels (Turban, Sharda, & Delen, 2010). While a review of the BIS literature offers various BIS definitions (Elbashir, Collier, & Davern, 2008; Trkman, McCormack, De Oliveira, & Ladeira, 2010; Watson, 2009; Williams & Williams, 2007; Wixom & Watson, 2010), we adopt the following definition: quality information in well-designed data stores, coupled with software tools that provide users with timely access, effective analysis, and intuitive presentation of the right information, enabling them to take the right actions or make the right decision (Popovič et al., 2012). In addition, we elevate this definition by adding in analytical decision-making as one of the organizational culture aspects, supported by BIS (Popovič et al., 2012).

For the purposes of our research, we also adopt the following definition of enterprise resource planning (ERP) solutions: "…an integrated, customized, packaged software-based

system that handles the majority of an enterprise's system requirements in all functional areas such as finance, human resources, manufacturing, sales, and marketing. It has a software architecture that facilitates the flow of information among all functions within an enterprise. It is built on a common database and is supported by a single development environment" (Buonanno et al., 2005).

Regarding prior studies, there are key differences between BIS and other IS (such as ERP) in several aspects, which can be summarized in the following points (Popovič et al., 2012). First, the use of BIS is primarily voluntary and the benefits of BIS are more indirect and long term than those of operational IS. Next, organizational users are typically knowledge workers at higher organizational levels. Further, the information collected in BIS is more aggregated at the level of the entire organization besides the greater sharing of information. Moreover, the structuredness of information needs and processes within which ISs are used, and the structuredness of instructions for using the BIS, are considerably lower since the use is usually more research-oriented and innovative. The focus is more on the necessary data and their relevance rather than on the technological solution, and in the context of BIS this data also comes from external sources, and not only from the processes themselves. Typical differences between BIS and operational information systems are summarized in Table 1.

Drawing upon these key differences, we strongly believe that in order to fully understand the determinants of the adoption of BIS it is necessary to develop an integrative adoption model that considers prior IT/IS adoption models and further develops them to address the specifics of BIS. Moreover, we firmly believe it is also necessary to develop a conceptual model to assess the determinants of BIS' impact on firm performance.

Further reasoning for studying the determinants of BIS impact on firm performance can be found as follows. As today's firms commonly operate in a complex and competitive business environment, and since IT/IS innovations generally represent substantial investments for firms, it is crucial that investments realize returns in areas such as efficiency and improved decision-making (Agarwal & Prasad, 1998). In order to realize returns, mere use of innovation is insufficient. It is essential for innovation use to also create a business value. Most existing research focuses on innovation usage only, while the ultimate effects on value creation (e.g. impact on management) and firm performance remain overlooked (Picoto, Belanger, & Palma-dos-Reis, 2014). Since BIS were developed as an IS innovation for offering data integration and analytical capabilities that can provide valuable decision-making information for stakeholders at different organizational levels (Turban et al., 2010), we propose that use of BIS can contribute to the creation of value in various organizational value chain activities, such as management, marketing, sales, internal operations, etc. Reflecting the above reasoning, we also further focus our research on the BIS post-adoption stage of use and its impact on firm performance.

Table 1. Comparing BIS and operational IS

	BIS	Operational IS
Structuredness of processes in which IS are used	lower	higher
Context for identifying information needs	processes, performance management	processes
Methods for identifying information needs	less established	well established
Data sources employed	additional data sources required	mostly from within the process
Level of voluntariness of use	higher	lower
Focus of IS	data- and process-oriented	application- and process-oriented
Main problems of information quality	relevance	sound data and data access quality
IS integration level	enterprise	process
Level of required reliability of IS	lower	higher

Source: Popovič et al., *Towards business intelligence systems success: Effects of maturity and culture on analytical decision making*, 2012, p. 731, Table 1.

To additionally support such a decision, we condense some of the previous findings. While Popovič et al. (2010) denote the creation of business intelligence business value as a generally accepted belief, Williams and Williams (2007) regard business intelligence as "business information and business analyses within the context of key business processes that lead to decisions and actions and that result in improved business performance", adding that in particular business intelligence signifies "leveraging information assets within key business processes to achieve improved business performance".

Although small and medium enterprises (SME) are often described as being the backbone of the European economy, providing a potential source of jobs and economic

growth (Olszak & Ziemba, 2012), existing research in the BIS field primarily focuses on large-sized firms (Popovič et al., 2012; Wixom & Watson, 2010; Yeoh, Koronios, & Gao, 2008). However, it is not just large-sized firms but also small and medium enterprises that are exploiting their sizeable data resources by developing and using advanced data-analysis capabilities (Kulkarni & Robles-Flores, 2013). Despite their specifics, namely fewer financial and human resources, greater risks, the need for closer cooperation with partners, etc. (Eikebrokk & Olsen, 2007), their importance in a country's economic development, revival, technological advancement, and job creation is not disputed (Fink, 1998). Accordingly, to fill this existing gap in the BIS research we identified an important need to frame our research in the contexts of BIS adoption and BIS use impact on firm performance in SMEs as we believe that, by exploring BIS in these organizational entities, we can significantly add to the existing body of knowledge in this topical area of BIS research.

Following the above reasoning, our research aims to: (i) conduct a comprehensive literature review to reveal possible BIS adoption determinants; (ii) carry out qualitative research to narrow the list of BIS adoption candidate determinants from the literature, and to detect additional determinants that are important for BIS which are not encompassed in the existing literature; (iii) develop a comprehensive, tentative BIS adoption model by building on existing firm-level adoption models and qualitative research results; (iv) test the hypothetical model, identifying the factors affecting BIS adoption in SMEs; (v) examine the influence of an adoption determinant on different adoption process stages; and (vi) develop and test a conceptual model for assessing the determinants of BIS impact on firm performance in SMEs.

1.2 Research topic and research questions

The aim of the research is to identify the determinants of BIS adoption and BIS impact on firm performance in SMEs on the firm level through the construction and confirmatory testing of integral adoption and value models. To realize this aim, the research topic should be first embedded in the correct theoretical framework.

1.2.1 Defining IT adoption

Within the IT adoption literature several IT adoption-related concepts appear that are used interchangeably to mimic some aspects/phases of the adoption process (Karahanna et al., 1999). In the following paragraphs, we try to delineate these concepts in greater detail and define our understanding of the IT adoption process.

To begin with, we need to clarify the distinction between IT *diffusion*, *assimilation*, and *implementation*. *Diffusion* is defined as "the process by which a technology spreads across a population of organizations", while *assimilation* refers to "the process within

organizations stretching from initial awareness of the innovation, to potentially, formal adoption and full-scale deployment" (Fichman, 2000). From a technological diffusion perspective, IT *implementation* is defined as "an organizational effort directed toward diffusing appropriate information technology among user community" (Cooper & Zmud, 1990). From these definitions, we can argue that diffusion deals with the process at the industry level, assimilation with the process within individual organizations, whereas implementation reflects (and overlaps with) a part of the assimilation process, namely the acceptance and use of technology.

Adoption of an innovation, which can be an idea, technology, product, or program, is a process that results in the introduction and use of an innovation that is new to the adopting unit (individual or firm), and offers a new means for solving a problem and for potential adopters to exploit opportunities (Hameed, Counsell, & Swift, 2012).

A more comprehensive view of the IT adoption process is provided by the stage model of IT implementation activities (adapted by Cooper and Zmud (1990)) that distinguishes six distinct stages (referring to adoption and post-adoption phases). First, they refer to the initiation stage as the active and/or passive scanning of organizational problems/opportunities and suitable IT solutions within the business environment that could help organizations tackle problems and/or seize opportunities. The next stage is adoption. They refer to it as ensuring organizational backing – through rational and political dialogues – for implementation of the IT solution. Once the new IT solution is developed and installed, organizational processes and structures are newly developed or revised (adaptation stage). Next, wider acceptance needs to be achieved among organizational actors; organizational actors are induced to commit to the IT solution in their work. Following acceptance, the IT solution becomes routinized within the organization, i.e. the solution is no longer perceived as something out of the ordinary but becomes a normal activity. Positive perceptions of the value of the IT solution are important because of its 'action-generating' properties that facilitate not only the acceptance and routinization of the technological solution but also its usefulness over time, ultimately ending in increased organizational effectiveness and efficiency through regular use of the IT solution (infusion stage).

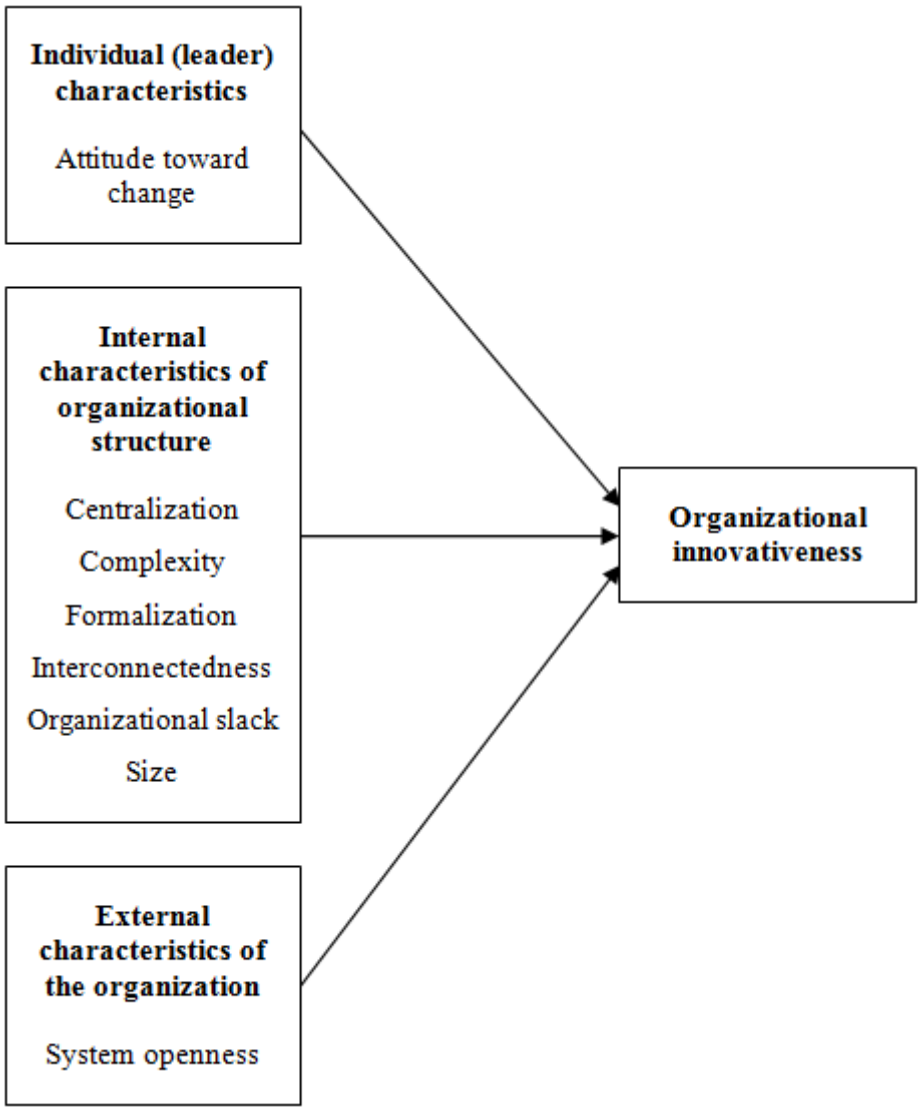
Drawing upon the stage model of IT adoption activities (adapted by Cooper and Zmud (1990)) and to be in line with the prevailing nomenclature in the IT adoption literature studying various adoption stages (e.g. Bose & Luo, 2011; Chan & Chong, 2013; Chong & Chan, 2012; Picoto et al., 2014; Thomas, Costa, & Oliveira, 2015; Zhu & Kraemer, 2005; Zhu, Kraemer, & Xu, 2006), we define IT adoption at the firm level as a stage process where organizations first consider and assess the available options for the problems/opportunities (*evaluation* stage), then they ensure organizational backing for the intended IT innovation before making the decision to invest resources to accommodate the implementation effort (*adoption* stage), before encouraging use of the IT innovation for

increasing organizational effectiveness (*use* stage) (Zhu & Kraemer, 2005; Zhu, Kraemer, & Xu, 2006).

1.2.2 Technology adoption theories

In the area of adopting models at the firm level there are two prominent theories which are also widely used as a basis for other theories (Chong, Ooi, Lin, & Raman, 2009): the first one is Diffusion of Innovation (DOI) (Rogers, 1995) and the second is the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990).

Figure 1. Diffusion of Innovations (DOI) theory

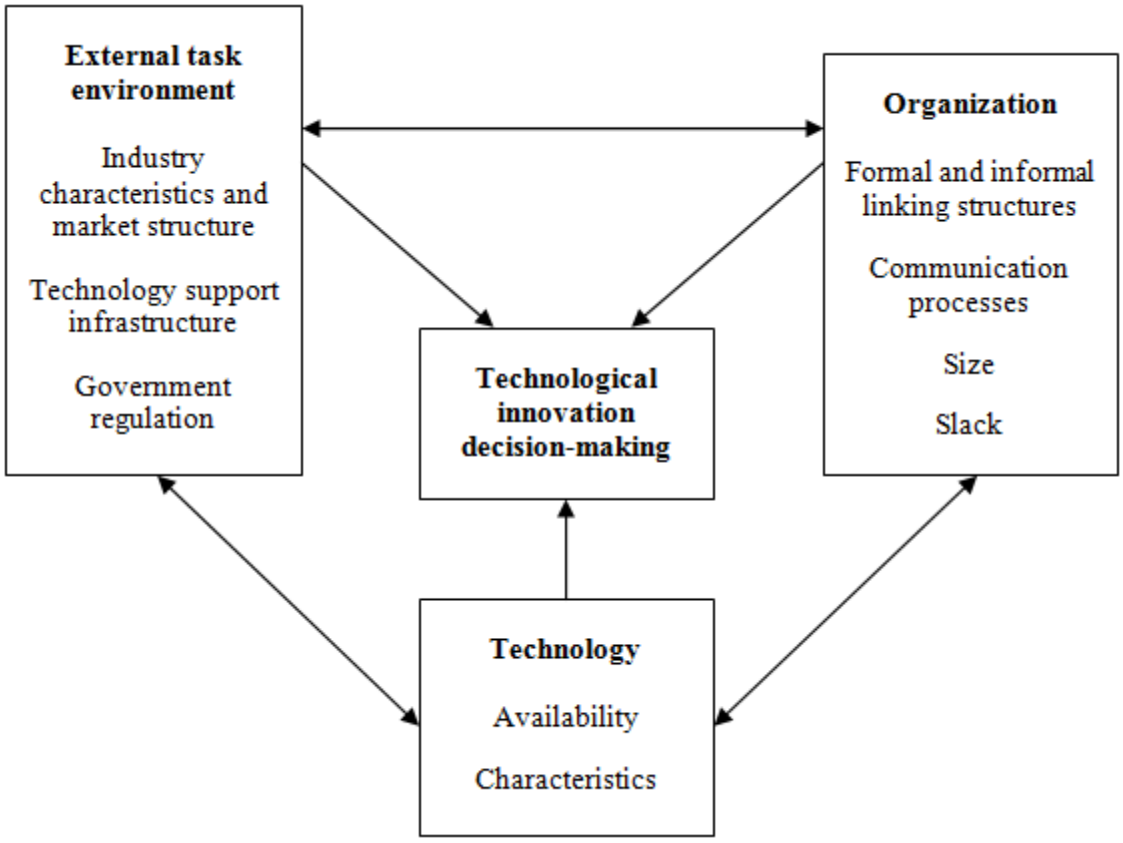


Sources: Oliveira, T., & Martins, M. F., *Literature Review of Information Technology Adoption Models at Firm Level*, 2011, p. 111, Figure 1; Rogers, E. M., *Diffusion of innovations*, 1995.

Diffusion of Innovation is a theory exposing three groups of factors that influence organizational adoption (Rogers, 1995). These factors include (Figure 1) individual/leader characteristics (attitude to changes), internal characteristics of the organizational structure (centralization, complexity, formalization, interconnectedness, organizational slack, size), and external characteristics of the organization (system openness).

On the other hand, the TOE framework (Figure 2) is a theory of the following three groups of factors (Tornatzky & Fleischer, 1990): external task environment (industry characteristics and market structure, technology support infrastructure, government regulation), organization (formal and informal linking structures, communication processes, size, slack), and technology (availability, characteristics).

Figure 2. The Technology-Organization-Environment framework (TOE)



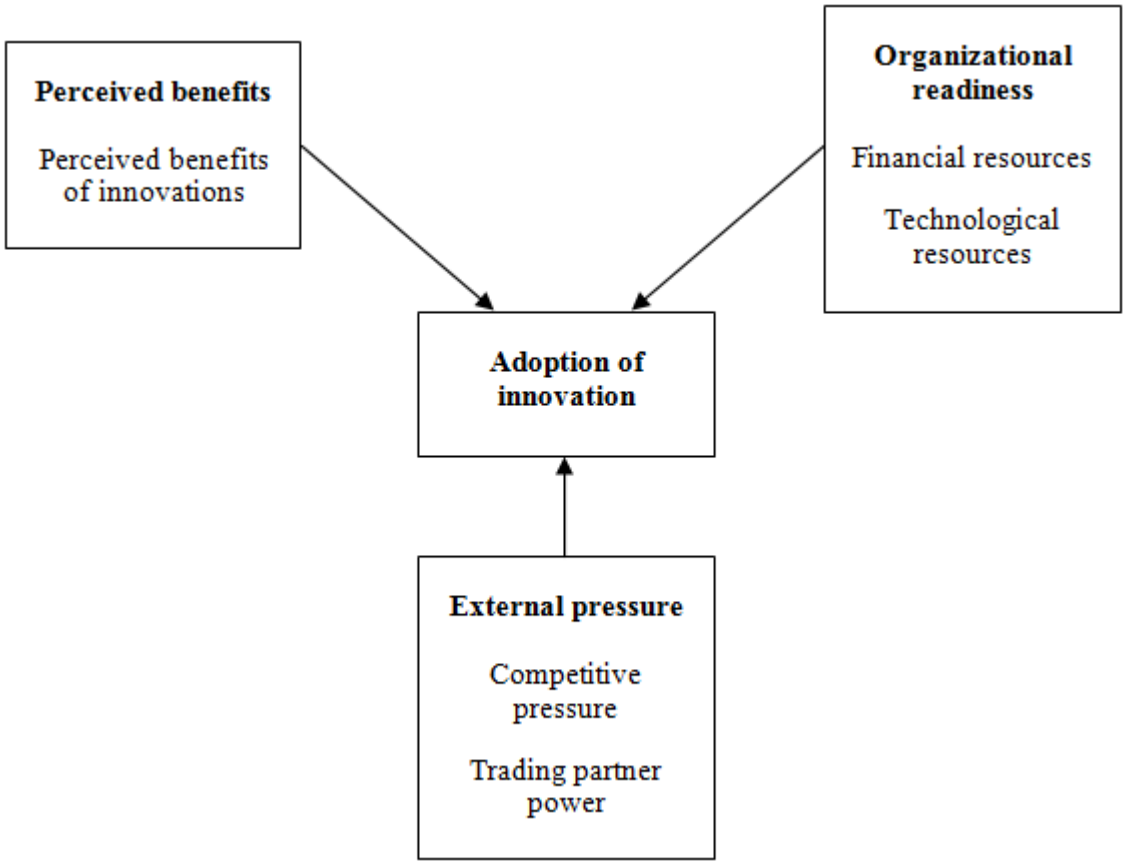
Sources: Oliveira, T., & Martins, M. F., *Literature Review of Information Technology Adoption Models at Firm Level*, 2011, p. 112, Figure 2; Tornatzky, L. and Fleischer, M., *The process of technology innovation*, 1990.

The theories presented above belong to the group of the most commonly used theories in the field of technology adoption; along with the Technology Acceptance Model (TAM) (Davis, 1985, 1989; Davis, Bagozzi, & Warshaw, 1989), the Theory of Planned Behavior (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology

(UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). But since DOI theory and the TOE framework are the only two in this group that are at the firm level (Oliveira & Martins, 2011), we decided to develop our model based on these two models.

In order to better understand the determinants of BIS adoption, we add in the third, Iacovou model (Iacovou, Benbasat, & Dexter, 1995) derived from TOE framework theory (Oliveira & Martins, 2011), which is important for our study because it was developed through research of SMEs. As such, it gives us a valuable insight into the adoption of IT in SMEs. The Iacovou model (Figure 3) suggests three groups of factors based on research into small enterprises (Iacovou et al., 1995), namely the perceived benefits of IT innovations, organizational readiness (financial resources, IT resources), and external pressures (competitive pressure, trading partner power).

Figure 3. The Iacovou model



Sources: Oliveira, T., & Martins, M. F., *Literature Review of Information Technology Adoption Models at Firm Level*, 2011, p. 117, Figure 3; Iacovou, C. L., Benbasat, I. and Dexter, A. S., *Electronic data interchange and small organizations: Adoption and impact of technology*, 1995.

Due to the challenges of BIS adoption and differences of BIS with other IT, it is important to combine various theoretical models and relevant constructs to achieve a reliable insight

into the adoption phenomenon (Oliveira & Martins, 2011). Hence, some factors proposed in the three theories above are combined, some of them do not fit with the BIS adoption phenomenon and some, although not included in the above models, are added to our research as they represent BIS specifics. One of this research's main goals is to identify which are these factors, based on a literature review and qualitative research.

1.2.3 Routine and innovative use

Technology use, as the last stage in the IT adoption process as defined earlier, represents the link between BIS adoption and BIS value. In our BIS value research, we examine the influences of separate BIS use aspects and BIS value creation activities.

Sundaram, Schwarz, Jones, and Chin (2007) suggest there are three types of use: the degree to which: (i) the person uses the technology (extent or frequency of use); (ii) the person adapts to the IT use or incorporates it into their routine work pattern (routinization); and (iii) the person maximizes the potential of the technology (infusion).

At the organizational level, researchers have studied the extent of infusion and routinization when analyzing the diffusion of innovations within organizations (Cooper & Zmud, 1990; Zmud & Apple, 1992). We acknowledge that IS/IT researchers have used other measures, such as the depth and breadth of usage and alternative conceptualizations of use, beyond that which we describe. However, in each of these cases the theoretical underpinnings were not developed for linking technology use with individual performance (Sundaram et al., 2007).

Although a person may make considerable use of a given technology, they might not necessarily demonstrate an increase in performance. However, it is significant that, while efficient use is important, so too is innovative use. We suggest that the notion of innovative use is captured within the concept of infusion, or the extent to which a decision-maker fully uses the technology to enhance productivity (Jones, Sundaram, & Chin, 2002). Routine use refers to integration of the technology into work patterns and does not necessarily mean a person uses all of the potential offered by the system.

In X. Li, Hsieh, and Rai (2009), where the BIS environment is explored, routinization is defined as system use consistent with normal work processes. Routinization also characterizes users' experience with using the technology and facilitates the integration of technology into work processes. According to Saga and Zmud (1994), innovative use adds value to the routine use. After the learning processes and accumulation of direct experience in the routinization phase, a technology can be used in a way that employs above-standard features. Innovative use represents a state when the extended amount of the technology's features is used in a more comprehensive and sophisticated manner. A higher level of

innovative use can result in exploitation of the fullest potential of the innovation, leading to various organizational benefits (Hsieh & Wang, 2007).

For the purpose of our study, we understand *BIS routine use as the degree to which use of a BIS has been incorporated into a firm's regular work activities whereas with innovative use of BIS we refer to the extent to which a decision-maker fully uses BIS-specific features to support their information needs.*

1.2.4 Resource-Based View

To examine the relationship between BIS use and BIS' impact on firm performance, we supplement our research with the Resource-Based View (RBV). The RBV, with its roots in the strategic management literature, has also been used in the IT/IS literature, e.g. (Picoto et al., 2014; Soares-Aguiar & Palma-dos-Reis, 2008; Zhu & Kraemer, 2005; Zhu, Kraemer, & Xu, 2006), where this theory has mostly been used to explain the creation of competitive value in firms from their IT resources (Soares-Aguiar & Palma-dos-Reis, 2008). This theory explains firm performance based on organizational resources and capabilities and has been employed to explain the successfulness of innovation adoption in organizations. By combining resources that work together in order to create organizational capabilities, firms can create performance advantages (Soares-Aguiar & Palma-dos-Reis, 2008). Heterogeneous resources, which when combined can create value for the firm, are economically valuable, difficult to imitate, relatively scarce, and imperfectly mobile across firms (J. Barney, 1991; Zhu & Kraemer, 2005). In the RBV, technological innovation is considered a strategic resource with the potential for a direct effect on organizational performance (Picoto et al., 2014). Its business value depends on how extensively it is used in the firm's key activities. Greater use will result in fostering potential for developing unique firm capabilities from its basic IT infrastructure, i.e. computers and other devices, networks, databases and other software, communication platforms, etc. (Zhu & Kraemer, 2005).

1.2.5 Research questions

The main research question of this study is: *Given the specifics of BIS, what are the determinants of BIS adoption in SMEs?*

Besides the main research question, we answer the following related questions: first, we identify the specifics of BIS adoption in SMEs at various adoption stages; second, we are interested in finding the relative relevance of an individual factor affecting BIS adoption; next, we seek to identify which factors foster the adoption of BIS in SMEs. Last but not least, we identify the linkages between BIS use and firm performance in SMEs.

1.3 Contribution to the field of knowledge

Through the research, an adoption model identifying adoption factors was developed, tested, and interpreted. Since to the best of our knowledge such a model has not yet been developed, and concerning the importance of the research topic area described above, the results are relevant for the field of knowledge in four ways. First, this study contributes to the literature on adoption of an IT/IS innovation by broadening it to the field of BIS. We explore how adoption differs for BIS and what are the adoption specifics of SMEs in this field. Further, we will theorize and test adoption factors in various adoption stages of BIS adoption, which has, again to the best of our knowledge, not been previously done in the BIS field and is also rare in other IT/IS fields. Second, we contribute to the literature on BIS by explaining how BIS are adopted on the firm level and what is the value of BIS alongside its impact on firm performance. Next, our study contributes to the knowledge about SMEs' specifics in the area of BIS adoption. Further, the research proposes a validated model of BIS' impact on firm performance, explaining the role of BIS in creating value for the firm and leveraging firm performance. Finally, the developed models represent useful groundwork for further studies, which are also suggested.

By answering the proposed research questions, our results are also relevant for software vendors and consultants as they provide a deeper understanding of the process of BIS adoption and BIS' impact on firm performance. Based on the importance of BIS, the results are also relevant for individual firms if planning BIS adoption, have already adopted BIS, or need to foster use of the BIS, as a determinant of the performance enhancement of a firm.

Considering the contributions described above and, within the description of the research topic area the facts expressed about the importance of BIS, we can state that this doctoral dissertation will contribute not only to the BIS theory but also to the general IS body of knowledge, since BIS are an important part of IS field.

1.4 Description of the research method

The first and second phases of this research entail a literature review, followed by exploratory research which provides the facts for modeling and proposes a conceptual model of BIS adoption. The comprehensive literature review gives a solid foundation to proceed with further narrowing of the determinants to address our research goals. In order to do so, through a qualitative survey we explored which of these determinants are deemed relevant for the milieu under study.

As many theories have studied the adoption of IT/IS but none was particularly dedicated to BIS adoption, we conducted a comprehensive literature review that gave us nearly 70 determinants from various IT/IS adoption models.

The literature review encompasses the 11 most important journals in the researched field. The first eight journals were chosen from the Association for Information Systems list, adopted from a formal statement by the "Senior Scholars Consortium" as of April 23, 2007, and revised on December 6, 2011 (Members of the Senior Scholars Consortium, 2011). We added three more journals to this list that are important for the field of research. All of the chosen journals are graded 4 (the highest) or 3 by the Academic Journal Quality Guide (Harvey, Kelly, Morris, & Rowlinson, 2010).

As the researched topic forms part of the rapidly changing IT/IS research field, we focused on volumes for the past 10 years. In subsequent phases of the research, other papers and publications were also used to ensure the best theoretical background for the study.

The researched 11 journals:

1. MIS Quarterly;
2. Information Systems Research;
3. Journal of the Association for Information Systems;
4. Journal of Management Information Systems;
5. European Journal of Information Systems;
6. Information Systems Journal;
7. Journal of Strategic Information Systems;
8. Journal of Information Technology;
9. Information & Management;
10. Decision Support Systems; and
11. Management Science.

The main goals of the literature research were to gain a deeper understanding of the adoption phenomenon, collect useful information about BIS specifics and finally to collect candidates for BIS adoption factors. Consequentially, the two main keywords of our literature (papers) search were *BIS* and *adoption*. Other keywords were *innovation*, *SME*, *management information systems* and *decision support*. We used determinants from the literature research as potential candidates for BIS adoption in the subsequent qualitative research.

Quantitative research was conducted through 10 face-to-face semi-structured interviews about the factors of BIS adoption. The interviews were carried out in a two-phase approach, which permits in-depth exploration of the research question. Informants were selected through criterion sampling among four SMEs identified as BIS adopters, and six

BI professionals from the field (see Table 6), all sufficiently familiar with BIS the adoption phenomenon in SMEs to adequately discuss the subject. This phase provided the content of the research model for the next phase.

In the third phase of the research, the conceptual adoption model was constructed. As complex technology adoption such as BIS adoption requires a combination of more than one theoretical model to achieve a proper understanding of the adoption process, the integral model is based on the three generally accepted IT adoption models described above: TOE, DOI, and Iacovou (Oliveira & Martins, 2011). Each of these three models namely studies the IS field and in turn BIS in partly specific way. To understand BIS adoption it is important to consider both the common and also the specific factors in these models. At this point, facts discovered in the first and second phases about BIS specifics compared to other IT provide a supplementation of the model so that it best fits the BIS adoption phenomenon. Next, the proposed model's validity was empirically tested. Three adoption stages – evaluation, adoption, and use (Thong, 1999; Zhu, Kraemer, & Xu, 2006) – were examined through the perspective of the adoption model.

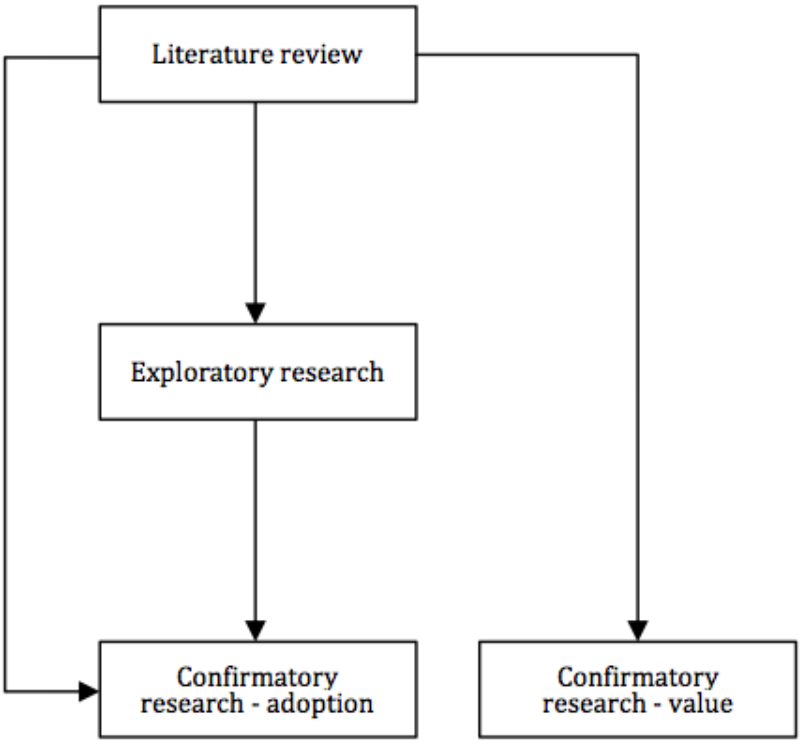
In the fourth phase, we developed a conceptual model for assessing the determinants of BIS' impact on firm performance. The model is based on the DOI post-adoption phase of use, and the Resource-Based Theory, extended with our findings from the other IT/IS research literature. The validity of the proposed model, with dependent variables of BIS' partial impacts on firm performance and an ultimate dependent variable of impact on overall firm performance, was then empirically tested.

Confirmatory research in both the third and fourth phases used primary data gathered in SMEs in South-East Europe. Data were gathered through an online survey service which allows one to create, execute, and briefly analyze online surveys. Invitations to complete the survey were distributed by email to 2,024 SMEs from various industry sectors, for which contact data were extracted and merged from different public information sources. In order to increase content validity, participation of the most qualified person regarding BIS was requested. Data were collected in mid-2015.

Over 12 weeks, a total of 181 usable responses was attained, corresponding to a response rate of 8.9%. We ascribe the lower response rate than expected (a response rate of 10%-15% was expected (Buonanno et al., 2005; Hsu, Kraemer, & Dunkle, 2006; Oliveira & Martins, 2010; Soares-Aguiar & Palma-dos-Reis, 2008)) to the fact that we targeted the overall SME milieu, i.e. adopters and non-adopters, regardless of how familiar an individual firm was with BIS. Nonetheless, due to large number of invitations sent our research sample size was sizeable enough to give an adequate basis for testing the model. Before publishing the survey and contacting the firms, items in the questionnaire were reviewed for content validity by a group of three IS researchers and three BI professionals, all appropriately familiar with the BIS adoption phenomenon. Following their comments,

some amendments were made to the questionnaire, which was then further pilot tested on 25 SMEs randomly selected from the sample frame to confirm the validity and reliability. After the pilot testing, no amendments were necessary. SMEs from the pilot testing were not included in the full dataset. The measuring applied a seven-point Likert scale on an interval level ranging from “strongly disagree” to “strongly agree”.

Figure 4. Research outline



In order to test for non-response bias, we compared the distributions of early and late respondents in the sample using the Kolmogorov–Smirnov test (Ryans, 1974). Moreover, we tested for common method bias using Harman’s single-factor test (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Smart PLS software (Ringle, 2005) was selected to test the research model. Partial least squares (PLS) represents a variance-based structural equation modeling (SEM) technique which is suitable due to the complexity of the models since the models were newly developed and as such had not previously been tested, and since items in the data were not distributed normally (Chin, 1998; Chin, Marcolin, & Newsted, 2003).

Before we tested the structural model, we first examined the reflective part of the measurement model in order to assess construct and indicator reliability, internal consistency, convergent validity, and discriminant validity. In the continuance, the quality of the formative construct in the measurement model was determined through content

validity (Straub, Boudreau, & Gefen, 2004), multicollinearity (Diamantopoulos & Siguaw, 2006), and weights (Chin, 1998).

1.5 The structure of the dissertation

Corresponding to the research summary shown in Table 2, this doctoral dissertation is structured as a collection of three papers. Although each individual paper represents a distinct entity, there is a common thread running through the entire dissertation, logically adhering to the design of the research.

The following three sections each represent one research paper. As such, all of the next three sections have their own abstract with keywords, introduction, theoretical background, presentation of the research model (except section two), presentation of the research methodology, results, discussion, and conclusion. Nonetheless, references for all three papers are provided in a common section at the end of the dissertation.

The rest of the dissertation is structured as follows. After this introduction, the second section presents the first paper providing a comprehensive literature review and exploratory research along with the findings. The aim of these first and second research phases is to identify SME-specific determinants of BIS adoption at the firm level that guide the subsequent development and testing of a BIS adoption framework in the SME milieu. By leveraging semi-structured interviews involving BIS experts and adopters, and blending them with comprehensive IT/IS adoption literature, instrumental candidate determinants for delving deeper into BIS adoption in SMEs were identified in this part of research. After the introduction of the first paper, the next subsection looks more deeply at the candidate determinants and their appearance in the literature. This is followed by an explanation of the methodology employed and an analysis of findings from qualitative research regarding the suitability of the identified candidate adoption determinants within the BIS milieu. Lastly, section two provides a discussion and conclusion for this part of the research.

The third section presents the first of two confirmatory studies, i.e. BIS adoption research. In this section, we present a developed conceptual model for assessing the determinants of the BIS adoption process of evaluation, adoption, and use, which primarily answers the research question about which determinants are important for BIS adoption in SMEs at the firm level. Accordingly, the first subsection introduces the problem, followed by a summary of innovation adoption theory, while the rest of the third chapter is structured as follows. The third subsection reveals the research model and forms hypotheses, moving deeper into the theory underlying the determinants. This is followed by an explanation of the methodology used and an analysis of findings from the quantitative research. The section is then completed with a discussion and conclusions.

Table 2. Research summary

Research	Type	Data collection	Method	Major outcome	Paper
Literature review	qualitative	literature review	analyzing and synthesizing, categorization	69 identified candidate BIS adoption determinants	*Unpacking Business Intelligence Systems Adoption Determinants: An Exploratory Study of Small and Medium Enterprises*
Exploratory research	qualitative	2-phase, semi-structured interviews	grading, ranking	11 identified candidate BIS adoption determinants	
Confirmatory research – adoption	quantitative	online survey	structural equation modeling (SEM) - partial least squares (PLS)	validated BIS adoption model	*Understanding the Determinants of Business Intelligence Adoption Stages*
Confirmatory research – impact on firm performance	quantitative	online survey	structural equation modeling (SEM) - partial least squares (PLS)	validated model of BIS impact on firm performance	*Justifying Business Intelligence Adoption: Effect of Business Intelligence Systems Use on Firm Performance*

The second confirmatory study, i.e. researching BIS' impact on firm performance, is presented in chapter four. This chapter discuss the development of the conceptual model for assessing the determinants of BIS' impact on firm performance. The model, which

primarily answers the research question of how BIS use influences a firm's performance in the SME milieu, is studied in the section with the following structure: the first subsection provides an introduction to the problem, the second subsection summarizes the corresponding background theory, in the third subsection we present the research model and form hypotheses, delving deeper into the theory of determinants. The fourth subsection explains the methodology employed and presents an analysis of quantitative research findings, while the section is completed with a discussion and conclusions.

The work continues with section five, where a summary of the overall findings of the dissertation is represented. The next section is a reference section, followed by appendices, which include a long abstract in the Slovenian language.

A succinct research summary is presented in Table 2 where the described four phases of our doctoral dissertation research are shown along with their type of research, data collection nature, analysis techniques, major outcomes, and resultant research paper.

2 UNPACKING THE DETERMINANTS OF BUSINESS INTELLIGENCE SYSTEMS ADOPTION: AN EXPLORATORY STUDY OF SMALL AND MEDIUM ENTERPRISES[1]

Abstract

While extant business intelligence systems (BIS) adoption research mainly focuses on the adoption of BIS in large-sized organizations, our understanding of the adoption determinants and the process within small and medium enterprises (SME) is still limited. The aim of our research is to identify SME-specific determinants of BIS adoption at the firm level that will guide the development and testing of a BIS adoption framework in the milieu of SMEs. By leveraging semi-structured interviews involving BIS experts and adopters, and blending them with comprehensive IT/IS adoption literature, we identified instrumental candidate determinants for delving deeper into BIS adoption in SMEs.

Keywords: IT/IS adoption; firm level; business intelligence systems (BIS); small and medium enterprises (SME); exploratory study

2.1 Introduction

Information technologies (IT) and information systems (IS) entail significant investments for firms; investments from which they hope to realize returns in areas such as efficiency and improved decision-making (Agarwal & Prasad, 1998). While it has been widely noted that technological innovations are a primary driver of organizational productivity, if promising innovations cannot be widely adopted the benefits resulting from the investment will be limited (Zhu, Kraemer, & Xu, 2006). It is therefore imperative for firms to understand the process and determinants of IT/IS adoption and use (Karahanna et al., 1999).

In a decision-support setting, business intelligence systems (BIS) have emerged as a technological innovation offering data integration and analytical capabilities to provide stakeholders at various organizational levels with valuable information for their decision-making (Turban et al., 2010). The IS literature has long emphasized the positive impact of BIS-enabled information on decision-making, particularly when firms operate in highly competitive environments (Popovič et al., 2012). While a review of the literature from

[1] The paper presented in this chapter of the dissertation has been published as Puklavec, B., Oliveira, T., & Popovič, A. (2014). Unpacking Business Intelligence Systems Adoption Determinants: An Exploratory Study of Small and Medium Enterprises. *Economic and Business Review, 16*(2), 185-213. Preliminary findings from this paper have also been presented as Puklavec, B., Oliveira, T., & Popovič, A. (2014). BIS Adoption Determinants in SMEs: An Exploratory Study (Conference Paper); at *20th Americas Conference on Information Systems, AMCIS 2014*; Savannah, GA; United States; 7 August 2014 through 9 August 2014.

different disciplines shows no scarcity of BIS definitions (Elbashir et al., 2008; Trkman et al., 2010; Watson, 2009; Williams & Williams, 2007; Wixom & Watson, 2010), in this work we adopt the following definition of BIS: quality information in well-designed data stores, coupled with software tools that provide users with timely access, effective analysis, and intuitive presentation of the right information, enabling them to take the right actions or make the right decision (Popovič et al., 2012). Evaluating the adoption of BIS is vital for our understanding of the value and efficacy of implementing these systems. Nevertheless, while IT/IS adoption on the firm level is well researched regarding various IT/IS applications, our understanding of the factors affecting BIS adoption, and the adoption process itself, is quite limited.

Prior studies suggest there are key differences between BIS and other IS in several areas (Popovič et al., 2012). To begin with, the use of BIS is primarily voluntary and the benefits of BIS are more indirect and long-term than operational IS. Second, BIS users are typically decision-makers at higher organizational levels. Next, the information collected through BIS is more aggregated on the enterprise level and there is more sharing of information. Further, the structuredness of the information needs and processes within which ISs are used, and the structuredness of instructions for using the BIS, are considerably lower since the use is usually more explorative whereas the use of operational ISs is more exploitative. Last but not least, the focus is more on necessary data and their relevance rather than on the technological solution, and in the environment of BIS this data also comes from external sources, and not only from the processes themselves. Against this backdrop, we firmly believe that in order to fully understand the determinants (and their effects) on BIS adoption it is necessary to take an integrative view which considers prior IT/IS adoption studies and further develops them to address the specifics of BIS.

While prior research in the BIS field has primarily focused on large-sized firms (Popovič et al., 2012; Wixom & Watson, 2010; Yeoh et al., 2008), studies delving deeper in the milieu of small and medium enterprises (SME) are still scarce. Due to their inherent characteristics, namely fewer financial and human resources, greater risks, closer cooperation with partners (Eikebrokk & Olsen, 2007), and given their importance in a country's economic development, technological advancement, and job creation (Ayyagari, Demirguc-Kunt, & Maksimovic, 2011; Fink, 1998), we consider that the exploration of BIS adoption factors in these organizational entities can significantly add to the existing body of knowledge in this topical area of BIS research.

We augment the existing BIS research efforts by conducting an exploratory study of BIS adoption determinants in the SME milieu. Specifically, we aim to answer the following research question: *what are the firm-level determinants of BIS adoption in SMEs?* Our work focuses on the quest for determinants influencing IS adoption on the firm level (how a firm adopts new technology) as opposed to determinants that represent influential factors of acceptance on the individual level (i.e. the user/employee level within the firm)

considered within the Technology Acceptance Model (TAM) (Davis, 1989), Theory of Planned Behavior (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

The rest of the paper is structured as follows. The next section more deeply examines the candidate determinants and their appearance in the literature. This is followed by an explanation of methodology used and an analysis of findings from the qualitative research regarding the suitability of candidate adoption determinants identified within the BIS milieu. Finally, the paper concludes with a discussion and conclusion.

2.2 Theoretical background

While there is no lack of technology adoption theories and models at the individual level (e.g. Ajzen, 1991; Davis, 1989; Venkatesh et al., 2003), IT/IS adoption at the firm level has received less attention. Within this field, two prominent theoretical foundations are commonly employed, namely the Diffusion of Innovation (DOI) theory and the Technology-Organization-Environment (TOE) framework (Chong et al., 2009). DOI (Rogers, 1995) exposes three sets of factors that influence a firm's IT adoption intent, namely *individual/leader characteristics* (attitude to changes), *internal characteristics of the organizational structure* (centralization, complexity, formalization, interconnectedness, organizational slack, size), and *external characteristics of the organization* (system openness).

On the other hand, the TOE framework (Tornatzky & Fleischer, 1990) encompasses *external task environment*, *organization*, and *technology*. The environmental context includes industry characteristics and market structure, technology support infrastructure, and government regulation. The organizational context includes formal and informal linking structures, communication processes, size, and slack. The technology context consists of the availability and characteristics of technology.

Derived from the TOE framework and developed in the milieu of IT adoption in SMEs, the Iacovou model (Iacovou et al., 1995) offers, along with DOI and TOE, a valuable foundation for our study. The Iacovou model proposes three sets of small enterprise-specific factors, namely *perceived benefits of IT innovations*, *organizational readiness* (financial resources, IT resources), and *external pressures* (competitive pressure, trading partner power) (Iacovou et al. 1995).

When addressing a specific IT/IS adoption milieu, it is important to combine various theoretical models and relevant constructs to achieve a reliable insight into the adoption phenomenon (Oliveira & Martins, 2011). Prior IT/IS adoption studies have not considered the BIS milieu as an adoption phenomenon, thus leaving a research gap in this topical area. Through a comprehensive literature review, which provided nearly 70 determinants from

various IT/IS adoption studies, we sought to expand our understanding of the BIS adoption phenomena by collecting relevant evidence about BIS-specific determinants and establishing the list of candidate BIS adoption factors.

To frame the breadth and depth of our theoretical foundations, we considered works appearing in 11 instrumental journals from the researched field in the past decade. The first eight journals (i.e. MIS Quarterly, Information Systems Research, Journal of the Association for Information Systems, Journal of Management Information Systems, European Journal of Information Systems, Information Systems Journal, Journal of Strategic Information Systems, and Journal of Information Technology) appear in the Association for Information Systems list of IS journals (Members of the Senior Scholars Consortium, 2011). To this list, we added three more journals that are deemed important for a broader range of the research context (i.e. Information & Management, Decision Support Systems, and Management Science). All of the chosen journals are considered to be top quality according to the Academic Journal Quality Guide (Harvey et al., 2010). As the researched topic forms part of the rapidly changing IT/IS research field, we focused on volumes published over the past 10 years.

To further narrow the focus of our research, within the pool of selected academic outlets we looked for the following keywords when deciding to include individual works: *business intelligence*, *adoption*, *innovation*, *SME*, *management information systems* and *decision support*.

The literature review that followed the procedure explained above returned an ample number of candidate determinants (69) that were hard to manage. For better understanding and further analysis, these determinants were organized in groups that were further mapped to TOE framework contexts. In the following paragraphs, we provide more detailed information about the identified determinants. Candidate determinants and their presence in previous adoption research are summarized in groups in Tables 2 through 4.

2.2.1 The environmental context

We begin with the environmental context of the TOE framework (Tornatzky & Fleischer, 1990). Within this context, we organized the identified candidate determinants in eight groups. *Linked firm* represents vertical linkages to connected firms; these may be important when the parent firm can use its size advantage to experiment with innovations and then transfer them to the subsidiaries, or it may even require its subsidiaries to use a certain type of IT and/or IS (Premkumar & Roberts, 1999).

Competitors is the group that reflects competitors' pressures to adopt an innovation. Intense competition can cause a firm to look for new ways of doing business (Ifinedo,

2011), whereas mimetic pressures may further cause a firm to change over time to become more like other firms in its nearby environment (Liang, Saraf, Hu, & Xue, 2007).

Customers is the group within the environmental context representing clients' pressures to adopt an IT-enabled innovation (e.g. Ifinedo, 2011; Mehrtens, Cragg, & Mills, 2001), as well as a firm's own desire to provide enhanced customer services with the help of new IT-enabled innovation (Daniel & Grimshaw, 2002).

Further, a group of determinants regarding *industry & market* characteristics also influences technology adoption. It consists of market complexity (Buonanno et al., 2005); industry pressures, which is related to the efforts of industry associations to proclaim standards related to innovation and encourage adoption (Chwelos, Benbasat, & Dexter, 2001), and expectations of market trends as an environmental adoption factor, that can force firms (similarly to competitors' pressure) to adopt an innovation (Chong et al., 2009).

Various influences on adoption can also be induced by business *partners*. Dependency on a trading partner is the first candidate factor from this group. It captures the potential power of a trading partner to "encourage" innovation adoption (Chwelos et al., 2001). Trading partner power is also a significant variable in the external pressure context (Iacovou et al., 1995). A firm that depends on a trading partner can be influenced to adopt an innovation. Influence strategy, like rewards and threats, can be exercised with various strengths (Chwelos et al., 2001). New technologies can also improve transactions and relationships between business partners (Ifinedo, 2011). That is why sometimes business partners influence the adoption of an innovation in an observed company. The expectation held by one firm that another will not exploit its vulnerabilities when faced with the opportunity to do so (Venkatesh & Bala, 2012) is the next candidate BIS adoption factor, expressed as relational trust. To increase some of the effects of the innovation, companies need to develop cooperation with trading partners in the community. In some cases, the bigger the community, the greater the benefits of the innovation (Zhu, Kraemer, Gurbaxani, & Xu, 2006). Trading partner readiness can be an adoption factor in cases where the observed firm is motivated and ready to adopt an innovation, but is unable to adopt it due to its trading partners not being ready (Chwelos et al., 2001).

To move on, *regulators* surfaced as another environment-related group of determinants that influences adoption by way of legal barriers, defined as the lack of institutional frameworks and business laws governing the use of innovation, which can pose a barrier to the adoption of an innovation (Zhu, Kraemer, Gurbaxani, et al., 2006), by way of government regulation (Tornatzky & Fleischer, 1990) or the regulatory environment (Zhu, Kraemer, & Xu, 2006). Another variable pertinent to this group is government support, viewed as "assistance provided by the authority to encourage the spread of IS innovations in businesses" (Ifinedo, 2011).

Table 3. BIS in SME adoption candidate determinants from the **environmental context** and references to prior works

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
1.1. Linked firm		
1.1.1. Vertical linkages / Supply chain integration	Buonanno et al. (2005); Premkumar and Roberts (1999)	Tsai, Lee, and Wu (2010); White, Daniel, Ward, and Wilson (2007)
1.2. Competitors		
1.2.1. Competitors' pressure	Chwelos et al. (2001); Daniel and Grimshaw (2002); Grandon and Pearson (2004); Iacovou et al. (1995); Ifinedo (2011); X. L. Li, Troutt, Brandyberry, and Wang (2011); Ling (2001); Premkumar and Roberts (1999); Quaddus and Hofmeyer (2007); Thong (1999)	Bose and Luo (2011); Chong et al. (2009); Frambach and Schillewaert (2002); Gu, Cao, and Duan (2012); Hsu et al. (2006); Hwang, Ku, Yen, and Cheng (2004); Jeyaraj, Balser, Chowa, and Griggs (2009); Oliveira and Martins (2010); Soares-Aguiar and Palma-dos-Reis (2008); Tung and Rieck (2005); Zhu, Kraemer, and Xu (2006)
1.2.2. Mimetic pressures		Liang et al. (2007); Teo, Wei, and Benbasat (2003)
1.3. Customers		
1.3.1. Customers' pressure	Daniel and Grimshaw (2002); Ifinedo (2011); Mehrtens, Cragg, and Mills (2001)	
1.3.2. Enhanced customer service	Daniel and Grimshaw (2002)	Jeyaraj et al. (2009)
1.4. Industry & market		
1.4.1. Expectations of market trends		Chong et al. (2009)
1.4.2. Industry & market complexity	Buonanno et al. (2005)	Tornatzky and Fleischer (1990)
1.4.3. Industry pressure	Chwelos et al. (2001); Grandon and Pearson (2004); Thong (1999)	Jeyaraj et al. (2009); Tung and Rieck (2005)

(table continues)

(continued)

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
1.5. Partners		
1.5.1. Dependency on trading partner	Chwelos et al. (2001); Grandon and Pearson (2004)	
1.5.2. Network effects		Zhu, Kraemer, Gurbaxani, et al. (2006)
1.5.3. Partner power/pressure	Caldeira and Ward (2002); Chwelos et al. (2001); Daniel and Grimshaw (2002); Grandon and Pearson (2004); Iacovou et al. (1995); Ifinedo (2011); Ling (2001); Quaddus and Hofmeyer (2007)	Hsu et al. (2006)
1.5.4. Relational trust		Chong et al. (2009); Venkatesh and Bala (2012)
1.5.5. Trading partner readiness	Chwelos et al. (2001)	Oliveira and Martins (2010); Soares-Aguiar and Palma-dos-Reis (2008)
1.6. Regulators		
1.6.1. Legal barriers		Hsu et al. (2006); Zhu, Kraemer, Gurbaxani, et al. (2006)
1.6.2. Regulatory environment / Government support	Grandon and Pearson (2004); Ifinedo (2011); Ling (2001); Quaddus and Hofmeyer (2007)	Bose and Luo (2011); Hsu et al. (2006); Tornatzky and Fleischer (1990); Tung and Rieck (2005); Zhu, Kraemer, and Xu (2006)
1.7. Providers		
1.7.1. External support	Caldeira and Ward (2002); Y. Lee and Larsen (2009); Premkumar and Roberts (1999); Quaddus and Hofmeyer (2007)	Hong and Zhu (2006); Hwang et al. (2004)
1.7.2. Supplier marketing activity		Frambach and Schillewaert (2002)
1.8. Broad		
1.8.1. Coercive pressures		Liang et al. (2007); Teo et al. (2003)
1.8.2. Critical mass	Ling (2001); Quaddus and Hofmeyer (2007)	

(table continues)

(continued)

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
1.8.3. Cultural differences	Ling (2001)	
1.8.4. Normative pressures		Liang et al. (2007); Teo et al. (2003)
1.8.5. Social influences		Tung and Rieck (2005)

One special group of partners are the *providers* of the innovation. Their external support as the next candidate refers to the availability of support for implementing and using an innovation. Some authors state that increased outsourcing and third-party support have an important impact on adoption. Organizations are namely more willing to risk trying an innovation if they have adequate vendor or external support for the innovation (Premkumar & Roberts, 1999). Vendor support is one of two predictors with the highest predictive power concerning IT innovation adoption in information systems and computer science by Basole, Seuss, and Rouse (2013). According to Jeyaraj, Rottman, and Lacity (2006), external information sources are one of the best IT adoption predictors. Further, providers' marketing activities about an innovation can significantly influence IT adoption. Three main factors that are important in this case are the targeting of the innovation, its communication, and the activities the provider undertakes to reduce the perceived risk of the potential customer (Frambach & Schillewaert, 2002).

Beside the groups described above from the environmental context we identified additional determinants that do not universally fit within the groups described earlier. Thus, we included these determinants in a distinct group named *Broad*. To begin with, social influence, namely the perception of the public, prospective investors, and other stakeholders as to the attractiveness of the firm adopting the innovation (Tung & Rieck, 2005) is one of the determinants from this group. The usefulness of an innovation sometimes depends on the level of use of the innovation (critical mass) in the environment (Ling, 2001). Cultural differences between different countries may affect the organization's ability to adopt and utilize an innovation (Ling, 2001). Also belonging to this group are coercive and normative pressure (Liang et al., 2007) and other determinants from the broader environment.

2.2.2 The organizational context

The next dimension of the TOE framework is the organizational context (Tornatzky & Fleischer, 1990). The first group of determinants explaining internal influences on a firm's adoption is firm *characteristics*. Quaddus and Hofmeyer (2007) suggest organizational characteristics such as business type, product type, etc. Next, widely used adoption factors also include the size of the firm, often identified by the number of employees in a firm (Rogers, 1995) and the age of the firm (Bruque-Camara, Vargas-Sanchez, & Hernandez-

Ortiz, 2004). A more extensive adoption should be linked with the likelihood that firms that have been longer in the market have more contact with the IT used in the sector. Global scope, as the next factor in this group, is suggested as the geographical extent of a firm's operations in the global market (Zhu & Kraemer, 2005). Firms may face increased costs when they expand into heterogeneous markets, hence firms with a greater global scope may have bigger needs to adopt some IS innovations as they can help reduce certain transaction costs (Zhu, Kraemer, & Xu, 2006). Next, the desire to expand its market reach can also influence a firm to adopt an innovation (Daniel & Grimshaw, 2002). To continue, the degree of functional extension refers to the number of strategic functions directly managed within the firm (Buonanno et al., 2005), namely the opposite of outsourcing, and can influence adoption. Further, firms with a higher level of diversification in terms of products, markets, and technologies will have a greater need to coordinate and control activities (Buonanno et al., 2005), which can lead to a larger need to adopt an IT innovation. As management of the information flow is a crucial issue for firms with branch offices that need to be remotely controlled (Buonanno et al., 2005), we add the presence of branch offices as the last candidate BIS adoption factor in this group.

In the *collaboration* group, internal processes, communication processes which firms use to communicate knowledge and stimulate technology adoption, can be important adoption factors, whereas lack of experience and knowledge about communicating information about new systems to employees hinders their adoption (Ling, 2001). Communication processes represent an adoption factor in the organizational context of the TOE framework (Tornatzky & Fleischer, 1990). Another internal characteristic of organizational structure is interconnectedness; viewed as the "degree to which the units in a social system are linked by interpersonal networks" (Rogers, 1995). Frambach and Schillewaert (2002) assert that the higher the degree of information sharing, the more likely it is that organizations are exposed to new ideas and products. Such informal networks may either connect organizations within the industry or organizations in different industries. Formal and informal linking structures among employees also belong to the organizational context of TOE (Tornatzky & Fleischer, 1990), which can significantly affect the adoption process. Degree of integration can represent links with extensive communication to coordinate activities on one side, or largely hierarchies characterized by bureaucracy with little integration between business functions on the other (Bajwa, Lewis, Pervan, & Lai, 2005). According to Bruque-Camara et al. (2004), flexibility measures the lack of bureaucracy in an organization. The use of inter-departmental working groups to solve key problems (Bruque-Camara et al., 2004) may be related to the adoption process as technology innovation is generally a project-oriented process. In the view of Hwang et al. (2004), the skills of the project team affect the decision on adopting an innovation. Proposed by Bruque-Camara et al. (2004), conflict as a measure of the disharmony or lack of consensus existing in the organization is the next candidate adoption factor. Last but not the least, according to Hwang et al. (2004) the participation of users in the adoption stage affects the adoption of IS. According to Basole et al. (2013), user involvement is a factor holding high

predictive power concerning the adoption of IT in information systems and computer science.

Table 4. BIS in SME adoption candidate determinants from the **organizational context** and references to prior works

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
2.1. Characteristics		
2.1.1. Degree of functional extension	Buonanno et al. (2005)	
2.1.2. Global scope / Expansion of market reach	Daniel and Grimshaw (2002)	Hsu et al. (2006); Soares-Aguiar and Palma-dos-Reis (2008); Zhu, Kraemer, and Xu (2006)
2.1.3. Level of diversification	Buonanno et al. (2005)	
2.1.4. Organization characteristics	Quaddus and Hofmeyer (2007)	
2.1.5. Organization age	Caldeira and Ward (2002)	Bruque-Camara et al. (2004)
2.1.6. Presence of branch offices	Buonanno et al. (2005)	
2.1.7. Size	Buonanno et al. (2005); Hameed et al. (2012); Y. Lee and Larsen (2009); Ling (2001); Premkumar and Roberts (1999); Thong (1999)	Bajwa et al. (2005); Bose and Luo (2011); Bruque-Camara et al. (2004); Frambach and Schillewaert (2002); Gu et al. (2012); Hsu et al. (2006); Hwang et al. (2004); Oliveira and Martins (2010); Ramamurthy, Sen, and Sinha (2008); Rogers (1995); Soares-Aguiar and Palma-dos-Reis (2008); Tornatzky and Fleischer (1990); Zhu, Kraemer, and Xu (2006)
2.2. Collaboration		
2.2.1. Communication	Ling (2001)	Bruque-Camara et al. (2004); Chong et al. (2009); Tornatzky and Fleischer (1990); White et al. (2007)
2.2.2. Conflict		Bruque-Camara et al. (2004)

(table continues)

(continued)

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
2.2.3. Interconnectedness / Social network		Frambach and Schillewaert (2002); Rogers (1995); White et al. (2007)
2.2.4. Linking structures / Degree of integration / Flexibility	Ling (2001)	Bajwa et al. (2005); Bruque-Camara et al. (2004); Frambach and Schillewaert (2002); Tornatzky and Fleischer (1990)
2.2.5. Participation of users		Hwang et al. (2004)
2.2.6. Working groups / Skills of project team		Bruque-Camara et al. (2004); Gu et al. (2012); Hwang et al. (2004)
2.3. Features		
2.3.1. Organizational absorptive capacity	Ling (2001); Thong (1999)	Ramamurthy et al. (2008); Tsai et al. (2010); White et al. (2007)
2.3.2. Organizational culture	Ling (2001)	Gu et al. (2012)
2.3.3. Organizational innovativeness		Frambach and Schillewaert (2002); Jeyaraj et al. (2009); Venkatesh and Bala (2012)
2.3.4. Previous experience in using IT		Bruque-Camara et al. (2004)
2.3.5. Propensity to change / IS/IT training	Caldeira and Ward (2002)	Bruque-Camara et al. (2004)
2.3.6. Satisfaction with present state		Gu et al. (2012); Hong and Zhu (2006)
2.3.7. System openness		Rogers (1995)
2.4. Management		
2.4.1. Centralization	Hameed et al. (2012)	Bajwa et al. (2005); Rogers (1995)
2.4.2. Formalization	Hameed et al. (2012)	Rogers (1995)
2.4.3. Leaders attitude toward changes / Management support / Organizational commitment	Caldeira and Ward (2002); Hameed et al. (2012); Ifinedo (2011); Ling (2001); Premkumar and Roberts (1999); Quaddus and Hofmeyer (2007); Thong (1999)	Bruque-Camara et al. (2004); Chong et al. (2009); Hwang et al. (2004); Ramamurthy et al. (2008); Rogers (1995); Tsai et al. (2010); Tung and Rieck (2005)

(table continues)

(continued)

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
2.4.4. Managerial complexity / Perceived obstacles	Thong (1999)	Hong and Zhu (2006); Soares-Aguiar and Palma-dos-Reis (2008); Zhu, Kraemer, Gurbaxani, et al. (2006); Zhu, Kraemer, and Xu (2006)
2.4.5. Power relationships	Caldeira and Ward (2002)	
2.4.6. Project champion	Hameed et al. (2012)	Bose and Luo (2011); Chong et al. (2009); Gu et al. (2012); Hwang et al. (2004); White et al. (2007)
2.4.7. Risk propensity	X. L. Li et al. (2011)	
2.5. Resources		
2.5.1. Development competencies	Caldeira and Ward (2002)	Gu et al. (2012)
2.5.2. IS department size	Caldeira and Ward (2002); Hameed et al. (2012)	Bajwa et al. (2005); Hwang et al. (2004)
2.5.3. IT expertise	Caldeira and Ward (2002); Hameed et al. (2012); X. L. Li et al. (2011); Premkumar and Roberts (1999); Thong (1999)	Bruque-Camara et al. (2004); Hong and Zhu (2006); Soares-Aguiar and Palma-dos-Reis (2008)
2.5.4. Organizational data environment		Ramamurthy et al. (2008)
2.5.5. Organizational readiness	Grandon and Pearson (2004); Hameed et al. (2012); Ifinedo (2011); Ling (2001); Mehrtens et al. (2001); Quaddus and Hofmeyer (2007)	Ramamurthy et al. (2008); Tsai et al. (2010)
2.5.6. Slack	X. L. Li et al. (2011)	Hwang et al. (2004); Jeyaraj et al. (2009); Rogers (1995); Tornatzky and Fleischer (1990)

Various *features* of the firm can also be considered to be significant adoption factors. For example, the understanding of culture is important for the study of information technologies. Culture at various levels (national, organizational, group) can affect the success of IT. It also plays a role in managerial processes that may influence adoption (Leidner & Kayworth, 2006). Organizational culture is in addition one of two predictors with the highest predictive power for IT innovation adoption in information systems and

computer science according to Basole et al. (2013). Another possible BIS adoption determinant is absorptive capacity, defined as the ability of key organizational members to utilize available or preexisting knowledge (Ramamurthy et al., 2008). A further candidate in this group is organizational innovativeness, viewed as the notion of openness to new ideas as an aspect of a firm's culture (Venkatesh & Bala, 2012). Next, external characteristics of the firm are, beside individual (leader) characteristics and internal characteristics of the organizational structure, another group of adoption factors in DOI theory. They refer to system openness (Rogers, 1995). Existing systems can also play an important role in adoption processes. According to Gu et al. (2012), higher levels of satisfaction with existing systems are negatively associated with adoption. On the other hand, previous experience in using IT may also foster the adoption of new technologies and result in extensive IT adoption (Bruque-Camara et al., 2004). Another candidate that could influence the BIS adoption process is the propensity to change (including the change related to the new IT) of members of the organization (Bruque-Camara et al., 2004). A similar factor is the intention to take IS/IT training (to increase/change level of knowledge) to achieve IS/IT success (Caldeira & Ward, 2002).

Another important group of determinants relates to the *management* of the company. Leaders' attitude to changes is an individual characteristic that represents part of DOI theory (Rogers, 1995). Same or closely related factors are also present in other studies, like in Ifinedo (2011) where "management support" is stated as the engagement of top management in implementing the IS, which plays a crucial role in influencing other organizational members to accept it. Decision-making in SMEs is often a part of the top management, therefore a similar factor can be expressed as "top management support" (Premkumar & Roberts, 1999), which is one of the top predictors of the adoption of an IT innovation in the IS and computer science fields (Basole et al., 2013). Centralization is another adoption factor derived from DOI theory. It forms part of the internal characteristics of the organizational structure and reflects the degree to which power and control in a system are concentrated in the hands of a relatively few individuals (Rogers, 1995). It was also used in other research like Bajwa et al. (2005) where it is expressed as the degree of centralization or concentration of decision-making activity. The next representative of DOI's internal characteristics of organizational structure is formalization, which is the "degree to which an organization emphasizes its members following rules and procedures" (Hameed et al., 2012; Rogers, 1995). Managerial complexity, as the next candidate determinant, is the level of complexity and attendant risk associated with making process changes and the organizational adjustments necessary to accommodate the new innovation (Zhu, Kraemer, Gurbaxani, et al., 2006). In some cases, it can be expressed as managerial obstacles, which refer to the lack of managerial skills for managing organizational adaptations (Zhu, Kraemer, & Xu, 2006). Power relationships are explained in Caldeira and Ward (2002) as possible conflict between managers which can emerge during the adoption process because of different perspectives on roles and responsibilities, or as differences in opinion on priorities, etc. Risk propensity is a decision-maker's

consistent tendency to take or avoid choices believed to be risky. It is an organizational-level variable denoting the extent to which a firm is willing to take risks (X. L. Li et al., 2011). A high-level individual for promoting an innovation within a firm (Hameed et al., 2012) is called a project/product champion. The adopting organization will have a higher adoption level if it appoints a project champion with an innovation-related background who has also been involved in similar projects before (Chong et al., 2009).

The last group of determinants in the organizational context relates to the company's *resources*. Slack, defined as the extent to which uncommitted resources are available to an organization (Rogers, 1995), forms part of both DOI and the TOE framework. As BIS exercise higher levels of voluntariness of use (Popovič et al., 2012) and are, as such, more sensitive to the availability of resources, slack could be an important factor in BIS adoption. According to Hameed et al. (2012), IS department size means the existing IT function and dedicated IT personal within the organization. The size of the IT function is closely connected with the time and labor needed to adopt new technology (Hwang et al., 2004). Firms that do not possess IT/IS expertise may even be unaware of new technologies or may simply not want to risk the adoption of these innovations (Premkumar & Roberts, 1999). A similar variable is IT-staff skills (Bruque-Camara et al., 2004). Professionalism of the IS unit is one of the best predictors of IT adoption according to Jeyaraj et al. (2006). Similar to IT expertise but a broader factor is organizational readiness as the availability of the required organizational resources (not only physical assets, but also human knowledge of IS) for adoption (Ifinedo, 2011). Hameed et al. (2012) define it as the level of awareness, resources, commitment, and governance for adoption. Development competencies is a candidate factor that refers to ability of a firm to develop IS/IT knowledge in-house or have IS/IT knowledge readily available from associated IS/IT enterprises (Caldeira & Ward, 2002). A data environment that is not properly managed is likely to face problems relating to quality, reliability, security, availability, integrity, and standards. Such an environment would pose greater challenges for introducing innovation (Ramamurthy et al., 2008).

2.2.3 The technological context

Finally, we look at the technological context of the TOE framework (Tornatzky & Fleischer, 1990). Here, we investigate the determinants through two groups. The first group, i.e. *innovation*, explores the influence of BIS characteristics on its adoption. The literature highlights complexity (Chong et al., 2009) or perceived ease of use (Grandon & Pearson, 2004) as pair-wise opposite views, or decision-makers' knowledge and expertise (Rogers, 1995) to depict how innovation is perceived as relatively difficult to understand and use. Other determinants pertaining to this group are the expected or perceived benefit of innovations (Chwelos et al., 2001; Iacovou et al., 1995; Mehrtens et al., 2001; Venkatesh & Bala, 2012; Zhu, Kraemer, Gurbaxani, et al., 2006), relative advantage (Ifinedo, 2011; Premkumar & Roberts, 1999), and internal needs (Hwang et al., 2004).

Perceived benefits and cost can also be found as top predictors of IS adoption with high predictive power (Basole et al., 2013). Especially for small businesses, the cost of IT/IS is still a big deterrent to adoption, and therefore firms evaluate the cost relative to the benefits before adopting a new technology (Premkumar & Roberts, 1999). Financial resources, as an organizational readiness factor in Iacovou et al. (1995), is closely connected to the cost of an innovation and thus warrants its inclusion as a factor related to cost in the study. Further, perception of strategic value, depicting how innovation can help with the firm's strategic activities, i.e. help with operational support, managerial productivity, and strategic decision aids (Grandon & Pearson, 2004), is another relevant construct. Perceived risk is the next possible factor representing the degree of risk (technical or other) associated with the adoption or use of an innovation (White et al., 2007). Finally, there is process compatibility, emphasizing the extent to which innovations are perceived as being consistent with existing methods for executing their mission (Venkatesh & Bala, 2012).

Table 5. BIS in SME adoption candidate determinants from the **technological context** and references to prior works

CANDIDATE DETERMINANT	***SME STUDIES***	***GENERAL AND OTHER STUDIES***
3.1. Innovation		
3.1.1. Perceived ease of use / Complexity	Grandon and Pearson (2004); Ifinedo (2011); X. L. Li et al. (2011); Premkumar and Roberts (1999)	Chong et al. (2009); Frambach and Schillewaert (2002); Y. Lee and Kozar (2008); Ramamurthy et al. (2008); Rogers (1995)
3.1.2. Expected benefits / Relative advantage	Caldeira and Ward (2002); Chwelos et al. (2001); Daniel and Grimshaw (2002); Grandon and Pearson (2004); Iacovou et al. (1995); Ifinedo (2011); X. L. Li et al. (2011); Ling (2001); Mehrtens et al. (2001); Premkumar and Roberts (1999); Quaddus and Hofmeyer (2007); Thong (1999)	Chong et al. (2009); Frambach and Schillewaert (2002); Gu et al. (2012); Hsu et al. (2006); Hwang et al. (2004); Y. Lee and Kozar (2008); Oliveira and Martins (2010); Ramamurthy et al. (2008); Tsai et al. (2010); Tung and Rieck (2005); Venkatesh and Bala (2012); White et al. (2007); Zhu, Kraemer, Gurbaxani, et al. (2006)
3.1.3. Innovation observability	Ling (2001)	White et al. (2007)
3.1.4. Innovation trialability	Ling (2001)	White et al. (2007)

(table continues)

(continued)

CANDIDATE DETERMINANT	*SME STUDIES*	*GENERAL AND OTHER STUDIES*
3.1.5. Perceived risk		White et al. (2007)
3.1.6. Perception of strategic value	Grandon and Pearson (2004)	
3.1.7. Process compatibility	Grandon and Pearson (2004); Ifinedo (2011); Ling (2001); Premkumar and Roberts (1999); Thong (1999)	Chong et al. (2009); Frambach and Schillewaert (2002); Y. Lee and Kozar (2008); Venkatesh and Bala (2012); White et al. (2007)
3.1.8. Cost / Financial resources	Caldeira and Ward (2002); Chwelos et al. (2001); Grandon and Pearson (2004); Hameed et al. (2012); Iacovou et al. (1995); Y. Lee and Larsen (2009); Premkumar and Roberts (1999)	Bose and Luo (2011); Chong et al. (2009); Hong and Zhu (2006); Hwang et al. (2004); Jeyaraj et al. (2009); Y. Lee and Kozar (2008); Tung and Rieck (2005); Zhu, Kraemer, Gurbaxani, et al. (2006)
3.2. Readiness		
3.2.1. Standards uncertainty		Venkatesh and Bala (2012)
3.2.2. Technology availability / Quality of software available in the market	Caldeira and Ward (2002)	Tornatzky and Fleischer (1990)
3.2.3. Technology fit		Bruque-Camara et al. (2004)
3.2.4. Technology infrastructure	Ling (2001)	Bajwa et al. (2005); Soares-Aguiar and Palma-dos-Reis (2008); Tornatzky and Fleischer (1990)
3.2.5. Technology integration		Hong and Zhu (2006); Oliveira and Martins (2010); Zhu, Kraemer, and Xu (2006)
3.2.6. Technology readiness	Chwelos et al. (2001); Hameed et al. (2012); Iacovou et al. (1995)	Bose and Luo (2011); Chong et al. (2009); Gu et al. (2012); Hsu et al. (2006); Oliveira and Martins (2010); Tornatzky and Fleischer (1990); Venkatesh and Bala (2012); Zhu, Kraemer, and Xu (2006)

The second group in the technological context is discussing technological *readiness* to adopt an innovation. Within this group, standards uncertainty, depicted as the inability to accurately forecast whether an innovation and associated technologies will be stable over time and able to deliver the intended outcomes (Venkatesh & Bala, 2012), appears as a noteworthy adoption factor. Next, technology availability (Tornatzky & Fleischer, 1990) surfaces as a relevant adoption factor that refers to the availability of external technologies that are relevant to the firm. Some studies, like Caldeira and Ward (2002), extended this availability factor with the need to have sufficient quality for the respective purpose. Another factor pertaining to this group measures how existing technology fits with the socio-economic system of the firm (Bruque-Camara et al., 2004). Moreover, technology integration, viewed as the degree of interconnectivity among back-office IS with databases inside the company and those externally integrated with suppliers' enterprise systems and databases (Zhu & Kraemer, 2005), is also deemed important. Factors that express the ability of internal technology to adopt new technology or the degree to which a firm has the necessary technology infrastructure in place to adopt, are also widely used in adoption studies. Tornatzky and Fleischer (1990) include this variable within technology characteristics. Other authors use this or similar variables in their models as technology readiness (Venkatesh & Bala, 2012; Zhu, Kraemer, & Xu, 2006), IT sophistication (Chwelos et al., 2001), or IT resources (Iacovou et al., 1995). In Iacovou et al. (1995), IT resources belong to the organizational readiness aspect of the model. Finally, the observability of an innovation, referring to the extent to which the relative advantage or gains of innovation are clear (Ling, 2001), and the trialability of an innovation, considered as the degree to which an innovation can be pilot tested or experimented (Ling, 2001), are the two determinants completing our literature review.

The above comprehensive literature review provides a solid foundation for proceeding with a further narrowing of the determinants to suit our research goals. In order to do so, through a qualitative survey we explored which of these determinants are deemed relevant for the milieu under study.

2.3 Identification of firm-level BIS adoption determinants in the SME milieu

To develop a more nuanced understanding of the literature-derived determinants, data were collected through 10 face-to-face semi-structured interviews by one of the three researchers. The interviews were carried out through a two-phase approach, which permits in-depth exploration of the research question. Informants were selected by way of criterion sampling among four SMEs identified as BIS adopters (i.e. incumbents of decision-makers holding adequate knowledge about BIS adoption within the firm), and six BI professionals from the field, all sufficiently familiar with the BIS adoption phenomenon in SMEs to adequately discuss the subject. We mostly considered experiences in BIS adoption and use,

work position and also broader experiences with IS/IT utilization. All informants came from different companies located in the European Union that mostly operated internationally. Detailed information about the informants is shown in Table 6.

Table 6. Informants' characteristics

	Project role	**Company type**	**Company size**	**Work position**	**Years holding position**	**Working with BIS** (years)
1	Expert	IS development	Middle enterprise	Product manager for BIS	10	14
2	Adopter	Engineering and production	Middle enterprise	Head of IT sector	2	1
3	Expert	Education	Middle enterprise	Assistant professor for business informatics	2	12
4	Expert	IS implementation and support	Small enterprise	IS implementation senior adviser	7	17
5	Adopter	Advertising	Small enterprise	Director of the company	14	1
6	Adopter	Distribution and service	Middle enterprise	Head of IT and controlling	5	4
7	Expert	IS development and implementation	Middle enterprise	BI unit manager	7	9
8	Expert	IS implementation and support	Small enterprise	Director / ERP implementation & support specialist	4	9
9	Adopter	Sale and distribution	Middle enterprise	Work coordinator	7	4
10	Expert	IS implementation and support	Small enterprise	Director / ERP implementation & support specialist	7	5

2.3.1 First phase – Identification of BIS-related determinants

The first interview phase was conducted in January and February 2014. An interview guide was purposefully constructed to permit a comprehensive exploration of the factors impacting BIS adoption, especially in a small or medium-sized company (see Appendix A). All interviews were recorded with the consent of the participants for later analyses and on average lasted nearly 50 minutes.

This phase consisted of two parts. In the first, unstructured part informants were asked questions without seeing the results of our literature review, i.e. a list of candidate determinants. In the second (structured) part, informants were asked questions about the candidate determinants we had identified in the literature review. We decided for this approach to ensure an innate response at the beginning of the interviews.

In the unstructured part, informants were first asked to point out the factors that, in their opinion, are the most important for BIS adoption in SMEs (experts), or which factors prevailed in their decision to adopt BIS (adopters). In the next step, informants were asked to express their level of agreement about the influence of the previously expressed factors on BIS adoption. For this, a 7-point Likert scale was employed, where 1 reflected complete disagreement about the influence of a specific determinant whereas 7 was linked to full agreement on the influence of a determinant.

From our unstructured data, we first compiled separate sets of determinants for each participant. We identified patterns and variance in descriptions of which factors were deemed influential for BIS adoption. To assess the reliability of the generated determinants, we then involved a second researcher with qualitative research experience. Disagreements were resolved by discussion between the first author and the other researcher. Next, we linked the related concepts with individual determinants. During this stage, we examined all conclusions derived from the initial compilation and established links between and among the previously stated determinants. To deepen our understanding and explanation, we compared each determinant across different compiled sets. Our main intent was to compare and contrast the determinants identified by different participants. Our profound data analysis moved back and forth between the emerging determinants and sought to explore broadly possible explanations for our findings and enable a focus on the explanation that best fits with the data. The above analysis provided us with 10 candidate determinants for the second interview phase. For inclusion in the second phase, each determinant had to be emphasized by at least two participants and needed to be graded highly (at least 6 out of 7) on the Likert scale employed.

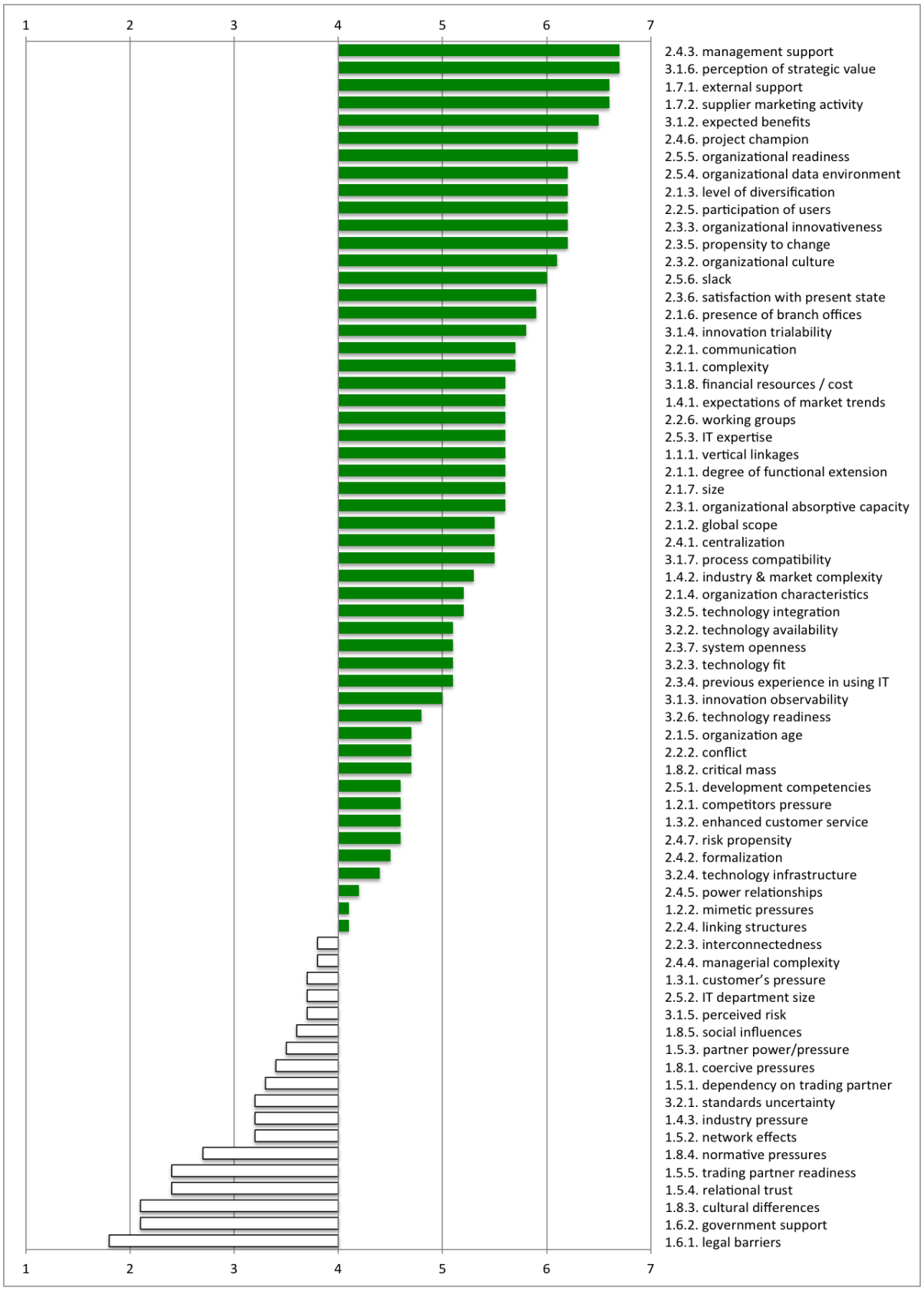
Following the unstructured part of the interviews as presented above, we carried out the structured part of the first-phase interviews. Within this part, the participants were called to assess the determinants the researchers had collected from the literature. From the

structured part of the interviews we recognized 17 candidate determinants; 4 determinants matched those ones from the unstructured data analysis whereas 13 determinants were newly identified. In this part, informants were asked to express their agreement about the influence of the factors which we had previously discovered during the literature review. A 7-point Likert scale, like in the unstructured part, was also used here. The 17 emphasized candidate determinants are those which reach an average grade of 6 ("I strongly agree that the given determinant influenced…") or higher among all participants, and/or were stated as "one of the most important" during the explanation of a given grade by at least two participants. To achieve reliable results without showing favoritism for those factors listed first, each interview began with a different factor (an interval of 7 was used). Results of the analysis of the structured part are presented in Figure 5.

Together, the unstructured (10 candidate determinants) and structured (13 candidate determinants) parts provided a total of 23 candidate determinants suitable for inclusion in the next research phase. Besides these candidate determinants, additional characteristics of BIS adoption in SMEs were identified. To begin with, the majority of determinants that were labelled as influential come from the organizational context (i.e. *level of diversification, organization characteristics, presence of branch offices, size, participation of users, organizational culture, organizational innovativeness, propensity to change, satisfaction with present state, management support, project champion, organizational data environment, organizational readiness, professional competence* and *slack*). *External support* and *supplier marketing activity* were then emphasized as dominant determinants of the environmental context, whereas *complexity, expected benefits, innovation trialability, perception of strategic value, cost* and *BIS is part of ERP feature* are the significant determinants linked with the technological context. Moreover, this phase also revealed that *government support, legal barriers, normative pressures, trading partner readiness, relational trust among trading partners* and *cultural differences among countries* are not deemed to be influential factors in BIS adoption decisions within SMEs.

To gain a comprehensive understanding of BIS adoption determinants in the context under study, participants were asked, both following the unstructured part as well as the structured part of the first phase, to express their view about which (if any) determinants would differ in the case of a large-firm milieu. In general, the informants agreed that differences between BIS adoption in SMEs and large firms do exist. More specifically, the *costs* associated with the *resources* of the firm (greater relative influence in the case of SMEs due to mainly limited resources) and *regulatory influences* (smaller impact in the case of SMEs). The informants also agreed that, given the size and complexity of the business environment, large firms have greater needs for BIS than their small and medium counterparts.

Figure 5. Average grades of informants' evaluation of candidate determinants influencing BIS adoption in the 1st round of interviews



2.3.2 Second phase – Selection of the key determinants

Against the backdrop of our first research phase, we asked the informants to rank the previously identified candidate determinants from both parts (unstructured and structured) of the first phase (see Appendix B). Figure 6 depicts the average ranking of candidate determinants in descending order. Candidates with the best average ranking (above 12) on the left side of the chart are considered as being prominent determinants of SMEs' adoption of BIS.

Overall, the second research phase produced a list of 11 BIS adoption determinants, as shown in Figure 7. Specifically, the results suggest that most determinants fall within the organizational context (6), followed by the technological context (4) and the environmental context (1). These BIS adoption determinants will be employed in a future confirmatory study where, in quantitative research, a conceptual BIS adoption model will be tested through a survey of a larger set of SMEs.

Figure 6. Results of the 2nd phase of the quantitative research

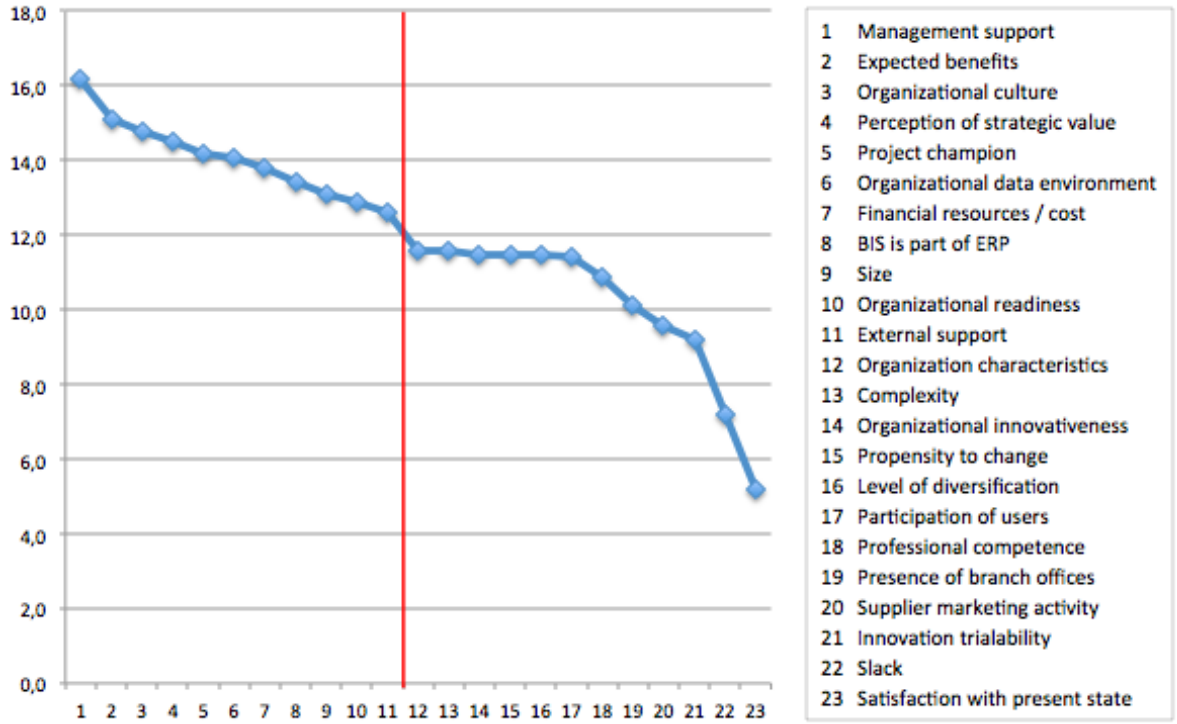
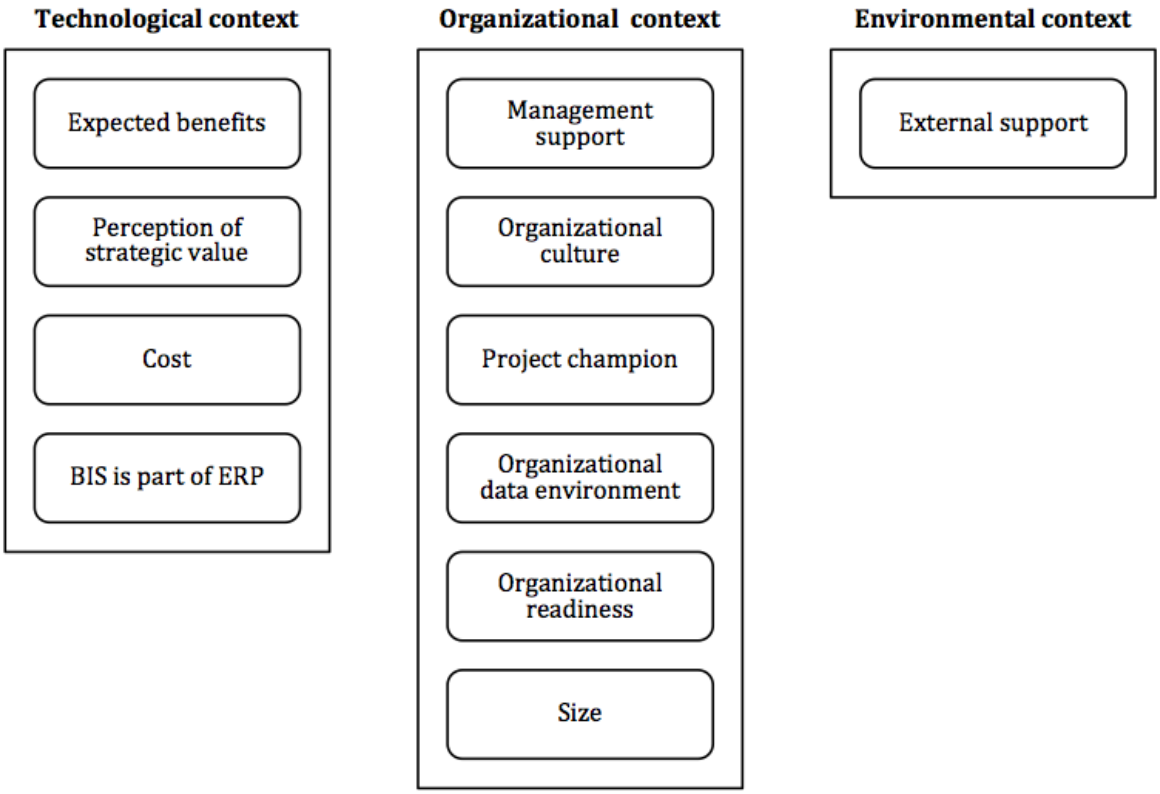


Figure 7. BIS adoption determinants within the corresponding contexts



2.4 Discussion

Qualitative in nature, our study provides new insights into current IT adoption research stream, namely BIS adoption within SMEs. To begin with, the results suggest that the majority of influences on BIS adoption originate in internal characteristics of the firm adopting the technology. Most of the identified determinants of BIS adoption in SMEs, as well as the candidate determinants showing the highest grades – i.e. *management support*, belong to the organizational context. Against the above-presented theoretical background management support, as a determinant, reflects management's engagement in IT/IS adoption. Since BIS are primarily implemented to support decision-makers at higher organizational levels (Popovič et al., 2012), thus generally management, we can assume that management's engagement with BIS is even more directly linked to BIS adoption than seen in the majority of other cases of IT/IS adoption. Next, it is observed that the environmental context is not considered an important set affecting SMEs' intention to adopt BIS. Specifically, only one of the identified determinants belongs to this set, namely *external support*, where its average ranking is even the lowest among the selected determinants. In contrast, the technological context is deemed important, particularly the characteristics of BIS as innovation. Among the relevant determinants, our results emphasize the expected benefits of BIS, the perception of BIS strategic value, BIS-related costs and whether BIS is part of an ERP solution.

The above discussion leads to the conclusion that BIS adoption within SMEs is a phenomenon mostly driven by the management support, organizational culture, presence of the project champion, organizational data environment and other organizational characteristics and features, but characteristics and expectations about the BIS like the expected benefits, perception of strategic value and cost must also be taken into account.

To align our findings with previous studies, we compared our results with the findings of research by Basole et al. (2013), which examined 472 articles from the field of IT innovation adoption and extracted the most common adoption predictors.

The results are consistent across the determinants of the expected benefits (perceived benefits, (Basole et al., 2013)), cost, management support (top management support, (Basole et al., 2013)), organizational culture, size (organizational size, (Basole et al., 2013)) and external support (vendor support, (Basole et al., 2013)). All of these determinants are described in Basole et al. (2013) as "top predictors of IT innovation adoption". The level of consistency is matched with previous studies for more than half (6 out of 11) the determinants.

When analyzing those determinants not consistent with the previous findings, one that stood out is the perception of strategic value. One possible explanation for its inconsistency with earlier findings lies in the differences between BIS and other IS/IT. BIS are namely a typical tool supporting decision-makers at higher organizational levels (Popovič et al., 2012), where decisions about strategies, visions, and missions are taking place and, as such, BIS can achieve the perception of strategic value.

Next in the line of determinants that appeared particular to BIS in SMEs is the project champion. This can also be linked to the specifics of BIS. As the use of BIS is largely voluntary, and the benefits of BIS are more indirect and long-term compared to operational IS (Popovič et al., 2012), the adoption effort arising from internal pressure (Basole et al., 2013) of the (future) users is appropriately poorer. Additional motivation for adoption, which can be provided by the project champion, is therefore fairly important for the successful adoption of this kind of IS.

Further, the organizational data environment is another determinant specific to BIS adoption in SMEs. This determinant is also mostly related to BIS specifics. BIS are namely IS which utilize data from other – mostly transactional – IS (e.g. ERP). Consequently, BIS can be sensitive to the quality of existing data in the organization in contrast to some other IS, whose purpose is to generate data and which rely on the use of existing data to a less significant extent.

Another BIS specific adoption determinant in SMEs is organizational readiness, i.e. the availability of the needed organizational resources (not only physical assets, but also

human knowledge of IS) for adoption (Ifinedo, 2011). This determinant's inconsistency with the most common IS adoption determinants can be related to SME specifics. More precisely, is relates to the limited resources of SMEs compared to their larger counterparts, which generally possess higher amounts of material resources and also more human knowledge of IS, among normally a higher number of employees.

Last in the group of determinants inconsistent with previous findings is self-evidently the determinant BIS as part of ERP. To the best of our knowledge, this determinant appears for the first time in our research and, as such, cannot be part of the common IS adoption determinants of prior studies.

One may also regard as inconsistent with earlier research the determinants Basole et al. (2013) indicate as predictors with the highest predictive power, but which are not selected in our research. Quite noticeable is external pressure, as a determinant distinctive of a more "open type" IS/IT, e.g. e-business (Oliveira & Martins, 2010). In the case of BIS, we can observe a typical 'internal' IS. Drawing on this reasoning allows us to explain the relatively poor representation of the environmental context of determinants in our research.

Comparing the results with the Iacovou model, a significant correlation can be established in the areas of expected benefits (Iacovou's *perceived benefits of IT innovations*) and the organizational context, mostly in *organizational readiness* (i.e. financial resources, IT resources). A low correlation appears in the area of external influences (i.e. *external pressures*), which could be attributed to the differences between BIS and Electronic Data Interchange as in Iacovou's research environment (Iacovou et al., 1995).

Nevertheless, attention in our research must also be given to the factors collected in the unstructured interview part. Most factors (8 out of 10 entering the 2nd interview phase) that surfaced in this part directly or indirectly correlate with the factors extracted from the literature review. The most frequently mentioned were management support and expected benefits in various forms, like "easier management", "growth control", "management needs", "management's initiative", "better management", "management effort", "management's sponsorship", "risk control", and "cutting expenses".

Yet, two other factors entering the 2nd phase were collected from the unstructured interview part and do not correlate with the factors extracted from the literature review. Some informants believe that BIS that are part of the ERP system of the company will be adopted more often, more quickly and easily than other BIS, emphasizing that "*BIS is part of ERP*" can be considered an important BIS adoption determinant. The roots of the importance of this determinant should be sought within both BIS and SME characteristics. BIS depend largely on the quality of available data; when BIS is part of an ERP solution, we can expect to have a better input for BIS as opposed to when it is insufficiently integrated with the transaction system (e.g. the data might not be readily available,

incomplete, in unsupported formats, etc.). This, in turn, leads to shorter BIS implementation times and, therefore, lower implementation costs. This is very important for SMEs as they are relatively more sensitive to cost increases than their larger counterparts. Also, such an integrated solution is more effective in terms of the burden on employees as they need to learn about fewer different systems to achieve their goals (e.g. the learning curve is steeper, there is a single user support, etc.). Since SMEs have fewer human resources, the above stated characteristics importantly impact the adoption of BIS in SMEs.

Another candidate determinant further arising from the unstructured part of the interview is the *professional competence* of the employees. This phenomenon encompasses all professional competence, knowledge, abilities and skills important for the company's processes and adoption of innovation. This leads us the conclusion that human resources, particularly their characteristics, could also be a significant determinant of BIS adoption in SMEs.

The 1st interview phase led to the identification of a wide range of factors that might impact BIS adoption in an SME. Indetermination about the reciprocal value of the influential strength among the determinants demonstrates that the 2nd phase of this exploratory research, entailing the ranking of the top candidate determinants from the 1st phase, was certainly needed to provide a reliable set of BIS adoption determinants for SMEs.

To ensure a more complete understanding of the BIS adoption determinants for SMEs, an assessment of which determinants would be different for large firms was carried out. In general, it was agreed that differences between BIS adoption in SMEs and large firms do exist; the costs associated with the firm's resources (greater relative influence in the case of SMEs due to mainly limited resources) and regulatory influences (a smaller impact in the case of SMEs). It was also agreed that, due to the size and complexity of the business environment, large firms have greater needs for BIS than their small and medium counterparts. Following further analysis of this response and additional clarification with the informants, we concluded that greater needs in fact mean a more varied BIS, namely a BIS with a greater pool of functionalities as a result of more complex business requirements. This does not curtail the importance of the BIS for SMEs, but emphasizes the fact that SMEs need a different type of BIS.

On the practical side, we expect that our results, although not yet empirically validated, will assist software vendors and consultants by providing a deeper understanding of what drives BIS adoption in SMEs. Based on the importance of BIS, the results will also be relevant for individual firms where they need to foster the use of BIS as a factor of success of the company. Managers and BIS specialists can gain a valuable insight into influences that are more or less present among the various factors in their adoption process. They can

be focused on key factors in their environment and their company, and be more efficient in managing them. Further, they can also be aware of which BIS and surrounding IT characteristics are important when seeking to adopt a BIS.

Last but not least, it is important to note the limitations of this work. First, to provide a more representative insight into the studied phenomenon the sample of firms could be larger and geographically more dispersed (all interviewees came from the same country). Another limitation is that this research directly addresses SMEs only, with large companies being studied just through the differences with SMEs, and with the limited experiences of the interviewees.

2.5 Conclusion

A comprehensive literature review, coupled with the results from qualitative cases, gave us an overview of those determinants considered as having a noteworthy influence on BIS adoption in SMEs. Through the two-phase approach, we pinpointed the candidate determinants for BIS adoption in SMEs to provide a succinct list of determinants for empirical confirmatory testing.

3 UNDERSTANDING THE DETERMINANTS OF BUSINESS INTELLIGENCE SYSTEM ADOPTION STAGES IN SMALL AND MEDIUM ENTERPRISES[2]

Abstract

Although business intelligence systems (BIS) adoption research has progressed considerably since its early inceptions, our understanding of how BIS determinants exert an influence in different adoption stages remains limited. In response, we develop and empirically test a conceptual model for assessing the determinants of BIS adoption on the evaluation, adoption, and use stages. The model is based on two prominent, firm-level adoption concepts: Diffusion of Innovation (DOI) and the Technology-Organization-Environment (TOE) framework, extended with our previous research findings. Drawing on data from 181 small and medium enterprises (SMEs), we identify seven distinct determinants (i.e. *cost*, *BIS is part of ERP*, *management support*, *rational decision-making culture*, *project champion*, *organizational data environment*, *organizational readiness*) as being statistically significant for different adoption stages.

Keywords: business intelligence systems (BIS); information technology/information systems (IT/IS) adoption; the Technology-Organization-Environment (TOE) framework; Diffusion of Innovations (DOI) theory; adoption stages; small and medium enterprises (SMEs)

3.1 Introduction

Today's firms generally operate in a complex and extensively competitive global business environment. Such conditions force firms to set goals that include continuously competing with rivals by operating more efficiently and productively, and by reducing operating costs (Chan & Chong, 2013). The widely recognized primary driver of organizational productivity, i.e. technological innovation, will significantly contribute to firms' goals, but only when it is widely adopted (Zhu, Dong, Xu, & Kraemer, 2006). Thus, it is crucial for firms to understand the process and determinants of technology adoption (Karahanna et al., 1999).

One innovation that can significantly contribute to the firm's goals by improving decision-

[2] The paper presented in this chapter of the dissertation has been submited as Puklavec, B., Oliveira, T., & Popovič, A. Understanding the Determinants of Business Intelligence System Adoption Stages; in *Decision Support Systems*. Preliminary findings from this paper have also been presented as Puklavec, B., Popovič, A., & Oliveira, T. (2016). Understanding the Determinants of Business Intelligence Adoption Stages: Research-In-Progress; at *EBR Conference 2016 - ECONOMIC AND BUSINESS RESEARCH IN THE AGE OF DATA - Management 2*; Faculty of Economics; September 9, 2016 - September 9, 2016.

making is business intelligence systems (BIS) (Popovič et al., 2012). BIS were developed as an IS innovation for offering data integration and analytical capabilities that can provide valuable decision-making information for stakeholders at different organizational levels (Turban et al., 2010). We define BIS as "quality information in well-designed data stores, coupled with software tools that provide users timely access, effective analysis and intuitive presentation of the right information, enabling them to take the right actions or make the right decision" (Popovič et al., 2012).

Although there are similarities among different types of IS, prior BIS research reveals key differences between BIS and other types of IS (Popovič et al., 2012). These divergences are some of the main reasons underpinning the need to examine the field of BIS adoption separately from traditional IS adoption, and to gain a better understanding of the determinants and their effects on the BIS adoption process. To do so, firms must consider an integrative view of the adoption process that builds on prior IS adoption studies and advances them to address the specifics of BIS.

In the broader field of IS/IT adoption research, studies about BIS adoption are still scarce. Moreover, extant research in the BIS milieu primarily focuses on large-sized firms (Popovič et al., 2012; Wixom & Watson, 2010; Yeoh et al., 2008). Accordingly, in the present work we focus on BIS adoption in small and medium enterprises (SMEs). These organizational entities have been found to importantly contribute to a country's economic development, technological advancement, and job-creation opportunities (Ayyagari et al., 2011; Fink, 1998).

Further, our work aims to explain the process of BIS adoption at the firm level, as opposed to the more abundant research performed on IT acceptance at the individual level (i.e. acceptance of innovations from individuals within the firm). To the best of our knowledge, this topical area of firm-level IT adoption is still under-researched. We contribute to the existing body of knowledge by answering the call by Puklavec, Oliveira, and Popovič (2014) to identify and empirically test which determinants are important for BIS adoption in SMEs at the firm level.

The remainder of the paper is organized as follows: the next section introduces the innovation adoption theory. Next, we present our research model and hypotheses, outline the data sources and explain our data analysis procedure. This is followed by our findings concerning the key determinants of BIS adoption at the firm level in SMEs. In the discussion section, we explore the theoretical contributions and practical implications of our findings. Finally, some inherent limitations and avenues for future research are given.

3.2 Theoretical background

In the last few decades, different prominent theories, frameworks, and models have shaped the field of technology adoption, e.g. the Technology Acceptance Model (TAM) (Davis, 1985, 1989; Davis et al., 1989), Theory of Planned Behavior (TPB) (Ajzen, 1991), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), Diffusion of Innovation (DOI) (Rogers, 1995) and the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990). Of those listed above, only the DOI theory and TOE framework represent the most prominent adoption models on the firm level (Oliveira & Martins, 2011) and are, as such, commonly employed as theoretical foundations for other firm-level studies and theories (Chong et al., 2009). When addressing a particular technology adoption environment, it is important to combine different adoption models and relevant concepts to achieve a more exhaustive insight into the adoption phenomenon (Oliveira & Martins, 2011). Deriving from the TOE framework and developed in the setting of IT adoption in SMEs, the Iacovou et al. (1995) model represents a good example of upgrading a prominent theoretical foundation for the purpose of a specific research context (Iacovou et al., 1995).

3.2.1 The Technology-Organization-Environment framework (TOE)

The TOE framework encompasses three contexts that influence a firm's adoption of innovation: technology, organization, and environment. The technology context consists of the availability and characteristics of technology. It refers to all technologies relevant to the firm (internal or external). Next, the organizational context denotes the firm's characteristics such as formal and informal linking structures, communication processes, size, and slack. Finally, the environmental context relates to the opportunities for and limitations of innovations, including the industry characteristics and market structure, technology support infrastructure, government regulation, and other actors' endeavors that may have an influence on the adoption (Tornatzky & Fleischer, 1990).

3.2.2 Diffusion of Innovations (DOI) theory

The DOI theory incorporates three different sets of factors that influence IT adoption: individual (leader) characteristics (attitude to changes), internal characteristics of the organizational structure (centralization, complexity, formalization, interconnectedness, organizational slack, size), and external characteristics of the organization (system openness) (Rogers, 1995).

The said theory presents five stages of the innovation adoption process, namely: the knowledge, persuasion (evaluation), decision (adoption), implementation (use), and confirmation stages (Rogers, 1995; Sharma, 2009). The distinction between the different stages of the adoption process allows a better insight into the adoption of innovations, and

offers a possibility to more broadly examine the innovation adoption phenomenon. In line with existing studies (e.g. Bose & Luo, 2011; Chan & Chong, 2013; Chong & Chan, 2012; R. Martins, Oliveira, & Thomas, 2016; Thomas et al., 2015; Zhu, Kraemer, & Xu, 2006), our research focuses on three stages of the adoption process, that is, evaluation, adoption, and use.

3.3 Research model

We propose an integrative research model (shown in Figure 8) that encompasses the two described prominent, firm-level innovation adoption models, namely the TOE framework and the DOI model, updated with recent findings from the literature (Puklavec et al., 2014). Coupling the TOE framework with the DOI model variables provides an improved ability to explain IT adoption (Hsu et al., 2006) and creates a theoretically grounded basis to evaluate the technology, organizational, and environmental characteristics of an SME that affect BIS adoption. We identify constructs based on existing IT/IS research and augment them with findings from comprehensive exploratory research about the determinants of BIS adoption in SMEs (Puklavec et al., 2014).

In order to gain a deeper insight into the dynamics of the BIS adoption process, we extend the model with BIS evaluation, adoption, and use as dependent variables. These variables are in line with the DOI stages of innovation and certain previous adoption studies (e.g. Bose & Luo, 2011; Chan & Chong, 2013; Chong & Chan, 2012; Rogers, 1995; Thomas et al., 2015; Zhu, Kraemer, & Xu, 2006) that propose use of the TOE/DOI constructs when studying these three stages of innovation adoption.

3.3.1 The technological context

We consider *relative advantage* as the degree to which a BIS is perceived as being superior to the system it replaces (Rogers, 1995). Earlier studies (e.g. Ifinedo, 2011; X. L. Li et al., 2011; Oliveira, Thomas, & Espadanal, 2014; Premkumar & Roberts, 1999; Ramamurthy et al., 2008; Thong, 1999; Tsai et al., 2010) suggest that the relative advantage of an IT innovation is one of the most frequently used predictors in IS adoption research. Positive perceptions of an IS's benefits should induce an SME to adopt the new IT innovation (Thong, 1999). A positive impact should already be indicated in the evaluation phase as firms require confirmation about the project's feasibility and substantive benefits from the IT innovation before its adoption is considered (Ramamurthy et al., 2008), which corresponds to the work of Tsai et al. (2010) where relative advantage significantly impacts the adoption intention. The influence of relative advantage also remains present in late adoption stages since perceived relative advantage positively affects firms' intention to continue to use the innovation (X. L. Li et al., 2011). Accordingly, we put forward the following hypothesis:

Hypothesis 1 (H1): Relative advantage has a positive impact on all BIS adoption stages.

Previous studies argued the financial/cost aspect of an innovation through diverse approaches (Caldeira & Ward, 2002; Chwelos et al., 2001; Hameed et al., 2012; Y. Lee & Kozar, 2008; Y. Lee & Larsen, 2009). We understand *cost* as cost effectiveness, i.e. where the benefits of adopting new technology exceed the costs of such technology (Premkumar & Roberts, 1999). Although cost is no longer a bottleneck for SMEs in adopting an IT innovation due to progress in IT development, the accessibility of out-of-the-box solutions and falling software and hardware prices, the cost aspect remains a big deterrent to adoption (Premkumar & Roberts, 1999). Further, cost is recognized as one of the most significant determinants hindering the IT development of small firms (Iacovou et al., 1995). It is thus common for firms to evaluate the costs relative to the benefits before deciding to adopt an IT innovation (Premkumar & Roberts, 1999). For subsequent adoption stages, namely the adoption and use stages, it is confirmed that costs have a strong effect on both stages (Chong & Chan, 2012). This may be attributed to the importance firms give to reducing costs and, thus, to their readiness to exploit the new IT to reduce costs (Tung & Rieck, 2005). An alternative explanation might be that firms seek a long-term return on their IT investment as opposed to only considering the short-term costs (Chong & Chan, 2012). As a result, we postulate that:

Hypothesis 2 (H2): Cost (effectiveness) has a positive impact on all BIS adoption stages.

BIS is part of ERP is a determinant that has only recently been considered in BIS adoption studies (Puklavec et al., 2014) and holds important value for understanding the BIS adoption phenomenon. We define this determinant as a state where BIS does not subsist as an independent IS solution, but is integrated into an ERP solution as an indivisible part of it and is, as such, typically implemented along with ERP. Yeoh et al. (2008) find that solid data source systems are fundamental for implementing BIS, in ETL (extraction, transformation, loading) processes, and in providing useful information for enhanced decision support. Subsequently, it is crucial to assess the stability and consistency of data source systems in order to avoid the costs stemming from changes after implementation of the BIS (Yeoh et al., 2008). As SMEs generally lack resources (Ifinedo, 2011; Quaddus & Hofmeyer, 2007) and cannot afford extra post-implementation costs, it is even more vital to ensure an adequate data source and smooth ETL, which can be realized with an integrated BIS/ERP solution in which the data source is commonly bound with the BIS, while ETL is ensured natively. Aligning these findings with previous research (Puklavec et al., 2014) where it is suggested that a BIS which forms part of the firm's ERP system will be adopted more often, quicker and more easily than other BIS, and given that these circumstances are primarily the case of the early adoption stages (i.e. evaluation and adoption stages), we hypothesize that:

Hypothesis 3 (H3): BIS being part of ERP has a positive impact on all BIS adoption stages,

yet the effect is greater on the evaluation and adoption stages than on the use stage.

3.3.2 The organizational context

We consider *management support* as top management's explicit and active support for the introduction and development of an IT innovation (Bruque-Camara et al., 2004). In SMEs, the decision-makers are commonly members of the top management team and, hence, the adoption of an IT innovation should have their explicit and active support (Premkumar & Roberts, 1999). As indicated in various research studies, management support is positively related to the adoption of an IT innovation (Chong et al., 2009; Hameed et al., 2012; Tung & Rieck, 2005). What is more, some previous studies suggest that management support is a key determinant affecting IT adoption (Hwang et al., 2004; Ling, 2001; Ramamurthy et al., 2008; Tsai et al., 2010) as management's commitment ensures indispensable resources for implementing the new technology (Premkumar & Roberts, 1999). Past research also empirically supports the proposition that management support is crucial to the successful adoption and use of innovations in SMEs since managers act as change agents in the adoption process (Ifinedo, 2011). If management is not convinced about an IT innovation, the innovation will likely not be adopted (Premkumar & Roberts, 1999). Regarding the different adoption process stages, Chan and Chong (2013) reveal that management support is a significant determinant in all three stages of IT innovation adoption. Therefore, we propose that:

Hypothesis 4 (H4): Management support has a positive impact on all BIS adoption stages.

A *rational decision-making culture* indicates the presence of organization-wide respect for measuring, testing, and evaluating quantitative evidence in decision processes. Such a culture encourages the use of data and information to support work processes and perform analyses, also with advanced techniques (Kulkarni & Robles-Flores, 2013). Previous research suggests that organizational culture signifies an important positive effect on the adoption process of an IT innovation (Gu et al., 2012). Regarding the influence of organizational culture on the use of an innovation, Popovič et al. (2012) study the strong impact of fact-based decision-making culture on BIS use, while Frambach and Schillewaert (2002) find that in the adoption process's evaluation stage firms become aware of an IT innovation, form an approach to it, and evaluate it, thus we assume a positive role of firms' rational decision-making culture in the evaluation stage. Based on the discussion, the following hypothesis is put forward:

Hypothesis 5 (H5): A rational decision-making culture has a positive impact on all BIS adoption stages.

We define *project champion* as a management-level individual who recognizes the usefulness of an idea for the organization, and leads authority and resources for such an

idea throughout its development and implementation phases (Meyer, 2000). He/she is the person who creates the awareness and a positive impression of an IT innovation (Gu et al., 2012). The adoption of an IT innovation normally meets certain resistance, and the project champion is expected to reduce such resistance (Hwang et al., 2004). Existing research indicates the presence of a project champion is a significant variable in successful adoption of an IS, and that it impacts all adoption process stages (Bose & Luo, 2011). In the evaluation stage, the project champion conventionally motivates management to acquire an IT innovation and creates awareness of the innovation within the organization. In the later stages of adoption and use, the project champion facilitates user acceptance (Hameed et al., 2012). Consequently, the absence of a project champion can lead to an IT innovation not being adopted, as shown in numerous studies (Hwang et al., 2004). It can thus be hypothesized that:

Hypothesis 6 (H6): The presence of a project champion has a positive impact on all BIS adoption stages.

In the existing research, *organizational data environment* is considered as data quality, availability, loading, etc., related to the process of preparing input data for BIS (Rehman & Raza Ali, 2014). It is contingent on successful realization of data resource management which can offer several benefits (e.g. reducing errors, increasing the ability to access previously unavailable information and interpret/share data across IT applications) (Ramamurthy et al., 2008). An inadequately managed data environment is linked to problems with data availability, quality, reliability, integrity, security, and data standards (Ramamurthy et al., 2008). An environment with such characteristics can face serious challenges when seeking to introduce and adopt BIS because BIS depend highly on the integration of different data sources (Popovič et al., 2010). We therefore propose that:

Hypothesis 7 (H7): A high quality organizational data environment has a positive impact on all BIS adoption stages.

We consider *organizational readiness* as the availability of the organizational resources required for innovation adoption (Iacovou et al., 1995). In this study, we discuss this determinant using the availability of financial, technological, and other necessary resources, aside from IT knowledge and expertise in the adopting organization (Grandon & Pearson, 2004; Ifinedo, 2011). While some previous research suggests organizational readiness is not significant (Grandon & Pearson, 2004; Ifinedo, 2011; Quaddus & Hofmeyer, 2007), other studies confirmed this determinant as a significant (Mehrtens et al., 2001; Tsai et al., 2010) or even the most significant factor (Hameed et al., 2012) in adoption of an IT innovation. Consistent with Iacovou et al. (1995), organizational readiness could be one of the primary aspects explaining the BIS adoption behavior of SMEs, not only in the adoption but also in the evaluation stage as better prepared firms are usually less likely to feel intimidated by the new IT innovation and further in the use stage

since firms which can afford better BIS projects are more likely to experience greater benefits from use of the BIS. We thus suggest that:

Hypothesis 8 (H8): Organizational readiness has a positive impact on all BIS adoption stages.

3.3.3 The environmental context

Specific to the environmental context, we consider external support as relevant to BIS adoption. *External support* refers to the readiness of support for implementing and using a technology-based solution (Premkumar & Roberts, 1999; Quaddus & Hofmeyer, 2007). Outsourcing and third-party support are shown to have an important impact on the adoption of IT innovations as firms are more prepared for the risks of implementing new technologies if adequate vendor or third-party support for the technology is available (Premkumar & Roberts, 1999). Moreover, the more external support is expected, the more SMEs are motivated to adopt IT innovations since SMEs have a limited number of internal IT experts available to support implementation; this lack of experts is also recognized as a major inhibitor of advanced IS adoption in SMEs (Y. Lee & Larsen, 2009). As seen in the definition of external support, this determinant not only influences the adoption but also the use of the innovation. When adding in Lee and Larsen's (2009) assertion that external support significantly affects the evaluation and actual adoption, it can be postulated that:

Hypothesis 9 (H9): External support has a positive impact on all BIS adoption stages.

3.3.4 Adoption stages

According to the DOI theory (Rogers, 1995), an IT innovation adoption process goes through various stages. While these stages might be viewed as individual independent variables in an adoption model, their interdependence should also be considered (Sharma, 2009).

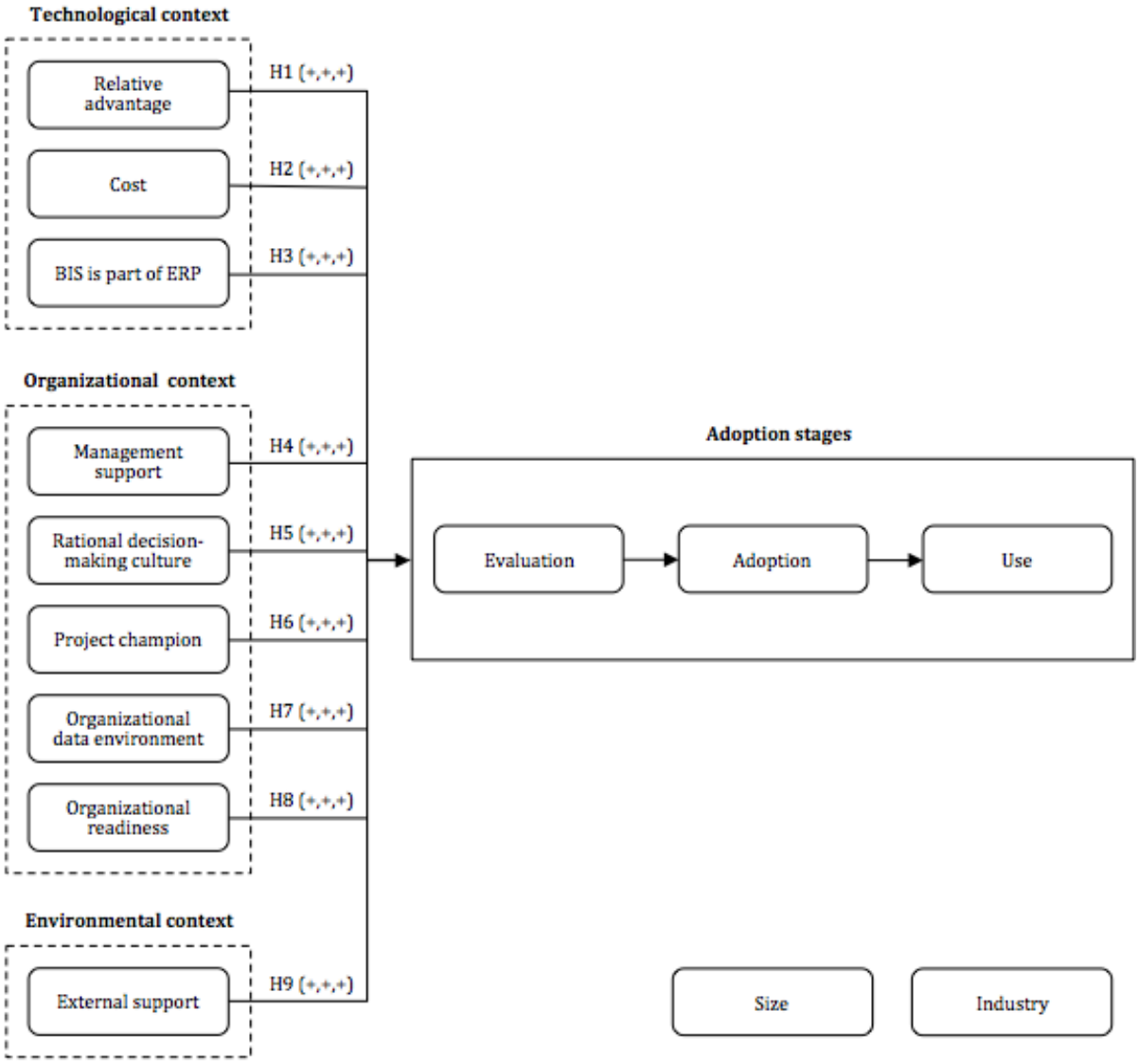
Evaluation of BIS arises when the firm initiates a consideration of the different aspects (technology, organization, environment) of the BIS adoption process. In the evaluation phase, the firm collects information about the BIS, which is then used for evaluating the BIS's suitability and possible advantages it may bring to the firm and its users (Zhu, Kraemer, & Xu, 2003). The evaluation stage constitutes the foundation for an efficient adoption.

The *adoption* phase refers to the decision-making involved when a firm is choosing which BIS solution suits its requirements (Chong & Chan, 2012). Following previous research, we propose a systemic sequence among the adoption stages, whereby BIS adoption leads to the BIS *use* stage (Chan & Chong, 2013).

3.3.5 Controls

Size and *industry* variables are used to control data variation that is not explained by the other variables of the proposed model. After considering earlier studies (Buonanno et al., 2005; Gu et al., 2012; Hsu et al., 2006; Popovič, Hackney, Coelho, & Jaklič, 2014; Thomas et al., 2015; Thong, 1999), we include size and industry dummy variables as control variables.

Figure 8. The research model



3.4 Research methodology

3.4.1 Measurement

Based on the proposed conceptual model, we develop a questionnaire to conduct a survey within SMEs (see Appendix D). The questionnaire covers the following constructs: relative advantage (RA), cost (C), BIS is part of ERP (BPE), management support (MS), rational decision-making culture (RDMC), project champion (PC), organizational data environment (OCE), organizational readiness (OR), external support (ES), evaluation (E), adoption (A), and use (U). These constructs were based on the existing literature (Hameed et al., 2012; Iacovou et al., 1995; Oliveira et al., 2014; Puklavec et al., 2014; Rogers, 1995; Tornatzky & Fleischer, 1990). The measurements applied a seven-point Likert scale on an interval level ranging from "strongly disagree" to "strongly agree". Consistently with the respective literature, all constructs used were operationalized as reflective.

Questionnaire items (see Appendix C) were reviewed for their content validity by a group of six IS researchers and BI professionals, all aptly familiar with the BIS adoption phenomenon in SMEs. Following their comments, some amendments to the questionnaire instrument were made. The instrument was further pilot tested on 25 randomly selected SMEs from the sample frame, which confirmed its validity and reliability.

3.4.2 Data

We used an online survey service, which allows online surveys to be created, executed, and briefly analyzed. The invitation to complete the survey was distributed by email to 2,024 SMEs from various industry sectors. The firm data were extracted and merged from different public information sources. In order to increase the content validity, participation of the most qualified BIS person (i.e. CIO, other management, or senior IS personnel) was requested, along with a brief yet complete description of the research's scope and importance.

Data were collected in mid-2015. Over 12 weeks, a total of 181 usable responses was obtained, corresponding to a response rate of 8.9%. The relatively low response rate was expected since we had targeted all SMEs, i.e. adopters and non-adopters, regardless of how familiar an individual firm was with BIS. The industry profile of the sample is as follows: 50.3% of the respondents come from the services sector, 24.3% from the manufacturing industry, and 25.4% from the distribution sector.

In order to test for non-response bias, we compare the distributions of early and late respondents in the sample using the Kolmogorov-Smirnov test (Ryans, 1974). The sample distributions of the early and late respondents do not differ statistically (the p-value for all variables was above 0.10). The absence of non-response bias is thus confirmed (Ryans,

1974). Moreover, we test for common method bias using Harman's single-factor test (Podsakoff et al., 2003). The test shows that the most variance explained by a single factor was 24.9% and that none of the factors' variance exceeds 50% of the suggested threshold value. Accordingly, we confirm the absence of any significant common method bias in the data set.

3.5 Results

The data analysis is conducted through partial least squares (PLS), a variance-based structural equation modeling technique. PLS is suitable for this research since: (i) some items in the data are not distributed normally ($p < 0.01$ based on the Kolmogorov-Smirnov test); (ii) the conceptual model is considered as complex; and (iii) it has not been previously tested (C. Martins, Oliveira, & Popovič, 2014). To test the proposed research model, we use Smart PLS 2.0 M3 (Ringle, 2005).

Before testing the structural model, we first examine the reflective part of the measurement model in order to assess the construct and indicator reliability, internal consistency, convergent validity, and discriminant validity. The quality of the formative construct in the measurement model is then determined through content validity (Straub et al., 2004), multicollinearity (Diamantopoulos & Siguaw, 2006), and weights (Chin, 1998), all described in the following sections.

3.5.1 Measurement model

Examination of the model is reported in Tables 6 and 7. First, we assess the construct reliability, tested using the composite reliability coefficient and Cronbach's alpha. As shown in Table 8, all constructs have composite reliability (CR) and Cronbach's alphas (CA) above 0.7, suggesting the constructs are reliable (Chau, 1999; Straub, 1989).

Indicator reliability is assessed using the criterion that the factor loadings should exceed the value of 0.7 (Henseler, Ringle, & Sinkovics, 2009). As seen in Table 7 (in bold), all loadings are above 0.7. Further, all items are statistically significant at 0.001. The model thus shows adequate indicator reliability.

In order to test convergent validity, we use average variance extracted (AVE). As seen in Table 8, all constructs show an AVE higher than 0.5, thereby meeting the criterion that the AVE should be above 0.5 so that the construct explains more than half of the variance of its indicators (Bagozzi & Yi, 1988; Henseler et al., 2009).

Table 7. Loadings and cross-loadings

Constructs	Item	RA	C	BPE	MS	RDMC	PC	ODE	OR	ES	E	A
Relative advantage (RA)	RA1	**0.886**	0.591	0.350	0.461	0.442	0.544	0.398	0.477	0.398	0.440	0.326
	RA2	**0.924**	0.602	0.344	0.471	0.501	0.553	0.431	0.531	0.429	0.442	0.417
	RA3	**0.953**	0.605	0.326	0.458	0.495	0.553	0.379	0.523	0.418	0.435	0.403
	RA4	**0.912**	0.644	0.336	0.458	0.514	0.570	0.426	0.510	0.425	0.456	0.405
	RA5	**0.859**	0.634	0.290	0.448	0.498	0.545	0.398	0.455	0.427	0.399	0.416
Cost (C)	C1	0.631	**0.902**	0.383	0.538	0.474	0.552	0.495	0.470	0.455	0.464	0.326
	C2	0.614	**0.949**	0.399	0.490	0.462	0.558	0.456	0.456	0.446	0.435	0.317
	C3	0.641	**0.932**	0.432	0.463	0.475	0.537	0.402	0.453	0.460	0.451	0.331
BIS is part of ERP (BPE)	BPE1	0.366	0.457	**0.942**	0.439	0.367	0.376	0.399	0.423	0.432	0.413	0.448
	BPE2	0.340	0.402	**0.960**	0.486	0.367	0.427	0.396	0.425	0.378	0.478	0.495
	BPE3	0.322	0.377	**0.929**	0.411	0.324	0.335	0.376	0.379	0.374	0.431	0.404
Management support (MS)	MS1	0.406	0.459	0.482	**0.915**	0.674	0.585	0.574	0.628	0.524	0.595	0.494
	MS2	0.532	0.517	0.421	**0.945**	0.703	0.678	0.564	0.656	0.572	0.680	0.572
	MS3	0.459	0.511	0.417	**0.915**	0.647	0.648	0.538	0.638	0.488	0.710	0.506
Rational decision-making culture (RDMC)	RDMC1	0.484	0.443	0.333	0.711	**0.950**	0.562	0.537	0.670	0.517	0.550	0.462
	RDMC2	0.502	0.470	0.384	0.706	**0.954**	0.529	0.513	0.641	0.516	0.511	0.434
	RDMC3	0.538	0.490	0.348	0.671	**0.936**	0.533	0.522	0.614	0.480	0.486	0.415
	RDMC4	0.523	0.521	0.349	0.660	**0.932**	0.565	0.544	0.658	0.451	0.458	0.385

(table continues)

(continued)

Constructs	**Item**	**RA**	**C**	**BPE**	**MS**	**RDMC**	**PC**	**ODE**	**OR**	**ES**	**E**	**A**
Project champion (PC)	PC1	0.544	0.530	0.400	0.707	0.633	**0.908**	0.620	0.670	0.545	0.635	0.569
	PC2	0.557	0.562	0.360	0.622	0.488	**0.951**	0.487	0.656	0.484	0.662	0.544
	PC3	0.612	0.574	0.376	0.612	0.508	**0.950**	0.510	0.616	0.494	0.663	0.583
Organizational data environment (ODE)	ODE1	0.468	0.471	0.416	0.604	0.537	0.594	**0.941**	0.654	0.542	0.497	0.420
	ODE2	0.407	0.462	0.319	0.529	0.542	0.546	**0.917**	0.620	0.429	0.452	0.357
	ODE3	0.348	0.405	0.403	0.523	0.462	0.429	**0.901**	0.558	0.429	0.430	0.290
Organizational readiness (OR)	OR1	0.439	0.393	0.385	0.565	0.622	0.593	0.614	**0.865**	0.412	0.530	0.457
	OR2	0.509	0.449	0.431	0.702	0.639	0.669	0.695	**0.899**	0.510	0.616	0.508
	OR3	0.487	0.385	0.313	0.575	0.600	0.621	0.558	**0.865**	0.463	0.555	0.474
	OR4	0.473	0.465	0.357	0.514	0.525	0.550	0.449	**0.794**	0.437	0.541	0.540
	OR5	0.415	0.402	0.342	0.556	0.503	0.478	0.488	**0.799**	0.383	0.587	0.484
External support (ES)	ES1	0.461	0.479	0.362	0.566	0.562	0.571	0.465	0.571	**0.914**	0.524	0.458
	ES2	0.436	0.460	0.418	0.528	0.437	0.460	0.462	0.444	**0.936**	0.436	0.338
	ES3	0.357	0.390	0.366	0.460	0.410	0.436	0.480	0.396	**0.889**	0.405	0.332
Evaluation (E)	E1	0.429	0.435	0.452	0.662	0.494	0.640	0.486	0.620	0.498	**0.918**	0.559
	E3	0.454	0.460	0.412	0.661	0.491	0.647	0.442	0.618	0.434	**0.926**	0.629
Adoption (A)	A1	0.423	0.313	0.476	0.548	0.442	0.585	0.368	0.568	0.383	0.620	**0.966**
	A2	0.417	0.363	0.445	0.549	0.429	0.580	0.389	0.557	0.424	0.625	**0.965**

Table 8. Descriptive statistics, correlation matrix, and square root of AVEs

Constructs	Mean	SD	CR	CA	RA	C	BPE	MS	RDMC	PC	ODE	OR	ES	E	A	U
Relative advantage (RA)	5.769	1.254	0.959	0.946	**0.907**											
Cost (C)	5.297	1.361	0.949	0.919	0.678	**0.928**										
BIS is part of ERP (BPE)	4.905	2.020	0.961	0.939	0.363	0.436	**0.944**									
Management support (MS)	4.916	1.623	0.947	0.916	0.506	0.537	0.474	**0.925**								
Rational decision-making culture (RDMC)	5.527	1.377	0.970	0.959	0.541	0.508	0.374	0.729	**0.943**							
Project champion (PC)	5.117	1.628	0.956	0.930	0.610	0.593	0.404	0.691	0.580	**0.937**						
Organizational data environment (ODE)	5.274	1.300	0.943	0.909	0.448	0.487	0.413	0.604	0.561	0.576	**0.919**					
Organizational readiness (OR)	5.373	1.321	0.926	0.899	0.551	0.496	0.434	0.693	0.685	0.691	0.667	**0.845**				
External support (ES)	4.811	1.599	0.938	0.901	0.463	0.489	0.417	0.572	0.522	0.542	0.512	0.524	**0.913**			
Evaluation (E)	4.810	1.640	0.919	0.824	0.479	0.486	0.468	0.717	0.534	0.697	0.503	0.671	0.504	**0.922**		
Adoption (A)	4.092	1.565	0.965	0.927	0.435	0.350	0.477	0.568	0.451	0.604	0.392	0.583	0.418	0.645	**0.965**	
Use (U)	4.799	1.813	NA	NA	0.490	0.416	0.497	0.682	0.535	0.660	0.569	0.613	0.502	0.650	0.673	**NA**

Note: Composite reliability, Cronbach's alpha, and average variance extracted are not applicable to the formative constructs; CR – composite reliability; CA – Cronbach's alpha; diagonal elements – square root of AVE; off-diagonal elements – correlations

Discriminant validity is evaluated based on the Fornell-Larcker criterion and on cross-loadings. The Fornell-Larcker criterion calls for the square root of the AVE to be greater than the correlations between the latent variables (Fornell & Larcker, 1981). Table 8 shows that the square roots of the AVEs (in bold) are greater than the correlation between each pair of variables. The criterion of cross-loadings suggests the loading of each factor should be greater than all cross-loadings (Götz, Liehr-Gobbers, & Krafft, 2010). To achieve these criteria, we delete items ODE4 and E2. Subsequently, as shown in Table 7, the patterns of the loadings are greater than the cross-loadings. Accordingly, both criteria are fulfilled.

A condition for evaluating the content validity, describing the degree to which the measured results stand for the content-semantic part of the construct, is an exact content definition for the constructs (Eckhardt, Laumer, & Weitzel, 2009). In order to ensure the content validity, our constructs were discussed with several BI professionals from the field, all appropriately familiar with the BIS adoption phenomenon in SMEs, and also decision-makers with adequate knowledge about BIS adoption within the firm to reliably discuss the subject (Churchill, 1979).

For the formative measure *use*, which is modeled using eight formative indicators, the test for multicollinearity denotes that analysis of significance of outer weights could be conducted as the next step since the variance inflation factor (VIF) values for all indicators are below 5, thus collinearity is not an issue (Hair Jr, Hult, Ringle, & Sarstedt, 2013).

Outer weights of the *use* construct are significant for three indicators; for the other five indicators the outer loading is greater than 0.5 and thus no indicator is eliminated (Hair Jr et al., 2013).

Since the evaluations of construct reliability, indicator reliability, convergent validity, discriminant validity (reflective measures), and content validity, multicollinearity, and weights (formative measures) are adequate, we confirm the constructs are suitable for testing the conceptual model.

3.5.2 Structural model

The predictive capacity of the structural model is evaluated using R^2 measures besides the level of significance of the path coefficients. The path significance levels are estimated using the bootstrapping method with 5,000 resamples (Chin, 1998; Henseler et al., 2009). The results of the analysis are summarized in Table 9 regarding direct effects and in Table 10 for the total effects, showing the path coefficients and t-value results. The R^2 of dependent variables are respectively 0.63, 0.53, and 0.66 for *evaluation*, *adoption*, and *use*.

Table 9. Results of the structural model – direct effects

Constructs	Evaluation		Adoption		Use	
	Path coeff.	**t-value**	**Path coeff.**	**t-value**	**Path coeff.**	**t-value**
Relative advantage (RA)	0.005	0.062	0.112	1.385	0.095	0.969
Cost (C)	-0.002	0.029	-0.181	2.357**	-0.117	1.567
BIS is part of ERP (BPE)	0.107	1.776*	0.213	2.970***	0.117	1.625
Management support (MS)	0.380	4.480***	0.071	0.640	0.279	2.749***
Rational decision-making culture (RDMC)	-0.122	1.790*	-0.021	0.234	-0.027	0.279
Project champion (PC)	0.293	3.679***	0.239	2.276**	0.161	1.614
Organizational data environment (ODE)	-0.077	1.088	-0.103	1.182	0.202	2.465**
Organizational readiness (OR)	0.270	3.639***	0.186	1.732*	-0.058	0.508
External support (ES)	0.047	0.756	0.021	0.288	0.023	0.288
Evaluation (E)			0.281	2.681***		
Adoption (A)					0.311	3.702***
Industry (Service)	-0.057	1.012	0.032	0.576	0.094	1.444
Industry (Distribution)	-0.064	1.059	0.022	0.377	0.082	1.258
Size	0.021	0.456	0.142	3.120***	0.070	1.211
	R^2 = 63.4%		R^2 = 52.9%		R^2 = 65.6%	

Note: * – significance at p < 0.10; ** – significance at p < 0.05; *** – significance at p < 0.01

Regarding the technological context, the present research finds that the hypothesis that *relative advantage* is a predictor of the BIS adoption (H1) is rejected for all three adoption stages ($p > 0.10$). The hypothesis of *cost* as a predictor of BIS adoption (H2) is also rejected for all three adoption stages as we find that *cost* is not statistically significant in explaining BIS *evaluation* and *use* ($p > 0.10$) and has significant but negative paths to *adoption* ($p < 0.05$), whereas we had proposed a positive relationship between *cost* and all adoption stages. *BIS is part of ERP* has significant and positive paths to *evaluation* ($p < 0.10$) and *adoption* ($p < 0.01$), but a nonsignificant and positive path to *use* ($p > 0.10$). These results provide partial support for hypothesis 3.

Within the organizational context, *management support* has significant and positive paths to *evaluation* ($p < 0.01$) and *use* ($p < 0.01$), yet a nonsignificant path to *adoption* ($p > 0.10$), so hypothesis 4 is only partially supported. *Rational decision-making culture* has a significant and negative path to *evaluation* ($p < 0.10$), and nonsignificant paths to *adoption* and *use* ($p > 0.10$). Thus, hypothesis 5 is not supported. The path to *evaluation* ($p < 0.01$) and *adoption* ($p < 0.05$) associated with *project champion* is significant and positive, while the path to *use* ($p > 0.10$) is nonsignificant and positive, with the outcome that hypothesis 6 is partially supported. *Organizational data environment* has a significant and positive path to *use* ($p < 0.05$), but nonsignificant paths to *evaluation* and *adoption* ($p > 0.10$). Thus, hypothesis 7 is also partially supported. Similarly, hypothesis 8 is partially supported as we find that *organizational readiness* has significant and positive paths to *evaluation* ($p < 0.01$) and *adoption* ($p < 0.10$), but a nonsignificant path to *use* ($p > 0.10$).

Finally, within the environmental context, all three paths associated with *external support* are nonsignificant ($p > 0.10$). Thus, hypothesis 9 is not supported.

As direct effects do not always achieve adequate comprehensiveness, in the research we also identify the total effect of independent variables (Lancelot Miltgen, Popovič, & Oliveira, 2013). To explain the total effect of an independent variable on *adoption* in a complex research model, the effect of *evaluation* must also be considered, along with the effect of *evaluation* and *adoption*, respectively, when explaining the total effect on *use*.

Considering the total effect of independent variables (see Table 10), the hypothesis of *cost* as a predictor of BIS adoption (H2) is still rejected for all three adoption stages, but the path to *use* becomes significant ($p < 0.05$). In contrast, consideration of the total effect provides strong support for hypothesis 3 since in this case *BIS is part of ERP* has significant and positive paths to *evaluation* ($p < 0.10$), *adoption* ($p < 0.01$), and *use* ($p < 0.05$). Correspondingly, in view of the total effect all three paths associated with *project champion* are significant ($p < 0.01$) and positive, providing strong support for hypothesis 6. Examining the total effect of independent variables also slightly changes the partial support for hypothesis 8 where the positive path to *adoption* reaches significance at $p < 0.05$.

Table 10. Results of the structural model – total effects

Constructs	Evaluation		Adoption		Use	
	Path coeff.	**t-value**	**Path coeff.**	**t-value**	**Path coeff.**	**t-value**
Relative advantage (RA)	0.005	0.062	0.113	1.410	0.131	1.350
Cost (C)	-0.002	0.029	-0.182	2.391**	-0.173	2.204**
BIS is part of ERP (BPE)	0.107	1.776*	0.243	3.293***	0.193	2.534**
Management support (MS)	0.380	4.480***	0.178	1.635	0.334	3.045***
Rational decision-making culture (RDMC)	-0.122	1.790*	-0.055	0.604	-0.044	0.460
Project champion (PC)	0.293	3.679***	0.321	3.239***	0.261	2.647***
Organizational data environment (ODE)	-0.077	1.088	-0.125	1.431	0.163	2.026**
Organizational readiness (OR)	0.270	3.639***	0.262	2.430**	0.023	0.201
External support (ES)	0.047	0.756	0.035	0.475	0.034	0.415
Evaluation (E)			0.281	2.681***	0.087	1.937*
Adoption (A)					0.311	3.702***
Industry (Service)	-0.057	1.012	0.015	0.286	0.100	1.490
Industry (Distribution)	-0.064	1.059	0.001	0.070	0.081	1.195
Size	0.025	0.456	0.151	3.084***	0.125	2.069**
	R2 = 63.4%		R2 = 52.9%		R2 = 65.6%	

Note: * – significance at $p < 0.10$; ** – significance at $p < 0.05$; *** – significance at $p < 0.01$

3.6 Discussion

Our research makes important contributions to both research and practice and offers implications for the IT/IS literature of the SME milieu, in particular for the field of BI and BIS.

3.6.1 Theoretical implications

Our results suggest that, from the perspective of perceived *relative advantage* which BIS can offer firms, BIS are significantly different to other types of IS previously studied. While prior adoption studies generally confirm the perceived relative advantage of an IT innovation as a significant adoption determinant for different IS and various firm sizes, i.e. also for SMEs (Chwelos et al., 2001; Ifinedo, 2011; X. L. Li et al., 2011; Oliveira et al., 2014; Premkumar & Roberts, 1999; Ramamurthy et al., 2008; Tsai et al., 2010), our results indicate that relative advantage is nonsignificant for BIS adoption. High levels of agreement about the role of relative advantage on one side and the nonsignificance of this variable on the other suggest that both adopters and non-adopters are well aware of BIS advantages. Thus, BIS can be regarded as an established IT innovation with generally large awareness of its relative advantage. Since non-adopting firms also acknowledge the advantages of BIS, we may assume that their potential adoption of BIS is hindered by other factors.

Next, we find a similar connection for the *cost* variable in the evaluation phase where both adopters and non-adopters consider BIS as being highly cost-efficient, which results in costs being nonsignificant, thus supporting some previous findings (Y. Lee & Kozar, 2008; Tung & Rieck, 2005). However, in later stages of adoption and use, our results surprisingly contradict most of the previous research (Chong & Chan, 2012; Chwelos et al., 2001; Iacovou et al., 1995) as we find a significant negative effect of cost effectiveness on those stages. One possible explanation is that expectations about BIS cost efficiency are generally overrated. Isolated observation of the adoption or use stage could lead to the incorrect conclusion that higher cost-efficiency hinders BIS adoption or use; when results in these stages are linked with the results of the evaluation phase, it can be concluded that cost is not a significant determinant and that firms are not sensitive to cost efficiency. Further, the negative association likely stems from higher expectations about cost-efficiency in the early phase and decreasing expectations in subsequent phases of the adoption process. As cost effectiveness does not represent a substantial determinant, excessively high expectations at the start of the adoption process do not inhibit further adoption and/or use. But, to ensure this, the high expectations must be translated into stable institutions and long-term commitments (Bakker & Budde, 2012).

Contrary to our findings on costs, our results regarding *BIS being part of ERP* suggest that this is one of the most important adoption determinants with an influence all three adoption

stages. To understand the roots of the influence of BPE, the features of such an integrated solution should be analyzed through the characteristics of the SME. Integrating BIS with ERP represents a more effective solution in terms of the effort for employees. As SMEs typically have fewer human resources than their larger counterparts, this can importantly impact the adoption (Puklavec et al., 2014). It can thus be expected that reducing the effort for employees should be most effective in late adoption stages as the evaluation phase normally does not considerably affect employees' work routines. Our results support this reasoning. It is also safe to expect that for different adoption stages distinctive features of BPE emerge as being fundamental. Within the evaluation phase, it is expected that considering adopting as an integrated solution (as opposed to separate solutions) will be less disturbing since there is only one adoption endeavor with a single external partner. For this adoption stage, it could also be important that adopting firms are more likely to trust more comprehensive solutions, i.e. solutions that cover a broader range of users' business needs compared to partial solutions where coupling with other partial solutions is needed. All of this continues to be important in the next stage when realization of an anticipated less disturbing adoption takes place. For instance, integrated solutions require a substantially less complicated data preparation and integration process since appropriate tools are normally already pre-prepared and integrated into such a solution; the implementation of BIS does not require analysis of the ERP used, etc. In the use stage, influential benefits emerge mostly due to consistent use and support, shared and pre-set settings, etc. Hence, users do not need to learn about different systems to achieve their goals.

Our research generally confirms extant findings (Chong et al., 2009; Hameed et al., 2012; Hwang et al., 2004; Ifinedo, 2011; Ling, 2001; Ramamurthy et al., 2008; Tsai et al., 2010) about the prominence of *management support* while adding to the discussion through the detailed analysis of the varying influence of management support across adoption stages. Management support appears as a significant determinant in the evaluation and use stages while it is not significant in the adoption phase. This finding is in line with Thong (1999) where managers' characteristics are recognized as influential for the initial decision to adopt an IS, but subsequently do not influence the extent of adoption. Our findings could be explicated through management's decision-making function; in the evaluation phase, managers must decide whether the firm will carry out the adoption or not. Following its initial prevalence in the evaluation stage, management support holds a diminishing effect in the adoption stage where other determinants gain importance. While this phenomenon was observed by Quaddus and Intrapairot (2001), our study complements this finding: the effect of management support is again amplified in the use stage of the adoption process where management represents one of key users of BIS and also requires other users to use it and provide managers with deliverables (e.g. analyses, reports) to support their decision-making tasks.

To the best of our knowledge, the influence of *RDMC* has not previously been studied in the BIS adoption literature, while some relationship characteristics between RDMC and BIS can be revealed from BIS success studies. While existing literature uncovers rational decision-making culture as a critical factor in ensuring BIS success (Kulkarni & Robles-Flores, 2013; Popovič et al., 2012), our results reveal that the link between RDMC and BIS success is not comparable with the link between RDMC and BIS adoption. Analyzing the RDMC influence on the adoption and use stages, we find a similar pattern as in the case of perceived relative advantage where adopters and non-adopters are aware of the BIS advantages to a similar extent. In the case of RDMC, adopters and non-adopters find RDMC similarly mature, making the influence of RDMC nonsignificant for the adoption and use stages. Somewhat different results are found in the evaluation stage, where slightly significant negative impacts of RDMC on the evaluation stage are identified. This initially quite unexpected influence can be explained through the relationship between BIS and RDMC. As BIS represents one of the instruments for instilling and improving RDMC within firms, it is possible that firms with lower levels of RDMC tend to express greater BIS adoption intention than firms which consider that their RDMC is already – without BIS – at higher levels.

Our study results also indicate that *project champion* is the most important factor in the BIS adoption process within SMEs. Thus, our research confirms the findings of previous studies (Bose & Luo, 2011; Chong et al., 2009; Gu et al., 2012; Hwang et al., 2004) and extends them to the BIS context. Further, our study suggests that project champion represents one of the most significant determinants for every adoption stage. Bose and Luo (2011) link the presence of a project champion with the success of any project and, in particular, with projects requiring additional user training and a shift in attitude. The importance of project champion in the use stage, where successful use of BIS requires additional training and at least some changes in attitude, supports the existing findings.

Another determinant proving to be significant in the use stage of the BIS adoption process is *organizational data environment* (ODE). As technology becomes ever more available, including for SMEs, data quality, availability, and ETL are not so much an issue anymore. If BIS becomes an integral part of an ERP, the organizational data environment becomes even less decisive since we can expect to have better input for BIS as opposed to when BIS is not sufficiently integrated with the transaction system (Puklavec et al., 2014). Consequently, both adopters and non-adopters feel confident in the field of ODE and thus ODE does not play a significant role in BIS evaluation and adoption. The relevance of ODE first appears in the use stage where it becomes clear that, without an adequate data environment, fast and reliable results are questionable and may likely impact the BIS use and further success (Popovič et al., 2012).

In contrast to ODE, *organizational readiness* does not influence the use stage of BIS adoption but emerges as a significant determinant in the evaluation and adoption stages.

These findings confirm some earlier studies (e.g. Hameed et al., 2012; Mehrtens et al., 2001; Tsai et al., 2010) and extend them with insights about behavior in the use stage. These findings, merged with firms' high average appraisal of their own organizational readiness, suggest that firms not using BIS find themselves ready to use it. However, there are other determinants (i.e. management support, project champion, BIS is part of ERP, and organizational data environment) that are reducing the impact of organizational readiness on BIS use.

Within the domain of *external support* for IT innovation adoption, previous studies presented mixed results (Quaddus & Hofmeyer, 2007). Our study results contradict certain earlier works (e.g. Hong & Zhu, 2006; Y. Lee & Larsen, 2009) but provide reasonable support for Premkumar and Roberts' (1999) postulations about two possible causes of the nonsignificance of external support for IT adoption. First, some variables could represent such a dominant influence on the adoption that they erode the impact of other variables. Similar findings can be found in Caldeira and Ward (2002) where management involvement and IS/IT knowledge availability are seen as dominating over external support. In our case, the prevailing determinant could be BIS being part of ERP. Since ERP support also covers support for BIS, and since an integrated BIS solution basically requires substantially less support, additional external support may not be necessary. Second, as both adopters and non-adopters can use the same resources, the extent of providers' external support is equal for both groups. Consequently, external support is not a significant variable in any of the adoption process stages.

3.6.2 Practical implications, limitations, and future research

Our study also holds important insights for organizational decision-makers in SMEs, IT solution providers, and IT specialists with an interest in BIS adoption and use.

To begin with, as perceived relative advantage does not significantly affect BIS adoption, communicating BIS advantages might not be a primary focus for BIS providers. They should, instead, concentrate on developing organizational capabilities to improve BIS adoption readiness or consider the possibility of offering a BIS solution bundled with ERP. In place of investing in BIS-related promotional activities, solution providers should seek close cooperation with key users (predominantly the BIS project champion) and emphasize the prominence of organizational readiness.

In addition, BIS solution providers should steer away from emphasizing BIS cost-efficiency and should not further inflate cost-related expectations about BIS because cost-efficiency does not influence evaluation. Moreover, as expectations are already quite high, additional promotional activities in this regard could produce an opposite effect, i.e. disappointment and the abandoning of the adoption. On the other hand, adopting firms

should do their best to keep the expectations of BIS cost-efficiency at moderate levels so their overambitious prospects do not negatively influence the adoption and use of BIS.

We further advise SMEs with the possibility to adopt BIS as part of their ERP solution to consider this option over adopting a third-party BIS solution. Moreover, it is sensible for firms that are considering adopting new ERP or replacing their present ERP to choose such an ERP solution that encompasses an integrated BIS. Accordingly, ERP providers as well as BIS providers should work together to integrate their solutions and develop package solutions. Consequently, implementations of these solutions would be more effective and users would be able to avoid the use of redundant resources as a consequence of separate adoption endeavors (i.e. one for BIS and one for the ERP solution).

BIS solution providers need to recognize that, without securing sufficient management support for the BIS adoption, success is likely at stake. As management support is one of the key determinants for evaluation, solution providers should focus their efforts on emphasizing the importance of BIS for decision-making and its role in the execution of core business processes. SMEs that want to adopt BIS should also be aware of the significance of management support, particularly for the use phase, or it is likely a firm will not exploit the implemented BIS to its fullest potential. In this context, management accompanied by the BIS project champion must articulate the firm's vision and emphasize a sense of importance in adopting BIS to increase stakeholders' commitment (Bose & Luo, 2011). In this vein, it is vital that firms striving for successful BIS adoption ensure a qualified individual to take on the project champion role. BIS providers should help firms find, train, and empower such an individual and maintain close cooperation with the project champion for the duration of the project.

In addition, both adopting firms and BIS providers should pay proper attention to the organizational data environment, even though it is not significant for the early phases of the adoption process. If the data environment is not at the proper level, this issue should be addressed before adopting the BIS solution as the organizational data environment has been found to be significantly linked to use, which ultimately affects adoption success.

SMEs intending to adopt BIS should also reassess their overall organizational readiness. BIS providers should assist their customers in this endeavor. As organizational readiness already influences BIS adoption in the evaluation stage, providers should help potential adopters understand the readiness factors linked to adoption, e.g. by including a clear description of requirements in their proposals and possibly also instructions on how to achieve them.

In addition, based on the identified low external support of providers, BIS solution providers could improve their service offerings in order to strengthen their competitive advantages. On the other hand, BIS adopting firms should not rely on external support too

greatly; they should instead draft appropriate adoption strategies focused on other determinants, such as presence of the project champion, management support, organizational readiness and, last but not least, consider the possibility of adopting a BIS that forms part of their present or future ERP.

As discussed above, our study provides a pattern of the factors that facilitate BIS adoption within SMEs. This knowledge can be used to structure BIS adoption procedures to replace the largely ad hoc ones often being followed. Based on our findings, we recommend that management approach BIS adoption in two steps. First, SMEs would be best off to carry out BIS adoption procedures in phases thereby minimizing the overall risk of technology acquisition. At the end of each phase, the decision should be made on whether or not to continue with acquisition. We propose firms take sequential steps, beginning with determining if sufficient BIS benefits exist and if the organizational environment is supportive of adopting technology. Further, an assessment should be made of technology available to the firm (e.g. by considering features and costs) and whether or not the necessary in-house IT expertise exists to integrate new with existing technology. Next, management should determine if there are sufficient internal resources available and appropriate procedures exist for the successful selection and implementation of BIS. Lastly, the external environment, support and resources need to be evaluated, particularly if in-house resources and support are lacking.

As the second step, management should give attention to those tasks and activities regarded as the most important for the successful adoption of BIS. Fink (1998) claims that management must focus on the following areas: (i) the value to be gained from the use of IT for operational efficiency, management effectiveness, and competitive advantage; (ii) the availability of IT in terms of the new features they offer, and the accompanying costs; (iii) the use of technology to stay competitive in the external environment, the existence of a positive attitude within the firm to use the IT, and top management support.

Despite its theoretical and practical contributions, our study entails some limitations and opens avenues for future research. First, our work was geographically limited. Future work could use the proposed research model to replicate BIS adoption within other environments (e.g. across other countries, in different firm-size segments) to advance our understanding of BIS adoption. Second, because BIS as part of the ERP solution was recognized to play an important role in BIS adoption – with research in this area being still in its infancy – we urge academics to further explore its role in other related research areas. Future research could develop similar determinants also for other IS/IT innovations and test them in various environments. Third, we encourage scholars to extend the proposed research model by introducing BIS value constructs into the model in order to examine the impact of BIS adoption and use on firm performance.

3.7 Conclusions

BIS are valuable tools for SMEs in competitive and uncertain environments. This study explores how technological, organizational, and environmental factors affect individual BIS adoption stages. Drawing on the Technology-Organization-Environment framework and IT adoption literature led to the development of research hypotheses and a conceptual framework that explicates these relationships in the BIS context. We conducted an empirical study among small and medium firms to test the research model and hypotheses.

Our study contributes to understanding of BIS adoption at the firm level as, to the best of our knowledge, no study has so far examined this phenomenon. Second, this research provides a reliable and valid instrument for predicting BIS adoption. In particular, we propose BIS is part of ERP as a novel determinant of BIS adoption. Further, most studies in the area of IT innovation adoption focus on the adoption stage of the adoption process, yet this is one of the few studies to conduct comprehensive research on all three adoption phases, i.e. evaluation, adoption, and use (for other works, see Bose & Luo, 2011; Chan & Chong, 2013; R. Martins et al., 2016; Thomas et al., 2015; Zhu, Kraemer, & Xu, 2006). Finally, by examining both the direct and total effect of the independent variables we provide a broader understanding of the adoption phenomenon given that evaluation, adoption, and use are not individual processes but are related and co-dependent stages of the adoption process.

This study represents important progress in our theoretical understanding of the role of technological, organizational, and environmental factors across the different BIS adoption stages. The results also provide instrumental insights for managers and solution providers to understand the influence of various determinants to more effectively conclude the adoption process. We hope this work inspires future attempts to elaborate on our findings.

4 JUSTIFYING BUSINESS INTELLIGENCE SYSTEMS ADOPTION IN SMALL AND MEDIUM ENTERPRISES: IMPACT OF SYSTEMS USE ON FIRM PERFORMANCE[3]

Abstract

The complex and competitive business environment facing today's SMEs, along with the generally substantial investment in a range of business intelligence systems (BIS) innovations for this type of firms, demand returns on the realization of the investments. In order to realize returns, mere use of BIS after effective adoption is insufficient. It is essential for BIS use to also create a business value by generating an impact on firm performance. Existing BIS research merely focuses on adoption and adoption determinants, or at the most on the innovation usage as the last phase in the adoption process. Consequently, a gap exists in BIS literature in the field of how BIS use impacts firm performance.

In response, we developed a conceptual model for assessing the determinants of BIS impact on firm performance in SMEs. The model is based on the Diffusion of Innovation (DOI) post-adoption phase of use, and the Resource-Based View (RBV), extended with our findings from the other IS/IT research literature. Our conceptual model encompasses two independent post-adoption variables of routine use and innovative use; three dependent variables of partial impacts on firm performance (impact on marketing and sales, impact on management and internal operations, impact on procurement); and an ultimate dependent variable of impact on firm performance.

To test the conceptual model, we utilized data collected from 181 small and medium enterprises (SME). The results indicate that BIS usage has a positive and significant correlation with partial impacts on firm performance, and that partial impacts explain a considerably large share of the overall impacts of BIS on firm performance variance, although not all variables of the partial impacts on firm performance show a significant influence on the overall impact on firm performance. Further, both routine use and innovative use were identified as statistically significant for all dimensions of partial impacts on firm performance. In the paper, implications of the findings are discussed separately for both theoretical and practical purposes.

Keywords: business intelligence systems (BIS); information technology/information systems (IT/IS) post-adoption use; routine use; innovative use; firm performance; small and medium enterprises (SME); confirmatory quantitative research

[3] The paper presented in this chapter of the dissertation has been completed and prepared for submission to Information and Management.

4.1 Introduction

In the literature on the business value of information technology (IT), the relationship between IT investments and their effects on firm performance continues to interest academics and practitioners (Devaraj & Kohli, 2003; Hsieh, Rai, & Xu, 2011; Liu, Ke, Wei, & Hua, 2013; Melville, Kraemer, & Gurbaxani, 2004; Schryen, 2013). Empirical evidence to unequivocally support the view that IT investments enhance firm performance has been elusive (Bharadwaj, 2000; Kohli & Grover, 2008; Nevo & Wade, 2010; Santhanam & Hartono, 2003). In enterprise-wide IS research, the adoption, use, and value of business intelligence systems (BIS) and the link to firm performance has emerged as an active research area within the discipline (Audzeyeva & Hudson, 2015; Işık, Jones, & Sidorova, 2013; Popovič et al., 2012).

Today, IS researchers still face strong pressure to answer the question of whether and how IT investments add to firm performance (Devaraj & Kohli, 2003; Hsieh et al., 2011; Zhu, 2004). Answers to this persistent challenge hold important implications for the way firms approach IT investment and management (Zhu & Kraemer, 2005). To respond to this challenge, some efforts in academia have been devoted to studying BIS adoption and firm performance (Côrte-Real, Oliveira, & Ruivo, 2017; Gupta & George, 2016; Wamba et al., 2017). While these studies significantly improved our understanding of BIS innovation, several gaps can be identified in the literature. To start with, although IT innovation adoption represents a complex process, much of the existing research has focused on the adoption decision and less on the post-adoption environment. In fact, prior research has shown that actual usage may be an important link to IT value, but this link seems to be missing in the literature (Devaraj & Kohli, 2003).

Next, there is a lack of empirical evidence to gauge BIS use, which we describe as the extent to which a decision-maker fully uses the technology to enhance productivity and to the level of integration of the technology into work patterns, and its impact on firm performance (Elbashir et al., 2008). Extant studies have addressed this issue from various (partial) perspectives (e.g. Wamba et al., 2017), yet there is a need for a theoretically thorough and empirically relevant framework to examine the use and value of BIS in organizations.

Third, earlier research explored the BIS adoption stage and use stage in the context of large firms and called for future research to re-examine the mechanisms linking adoption and use to performance outcomes in other contexts (X. Li, Hsieh, & Rai, 2013; Popovič et al., 2014). We believe it is important to investigate whether the prior assumptions can be generalized and empirical findings are applicable in different firm-size contexts. To achieve this, we study BIS in an SME setting to encompass the experience of smaller firms that might represent different aspects of BIS use in transforming firm performance.

In summary, these gaps in the literature limit our understanding of the process of BIS use for attaining higher levels of firm performance. Our study seeks to narrow these gaps. The following research questions motivating our work are: (i) What framework can be used as a theoretical basis for studying BIS use and firm performance? (ii) Within this theoretical framework, how can different usage behaviors affect value in the context of SMEs? (iii) How would various BIS-enabled partial impacts on firm performance then affect the overall firm performance? To better understand these issues, from a resource-based perspective we analyzed the BIS impact on firm performance that stems from the unique characteristics of the BIS (Popovič et al., 2012). Then, an integrative model for BIS use and its impact on firm performance is developed which incorporates two BIS usage behaviors activities and three dimensions of partial impacts on firm performance. We tested this model using survey data from 181 SMEs. Data analysis was performed by partial least squares. The results demonstrate varied impacts of distinct usage behaviors on firm performance. These results contribute to the continued debate on IT payoffs (Davern & Kauffman, 2000; Melville et al., 2004) and their state in the BIS context (Elbashir et al., 2008; Popovič et al., 2010).

4.2 Theoretical framework

Firm performance denotes collective IT-enabled performance across all firm activities, with metrics capturing bottom-line firm impacts such as cost reduction, revenue enhancement, and competitive advantage (Melville et al., 2004). Prior research on the business value of enterprise-wide IT adoption has investigated the direct effect of IT implementation and use on firm performance, but rarely how this effect is realized through the partial impacts of IT use on firm performance.

4.2.1 Linking IS use to firm performance

The importance of the link between IS use and firm performance has long been discussed in the literature (Aral & Weill, 2007; Devaraj & Kohli, 2003; Mithas, Ramasubbu, & Sambamurthy, 2011). IS use has been proposed as a pivotal construct in the system-to-value chain that links research on IS adoption/success with research on the organizational impacts of IS (DeLone & McLean, 1992; Doll & Torkzadeh, 1998).

For IS impacts to occur, it is essential that use is tied to firm performance goals. IT use only has organizational impacts when the suitability of the application is matched with the technology (Devaraj & Kohli, 2003). Goodhue and Thompson (1995) argue that a task-technology fit has to be established before IS use can produce performance impacts. A task-technology fit is achieved when the technology is compatible with the targeted application and there are skilled users who use it (Devaraj & Kohli, 2003). In our research, the importance of BIS (technology) for SMEs and the business value of the marketing, sales, internal operations, and procurement activities (tasks) mediated by IS use are steps

that lead the BIS investment toward organizational performance outcomes. Thus, the task-technology fit suggested by Goodhue and Thompson (1995) holds true in our research setting. What is more, required specialized skills affirm that the BIS users and technology form a synergy to monitor marketing, sales, internal operations, and procurement, the key business areas critical to the firm's stability and growth. Such argumentation is in line with Weill's (1992) call to examine the steps between IS investment and the resulting performance impacts.

4.2.2 The importance of IS use and its distinct usage behaviors

Whereas early IS adoption stages establish indicators of initial IS success (Thong, 1999), the use stage is critical for firms to realize returns on IS investments (Bhattacherjee, 2001; Jasperson, Carter, & Zmud, 2005). According to X. Li et al. (2013), two distinct usage behaviors in the IS adoption use stage, namely routine use and innovative use, are vital in leveraging implemented systems and alleviating low returns on IS investments.

Routinization reflects employees' routine use of an IS to support their work. This usage behavior is repetitious and perceived as a normal part of employees' work activities and has been standardized and incorporated in individual employees' work processes (X. Li et al., 2013). However, this does not necessarily mean that a person uses the IS to the system's full potential.

The main difference between the two presented usage behaviors lies in the nature of these two behaviors; namely, how the firm succeeds in instilling the system's use in its working practices and how the employees take advantage of the features offered by the system (X. Li et al., 2013). Consider a procurement analyst whose job responsibilities include evaluating suppliers, developing innovative approaches to review procurement process effectiveness, providing recommendations on all procurement-related issues (e.g. plans, reports, and metrics), and suggesting procurement strategies. To efficiently fulfil the assigned work, a procurement analyst is expected to routinely use BIS. In this setting, routine use could refer to the analyst relying solely on the system when performing his work activities (e.g. generating regular reports). If the procurement analyst believes they can attain advanced insights, they should look for more innovative use such as exploring new dimensions and measures from the data store, combining them across several reports to generate novel views on potential and established vendors or synthesizing the analysis functions to analyze the data in very different ways. In effect, innovative use relates to the extent to which the analyst uses the BIS-specific features (i.e. various analytical capabilities) to their fullest potential to creatively analyze data in the data store and suggest alternatives for procurement strategies. Thus, both BIS usage behaviors can enable the procurement analyst to accomplish the assigned work in an efficient and effective way.

4.2.3 BIS impact on firm performance

A firm's resources and capabilities are valuable if they reduce a firm's costs or increase its revenues compared to what would have been the case if the firm did not possess those resources (Amit & Zott, 2001). For the purpose of this work, we examine the unique characteristics of BIS (as an IT capability) and connect them in three ways through which BIS may have partial impacts on firm performance for various business areas – marketing and sales, management and internal operations, and procurement.

BIS are data-driven, enterprise-wide decision-support systems that integrate data gathering and data storage with advanced analytical functions for decision-making (Davenport, Harris, & Morison, 2010; Negash & Gray, 2008). BIS enable employees to apply a variety of analytical functions to analyze large volumes of data, which are typically drawn or refined from data warehouses of internal and external data, and the results from these analyses are used for firms' decision-making (X. Li et al., 2013). According to X. Li et al. (2013), in the post-adoption stage complex organizational IS, such as BIS, can be used on a regular basis to analyze customer, product, service, and sales data; monitor competitors' activities; and observe market conditions and trends in the industry, but might not be utilized to its fullest potential.

Benefiting from data integration and prediction capabilities, BIS can substantially improve a firm's position in the marketplace (Chen & Siau, 2011). For instance, information richness can help capitalize on marketing investments; advanced analytical capabilities can lead to a closer match between a firm and its customers to a greater extent than before; and predictive capabilities enable firms to increase their sales potential (Elbashir et al., 2008; Negash & Gray, 2008).

BIS have also been previously identified as supporting a wide range of internal operations aspects, such as planning, manufacturing, and quality assurance. Specifically, the literature emphasizes four improvements the utilization of BIS brings to operations management. First, BIS-enabled information provides more comprehensive and accurate insights (Babiceanu & Seker, 2015; Waller & Fawcett, 2013). Second, equipment availability for the manufacturing and logistics processes has also improved as a result of exploiting BIS (Munirathinam & Ramadoss, 2014). Third, J. Lee, Lapira, Bagheri, and Kao (2013) discuss the benefits of BIS use in reducing manufacturing waste, which aided the move toward lean manufacturing. Finally, the utilization of BIS improves insights into the identification of faulty products, further preventing returns and rework (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011).

Further, BIS value has often been emphasized in connection with the procurement process as one of the firm's key operational processes (Davenport et al., 2010; Elbashir et al., 2008). Within firms, the role of procurement has changed noticeably from that of simply

buying goods and services to overseeing an integrated set of management functions. As firms look beyond short-term costs and the scope of procurement-related issues has grown, procurement professionals are paying more attention to the broader costs of operating, maintaining, and replacing the items and resources they purchase over time (den Butter & Linse, 2008). BIS enables process analysts and operational managers to have a better insight into procurement processes so they can identify process inefficiencies, as well as possibilities for improvement (Marjanovic, 2007). For example, in the case of an exception (a delay in the procurement process), using BIS will enable the procurement manager to analyze possible effects of the delay on different operational processes, so they can manage this exception.

In sum, the data integration and analytical capabilities of BIS enable partial impacts on firm performance by improving marketing and sales activities, internal operations, and assisting procurement initiatives. Such partial BIS impacts on firm performance may therefore lead to improved overall firm performance.

4.2.4 Resource-based theory

The Resource-Based View (RBV) provides a theoretical lens for linking BIS use and value (J. Barney, 1991; Peteraf, 1993). IS scholars have drawn on RBV to analyze IT capabilities and elucidate how IT value resides more in the firm's ability to leverage IT than in the technology itself (Wade & Hulland, 2004). That is, IT business value is contingent on the breadth and depth to which IT is used in the key activities in the firm's value chain (Zhu & Kraemer, 2005). The greater the use, the more likely the firm is to develop distinctive capabilities from its core IT infrastructure (computers, networks, databases, and communication platforms) (Zhu, 2004). The way IT infrastructure components are integrated with the business processes and are aligned with the firm's corporate strategy is essential to organizational effectiveness (Picoto et al., 2014). In fact, more consideration is given to the processes underlying the bonds proposed by RBV since the firm's context affects the nature of its processes (Jay Barney, Ketchen, & Wright, 2011).

Drawing upon RBV theory, technology is viewed as a key resource that can directly influence firm performance (Oh & Pinsonneault, 2007). Following this line of thought, firms that embed BIS more broadly and deeply into their value chain activities (i.e., use BIS to a greater extent) can create superior business value from their use of BIS. Even though BIS itself can be considered a commodity, the particular ways in which a firm assimilates this technology in its business processes is unique. Higher degrees of BIS usage will consequently be linked with firm performance improvements.

4.3 Research model

Pursuing the aim of our research, we propose a conceptual research model (shown in Figure 9) grounded on resource-based theory and diffusion of innovation theory, updated with recent findings from the literature.

According to Picoto et al. (2014), a theoretical linkage exists between innovation use and its impact on firm performance and, thus, more comprehensive innovation use elevates innovations' impact on the sales, marketing, internal operations, and procurement dimensions of firm performance. Elbashir et al.'s (2008) identification of the BIS-supported business activities within a firm uses an industry structure perspective within a value-chain activities framework (Porter & Millar, 1985), which is broadly used for grounding the measures of technology use and performance impact (Elbashir et al., 2008). Porter & Millar (1985) group value chain activities as: (i) primary activities (i.e. sales, marketing, operations, logistics, service); and (ii) support activities (i.e. procurement, human resources, infrastructure management, development). To ensure the conciseness of this research and to be in line with recent research on the issue of IT value (e.g. Picoto et al., 2014; Zhu & Kraemer, 2005), we focus on three major organizational value chain activities, i.e. marketing and sales, management and internal operations, and procurement; and study other activities as part of these three groups of partial impacts on firm performance.

BIS that are focused on management and business processes with a substantial impact on profitability, productivity, and the quality of service are able to contribute to business performance (Popovič et al., 2010). They support improved decision-making within a wide range of business activities as they provide the capability to conduct business information analyses. Further, the incorporation of BIS into firms' business activities creates business benefits and process enhancements which can improve organizational performance (Elbashir et al., 2008; Elbashir & Williams, 2007). Based on the described BIS impact on organizational and business process performance improvements, we suggest the following hypothesis:

Hypothesis 1 (H1): Routine BIS use has a positive correlation with all BIS partial impacts on firm performance.

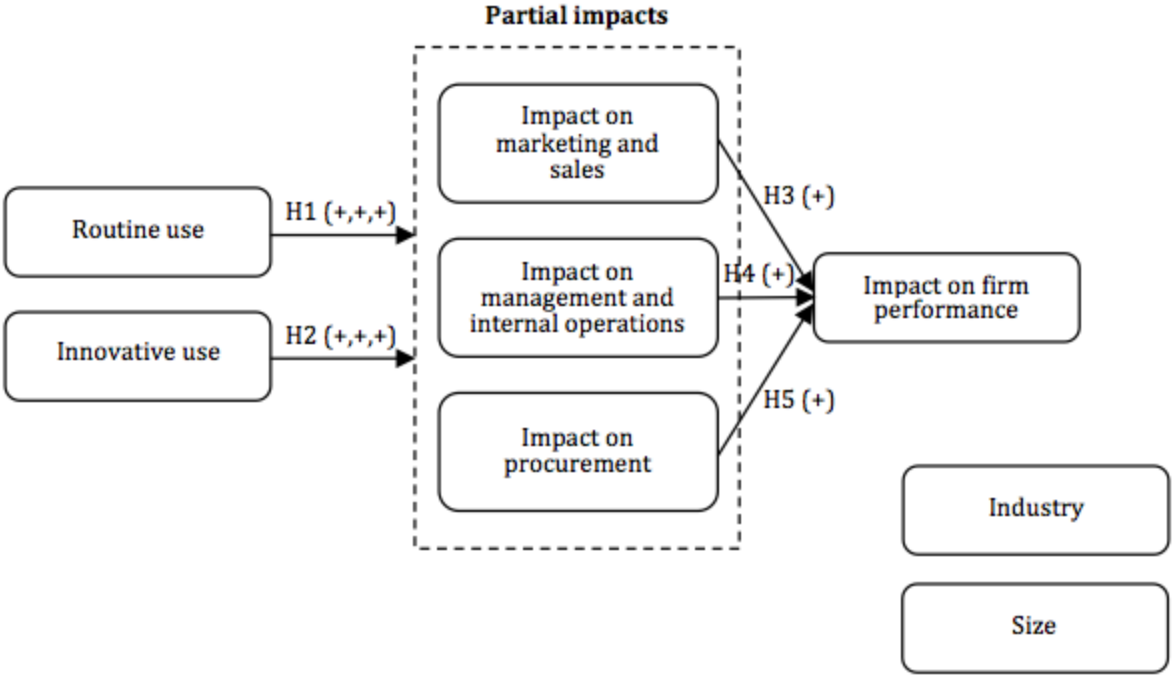
Considering Hsieh and Wang (2007), extended use refers to taking advantage of additional features of the technology to support performance of a business task. Namely, a firm that adopts an IS innovation rarely routine uses the new system to its fullest potential or achieves the expected return on investment (Jasperson et al., 2005). Since the described underachievement can be linked to underutilization of the adopted IS, some studies (e.g. Hsieh & Wang, 2007) considered extended use as the use that goes beyond standard use

and holds the potential to lead to enhanced results and higher returns. As a result, we also propose:

Hypothesis 2 (H2): Innovative BIS use has a positive correlation with all BIS partial impacts on firm performance.

Additional reasoning for the above hypothesis can be found in Zhu and Kraemer (2005) where IT business value is described as being dependent on the extent to which IT is used in the main value chain activities of the firm. In the same research, greater use is linked with a higher probability of the firm developing distinctive capabilities from its core IT infrastructure.

Figure 9. The research model



Further, RBV suggests that firms with a greater extent of IT use have a greater probability of creating IT capabilities that are rare, inimitable, valuable, and sustainable, thereby contributing to value creation. Deeper usage in firms leads to IT creation of specific assets and subsequently to competitive advantage (Zhu & Kraemer, 2005). Since many studies support the positive-oriented link between competitive advantage and firm performance (Majeed, 2011), and since firms mainly use IT innovation for the purpose of improving their performance (Stieglitz & Brockmann, 2012), we predict:

Hypothesis 3 (H3): Through its impact on marketing and sales BIS use has a positive impact on firm performance.

Hypothesis 4 (H4): Through its impact on management and internal operations BIS use has a positive impact on firm performance.

Hypothesis 5 (H5): Through its impact on procurement BIS use has a positive impact on firm performance.

The ultimate endogenous variable in our research is thus the impact on general organizational performance, while the partial impacts represent partial effects that BIS usage has on overall firm performance. Hence, a higher level of BIS usage will be associated with firms' improved performance (Picoto et al., 2014).

In line with some of the preceding studies, we included *size* and *industry* dummy variables as control variables that were used to control data variation not explained by the other variables (Buonanno et al., 2005; Gu et al., 2012; Hsu et al., 2006; Popovič et al., 2014; Thomas et al., 2015; Thong, 1999).

4.4 Research methodology

4.4.1 Measurement

Subsequent to the proposed conceptual model, we developed a questionnaire to conduct a survey of SMEs (see Appendix D). The constructs utilized (routine use, innovative use, impact on marketing and sales, impact on management and internal operations, impact on procurement, impact on firm performance) were based on the existing literature. Measuring applied a seven-point scale on an interval level ranging from "strongly disagree" to "strongly agree" or from "strongly insignificant" to "strongly significant". Consistently with the respective literature, some of the constructs used were operationalized as reflective (routine use, innovative use, impact on firm performance) and others as formative (impact on marketing and sales, impact on management and internal operations, and impact on procurement) (see Appendix E).

Items in the questionnaire (see Appendix E) were reviewed for their content validity by a group of six IS researchers and BI professionals, all appropriately familiar with BIS use and its impact on firm performance. Following their comments, some amendments to the questionnaire were made. The questionnaire was further pilot tested on 25 randomly selected SMEs from the sample frame, which confirmed its validity and reliability.

4.4.2 Data

We used an online survey service which allows one to create, execute, and briefly analyze online surveys. The invitation to the survey was distributed via email to 2,024 SMEs from various industry sectors (e.g. agriculture, manufacturing, construction, commerce,

information and communications, services, education, health). The firm and contact data were extracted and merged from different public information sources. In order to increase the content validity, participation of the BIS most qualified person (i.e. CIO, other management, or senior IS personnel) was requested along with a brief complete description of the research's scope and importance.

Data were collected in mid-2015. Over 12 weeks, a total of 181 usable responses was attained, corresponding to a response rate of 8.9%. The quite low response rate was expected since we targeted the overall SME milieu, i.e. adopters and non-adopters, regardless of how familiar an individual firm was with BIS.

In order to test for non-response bias, we compared the distributions of early and late respondents in the sample using the Kolmogorov-Smirnov test (Ryans, 1974). The sample distributions of the early and late respondents did not differ statistically (p-value > 0.10 for all variables). Accordingly, the absence of non-response bias was confirmed (Ryans, 1974).

The industry profile of the sample was as follows: 50.3% of the respondents came from the services sector, 24.3% the manufacturing industry, and 25.4% the distribution sector. The good quality of the data is indicated by the fact that the respondents were qualified individuals, predominantly CEOs.

4.5 Results

Smart PLS 3.0 M3 (Ringle, 2005) software was used to test the research model. Partial least squares (PLS) represents a variance-based structural equation model (SEM) technique which is suitable for this research since: (i) some items in the data are not distributed normally ($p < 0.01$ based on the Kolmogorov-Smirnov test); (ii) the conceptual model is considered to be complex; (iii) the model has both reflective and formative constructs (see Appendix E); and (iv) it has not previously been tested.

Before we test the structural model, we first examine the reflective part of the measurement model in order to assess the construct and indicator reliability, internal consistency, convergent validity, and discriminant validity. In the continuance, the quality of the formative construct in the measurement model was determined through content validity (Straub et al., 2004), multicollinearity (Diamantopoulos & Siguaw, 2006), and weights (Chin, 1998), all described in the following sections.

4.5.1 Measurement model

Examination of the model is reported in Tables 10 and 11. First, we assessed the construct reliability using the composite reliability coefficient and Cronbach's alpha. As shown in

Table 11, all constructs have composite reliability (CR) and Cronbach's alphas (CA) above 0.7, suggesting the constructs are reliable (Chau, 1999; Straub, 1989).

Indicator reliability was assessed using the criterion that the factor loadings should exceed the value of 0.7 (Henseler et al., 2009). As seen in Table 11 (in bold), all loadings are above 0.7. In addition, all items are statistically significant ($p < 0.01$). Thus, the model shows adequate indicator reliability.

Table 11. Loadings and cross-loadings

Constructs	**Item**	**URU**	**UIU**	**IFP**
Routine use (URU) CR=0.981; CA= 0.971; AVE=0.946	URU1	**0.973**	0.809	0.799
	URU2	**0.974**	0.776	0.792
	URU3	**0.971**	0.785	0.815
Innovative use (UIU) CR=0.976; CA= 0.967; AVE=0.909	UIU1	0.821	**0.964**	0.799
	UIU2	0.760	**0.944**	0.785
	UIU3	0.777	**0.964**	0.804
	UIU4	0.740	**0.941**	0.779
Impact on firm performance (IFP) CR=0.982; CA= 0.975; AVE=0.930	IFP1	0.821	0.820	**0.955**
	IFP2	0.797	0.816	**0.974**
	IFP3	0.768	0.783	**0.956**
	IFP4	0.796	0.785	**0.973**

Note: CR – composite reliability; CA – Cronbach's alpha; AVE – Average variance extracted

In order to test the convergent validity, we used average variance extracted (AVE). As seen in Table 11, all constructs show AVE higher than 0.5, which meets the criterion that AVE should be above 0.5 so that the construct explains more than half of the variance of its indicators (Bagozzi & Yi, 1988; Henseler et al., 2009).

Discriminant validity was evaluated based on the Fornell-Larcker criteria and also on cross-loadings. A Fornell-Larcker criterion suggests that the square root of AVE should be greater than the correlations between the latent variables (Fornell & Larcker, 1981). Table 12 shows that the square roots of AVEs (in bold) are greater than the correlation between

each pair of variables. The criteria of cross-loadings suggests that the loading of each factor should be greater than all cross-loadings (Götz et al., 2010). As shown in Table 11, patterns of the loadings are greater than the cross-loadings. Accordingly, both criteria are fulfilled.

A condition for evaluating content validity, describing the degree to which the measured results stand for the content-semantic part of the construct, is an exact content definition of the constructs (Eckhardt et al., 2009). In order to ensure the content validity, our constructs were discussed with several BI professionals from the field, all appropriately familiar with BIS adoption and the operation of SMEs, and also decision-makers with adequate knowledge of BIS adoption within the firm to reliably discuss the subject (Churchill, 1979).

Table 12. Descriptive statistics, correlation matrix, and square root of AVEs

Constructs	**Mean**	**SD**	**URU**	**UIU**	**IMS**	**IMIO**	**IP**	**IFP**
Routine use (URU)	4.659	2.001	**0.973**					
Innovative use (UIU)	4.249	1.826	0.813	**0.953**				
Impact on marketing and sales (IMS)	4.566	1.782	0.622	0.637	NA			
Impact on management and internal operations (IMIO)	5.137	1.667	0.714	0.688	0.810	NA		
Impact on procurement (IP)	4.688	1.782	0.543	0.515	0.729	0.761	NA	
Impact on firm performance (IFP)	4.606	1.823	0.825	0.831	0.739	0.803	0.642	**0.965**

Note: NA: not applicable to the formative constructs; diagonal elements – square root of AVE; off-diagonal elements – correlations

For the formative measures, the test of multicollinearity denotes that the analysis of the significance of the outer weights could be conducted as the next step since variance

inflation factor (VIF) values for all indicators were below 5, meaning that collinearity does not arise as an issue (Hair Jr et al., 2013). To achieve these criteria, we deleted items IMS3 and IMS5 of the construct Impact on marketing and sales; IMIO2, IMIO6, IMIO9, IMIO10, IMIO11, IMIO14, and IMIO15 of the Impact on management and internal operations; and IP5 of the Impact on procurement.

Outer weights of the construct Impact on marketing and sales were significant for two indicators; for the other indicator the outer loadings were greater than 0.5. Further, the outer weights of Impact on management and internal operations were also significant for two indicators; for the further six indicators the outer loadings exceeded 0.5. Similarly, the outer weights of the construct Impact on procurement were significant for two indicators and for the other two indicators the outer loadings were greater than 0.5 (see Appendix F). Hence, no indicator was eliminated (Hair Jr et al., 2013).

Since the evaluations of construct reliability, indicator reliability, convergent validity, discriminant validity (reflective measures), and content validity, multicollinearity, and the weights (formative measures) were adequate, we may confirm the constructs are suitable for testing the conceptual model.

4.5.2 Structural model

The structural model's predictive capacity was evaluated using R^2 measures besides the level of significance of the path coefficients. The path significance levels were estimated using the bootstrapping method with 5,000 resamples (Chin, 1998; Henseler et al., 2009). Regarding the multicollinearity statistics, variance inflation factors among the constructs were all below 5, hence multicollinearity does not arise as an issue (Hair Jr et al., 2013). The results of the analysis are summarized in Figure 10, showing the path coefficients, statistical significance of the path coefficients, and the R2 of dependent variables, which are respectively 0.67, 0.44, 0.55, and 0.33 for the impact on firm performance, the impact on marketing and sales, the impact on management and internal operations, and the impact on procurement.

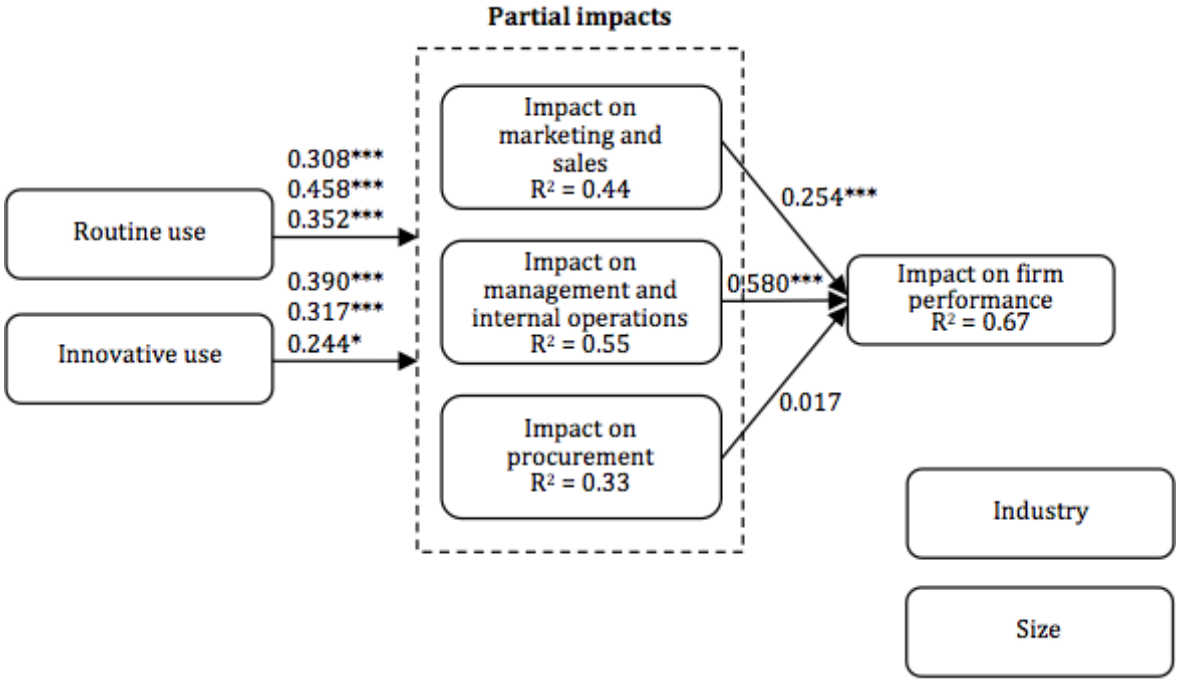
Regarding the use variables, the present research found that the hypothesis of routine use as a predictor of the partial BIS impacts on firm performance (H1) is supported for all three impact variables ($p < 0.01$). The hypothesis of innovative use as a predictor of the partial BIS impacts on firm performance (H2) is also supported for all three impact variables; specifically for the impact on marketing and sales, the impact on management and internal operations at $p < 0.01$, and for the impact on procurement at $p < 0.10$.

Within the partial impact variables, the impact on marketing and sales has significant and positive paths to the impact on firm performance ($p < 0.01$), so H3 is strongly supported. Equivalent strong support was identified for H4 as a path to the impact on firm

performance associated with the impact on management and internal operations is significant and of a high magnitude ($p < 0.01$). Dissimilar results were found for the path for the impact on procurement to the impact on firm performance variable since it is insignificant ($p > 0.10$). Thus, H5 is not supported.

We also tested the influence of the control variables on the dependent variables. For industry, we used two dummy variables (i.e. service and distribution) and also tested for the effect of firm size. The results suggest that all control variables are statistically nonsignificant.

Figure 10. The structural model



Note: * – significance at $p < 0.10$; ** – significance at $p < 0.05$; *** – significance at $p < 0.01$

4.6 Discussion

This study offers important contributions to both research and practice. It suggests implications for the IT/IS literature, in particular for the field of BI and BIS, and proposes a validated model of BIS use impact on firm performance in SMEs.

4.6.1 Theoretical implications

The results of our research suggest that the relationships between BIS routine use and the impact on marketing and sales, impact on management and internal operations, and impact on procurement are all positive and highly significant. This means that higher levels of

routine BIS use are related with higher levels of all partial BIS impacts on firm performance, which is consistent with the RBV theory.

Similarly to routine use, innovative use also shows a positive and highly significant correlation with the impact on marketing and sales, and the impact on management and internal operations. A somewhat different relationship was found between BIS routine use and the impact on procurement, which is still significant but with a smaller impact. However, these findings are also consistent with the RBV since higher levels of innovative BIS use are related with higher levels of all partial BIS impacts on firm performance. Following the above reasoning, it can be concluded that innovative use should follow routine use in order to create an additional impact on firm performance; and that, regarding partial impacts, the focus should be on the impact on marketing and sales, and on the impact on management and internal operations.

The finding that BIS use has a greater impact on sales with marketing, and management with internal operations than on procurement is consistent with Picoto et al.'s (2014) findings that explain this outcome with the tendency of procurement personnel to work in a traditional environment as opposed to sales or support personnel. Extending this reasoning, we propose that a partial cause for this can also be found in the need for sales personnel to act more innovatively as they are often more exposed to a highly competitive business environment.

Further, our results indicate that the relationship between the impact on marketing and sales, and the impact on firm performance is positive and of a high magnitude. The same results were found for the linkage between the impact on management and internal operations and the impact on firm performance, while the linkage between the impact on procurement and the impact on firm performance is nonsignificant. Considering these findings, it can be concluded that BIS usage correlates with the impact on firm performance only through the impact on marketing and sales, and through the impact on management and internal operations, but not through the impact on procurement. Moreover, we suggest that the influence of BIS routine and innovative usage on procurement is of such a nature that it does not correlate with the overall impact on firm performance.

Last but not least, our model shows that BIS partial impacts on firm performance explain a considerably large share of the impacts of BIS on the overall variance in firm performance, where R^2 is 0.67. With this result, we can confirm that by using a BIS routine and/or innovative way the impact on firm performance among SMEs can be influenced in the general sense.

4.6.2 Practical implications, limitations, and future research

Our research also carries important insights for SME organizational decision-makers, IT solution providers, and IT specialists. We generally confirm Picoto et al.'s (2014) view that when making innovation investment decisions firms need to consider the value creation of an innovation. Our research offers them a list of metrics which can be used to assess their own BIS innovations.

Moreover, our findings suggest that SME decision-makers who want to improve their firm's performance should consider the adoption and (innovative) use of the BIS since there is a considerable possibility that, after using BIS, their firm performance will actually improve. SME decision-makers should also focus on fostering BIS use primarily in the business areas of marketing, sales, management, and internal operations and not in the area of procurement because it is fairly possible that by using BIS in the procurement area the firm performance will not increase. We further advise firms that, in order to maximize their business value by using BIS, they should not stop using BIS in the standard way. By expanding BIS use to include innovative ways, they can create additional value.

In relation to BIS solution providers, they should focus their promotional activities on sales personnel and management rather than on procurement personnel since they can ensure the value of the BIS better by supporting sales/marketing, internal operations, and management activities than by supporting procurement. Solution providers that are often also supporters of the adopted BIS should also foster use of the BIS. Although the firm performance of their SME customers can already be improved by using BIS in the standard way, they should stimulate and support the use of BIS at the level of innovative use as it is only then that the potential of the BIS will be considerably exploited, while the solution provider's business references will grow.

Despite its theoretical and practical contributions, our study carries some limitations and opens avenues for future research. First, our work was geographically limited and included grouped categories of BIS partial impacts on firm performance. Future work could use the proposed research model to replicate BIS use and impact on firm performance within other environments (e.g. different firm-size segments, across other countries) to advance our understanding of the impact of BIS on firm performance while broadening the value aspects presented above. Future research could also include adoption/use determinants in the model to identify the antecedents of usage and broaden the overall picture of this phenomenon. Finally, we encourage scholars to develop similar models for other IS/IT innovations and test them in various environments.

4.7 Conclusions

This study explored how post-adoption use of BIS affects the partial BIS impacts on firm performance in the SME milieu. Drawing on the Resource-Based Theory and other IT literature led to the development of the research hypotheses and a conceptual framework that explicates these relationships in the BIS context. We conducted an empirical study among small and medium firms to test the research model and hypotheses.

The results of this study indicate that BIS usage has a positive and significant correlation with the partial impacts on firm performance, and that the partial BIS impacts on firm performance explain a considerably large share of the impacts of BIS use on the variance in overall firm performance, although only two variables of partial impacts (specifically, the impact on marketing and sales, and the impact on management and internal operations, but not the impact on procurement) show a significant positive correlation with the overall impact on firm performance.

Our study contributes to our understanding of how BIS impact firm performance at the firm level in the SME milieu as to the best of our knowledge no present study has examined this phenomenon in this manner. Moreover, this research provides a reliable and valid instrument for predicting the impact of BIS on firm performance as a result of BIS usage. While most of the prior studies merely focus on use of the innovation, our research analyzes BIS use effects on firm performance. Finally, by examining routine use and innovative use individually, we provide a broader understanding of the post-adoption phenomenon of innovation usage.

This study represents important progress in our theoretical understanding of the role of BIS routine and innovative usage across different BIS partial impacts on firm performance dimensions, i.e. the impact on marketing and sales, the impact on management and internal operations, and the impact on procurement. The results also provide instrumental insights for managers and solution providers to help them understand the influence of various determinants to more effectively conclude the post-adoption process in SMEs. We hope this work inspires future attempts to elaborate on our findings.

5 CONCLUSION

BIS are valuable tools for SMEs in today's competitive and uncertain environments. This study explored how technological, organizational, and environmental factors affect individual BIS adoption stages, and how the use of BIS affects firm performance. We posit that for SMEs to realize positive effects from BIS adoption the technological, organizational, and environmental variables should be carefully considered across the different adoption stages, and BIS use should ultimately be considered instrumental for achieving positive impacts across diverse business areas that eventually lead to improved firm performance.

A comprehensive literature review of the first phase of our research, coupled with the results from the second phase of qualitative cases, gave us an overview of those determinants considered as having a noteworthy influence on BIS adoption in SMEs. Through this two-phase approach we pinpointed the candidate determinants for BIS adoption in SMEs to provide a succinct list of determinants for the empirical confirmatory testing in third phase of this research.

Drawing on the TOE framework and IT/IS adoption literature facilitated the development of the research hypotheses and a conceptual framework that explicates relationships among the determinants and adoption stages in the BIS context. In the third phase, we conducted an empirical study among SMEs to test the research model and hypotheses. The third phase of this study contributes to our understanding of BIS adoption at the firm level as, to the best of our knowledge, no present study has examined this phenomenon. This part of the research also provides a reliable and valid instrument for predicting BIS adoption. In particular, we propose BIS is part of ERP as a novel determinant of BIS adoption, and suggest a rational decision-making culture as a determinant of BIS adoption which, again to the best of our knowledge, has also not been studied in the previous BIS adoption literature.

The third phase of our research also suggests that, from the perspective of the perceived relative advantage which BIS can offer firms, BIS are significantly different to other types of IS previously studied. In contrast to prior adoption studies which generally confirm the perceived relative advantage of an IT innovation as a significant adoption determinant (Chwelos et al., 2001; Ifinedo, 2011; Li et al., 2011; Oliveira et al., 2014; Premkumar & Roberts, 1999; Ramamurthy et al., 2008; Tsai et al., 2010), our results indicate that relative advantage is nonsignificant for BIS adoption.

Similarly, we find the cost variable to not be significant in the evaluation phase, supporting some previous findings (Lee & Kozar, 2008; Tung & Rieck, 2005). However, in later stages of adoption and use our results surprisingly contradict most of the previous research

(Chong & Chan, 2012; Chwelos et al., 2001; Iacovou et al., 1995) as we find a significant negative effect of cost effectiveness on those stages.

Further, our research generally confirms extant findings about the prominence of management support (Chong et al., 2009; Hameed et al., 2012; Hwang et al., 2004; Ifinedo, 2011; Ling, 2001; Ramamurthy et al., 2008; Tsai et al., 2010). Through the detailed analysis of the varying influence of management support across the adoption stages we add to the discussion by suggesting management support is a significant determinant in the evaluation and use stages but is not significant in the adoption phase.

Our study results also confirm the findings of previous research about project champion (Bose & Luo, 2011; Chong et al., 2009; Gu et al., 2012; Hwang et al., 2004), which is indicated as the most important factor in the BIS adoption process within SMEs, and extends those findings to the BIS context while suggesting that project champion is one of the most significant determinants in every adoption stage. Another determinant proving to be significant in the use stage of the BIS adoption process is the organizational data environment.

In contrast to the previously described determinants, organizational readiness, similarly to external support, does not influence the use stage of BIS adoption but emerges as a significant determinant in the evaluation and adoption stages, while external support remains nonsignificant in all stages. These findings confirm some earlier studies (e.g. Hameed et al., 2012; Mehrtens et al., 2001; Tsai et al., 2010) and extend them with insights into behavior in the use stage.

Moreover, most research studies looking at IT innovation adoption focused on the adoption stage of the adoption process, yet this is one of the few studies to have conducted comprehensive research on all three adoption phases, i.e. evaluation, adoption, and use. In addition, by examining both the direct and total effect of the independent variables we provide a broader understanding of the adoption phenomenon as evaluation, adoption, and use are not individual processes, but are related and co-dependent stages of the adoption process. This phase of our study represents an important advance in our theoretical understanding of the role of technological, organizational, and environmental factors in the different BIS adoption stages. The results also provide instrumental insights for managers and solution providers to help them understand the influence of various determinants to more effectively conclude the adoption process.

In the last phase of our study, we observed how post-adoption use of BIS affects the partial BIS impacts on firm performance. Drawing on the RBV and other IT literature led to the development of research hypotheses and a conceptual framework that explicates these relationships in the BIS context. In this phase, we also conducted an empirical study among SMEs to test the research model and hypotheses. The results of this part of the

study indicate that BIS usage has a positive and significant correlation with BIS partial impacts on firm performance, and that these partial impacts explain a considerably large share of the variance in the overall impacts of BIS on firm performance, although only two variables of the partial impacts (specifically, the impact on marketing and sales, and the impact on management and internal operations, but not the impact on procurement) show a significant overall influence on firm performance. The fourth phase of our study contributes to our understanding of how BIS impact firm performance at the firm level since, to the best of our knowledge, no study has so far examined this phenomenon in this way. Further, this research provides a reliable and valid instrument for predicting the impact of BIS on firm performance as a result of BIS usage.

While most of the earlier studies simply focus on use of the innovation, our research analyses the effects of BIS on the partial and overall firm performance. Further, by examining routine use and innovative use individually, we provide a broader understanding of the post-adoption phenomenon of innovation usage. This part of the study represents important progress in our theoretical understanding of the role of BIS routine and innovative usage across different dimensions of partial BIS influences on firm performance, i.e. the impact on marketing and sales, the impact on management and internal operations, and the impact on procurement. The results also provide instrumental insights for managers and solution providers to assist them in understanding the influence of various determinants so as to more effectively conclude the post-adoption process.

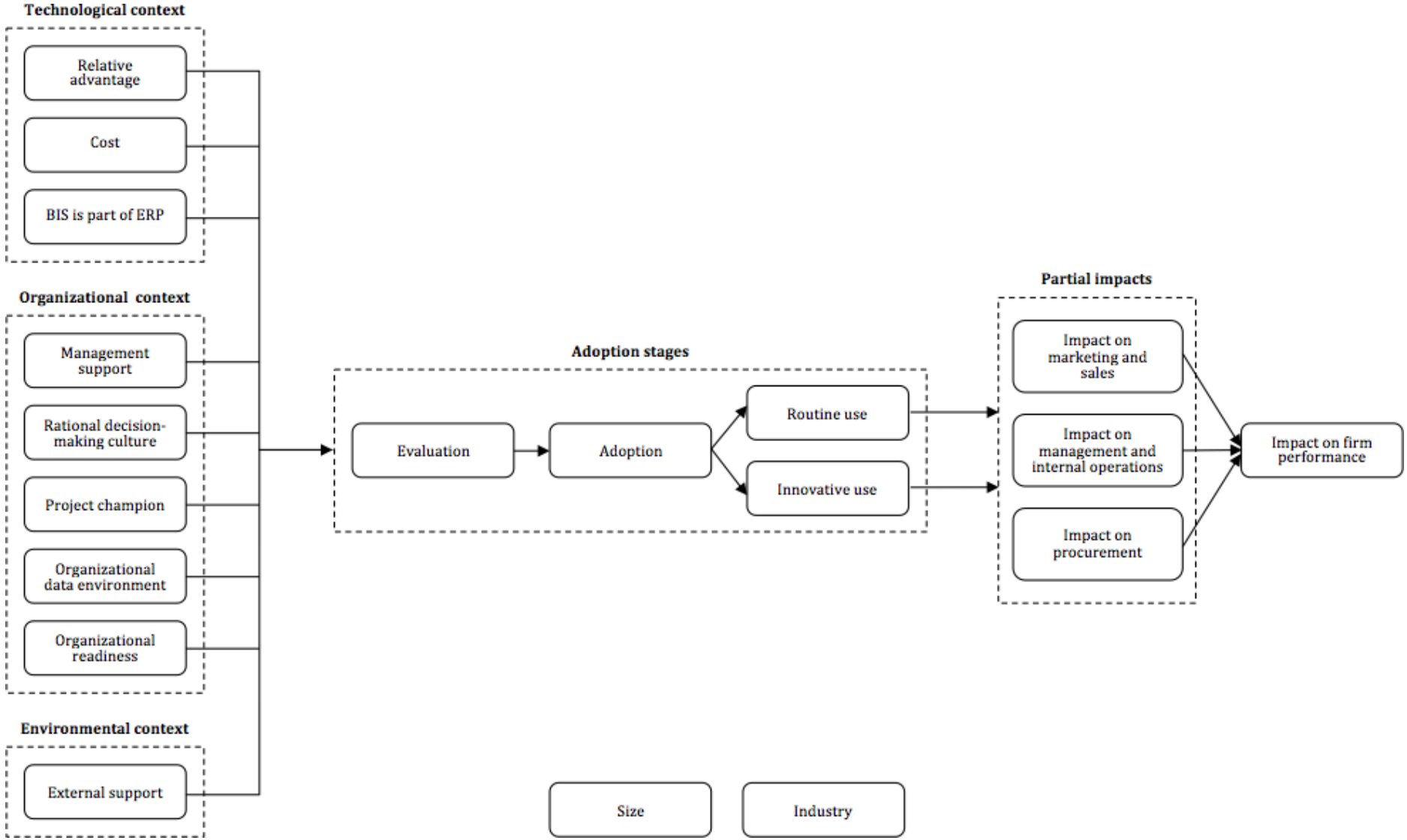
In order to summarize the practical contributions made by this doctoral dissertation for SMEs, we state the following: SMEs which have realized that adopting BIS brings positive effects and are planning to adopt this kind of IS should take into account that the adoption of BIS in the SME milieu is generally influenced by the presence of a project champion and management support. Further, their BIS adoption will be more effective if they are ready in the organizational sense and if they consider BIS as a cost-effective innovation. Nonetheless, if their present ERP solution supports the possibility of implementing BIS as part of the ERP they should seriously consider such an adoption strategy. However, they should also be aware that the adoption process varies among its stages and that different determinants are important in different stages of that process; for example, the abovementioned management support is most important in first (evaluation) phase and then again in the last (use) phase; but in the phase of adoption, management support can be generally absent. Last but not least, SMEs that have yet not decided on adopting BIS should recognize the positive impact which BIS can have on their firm performance.

Despite its theoretical and practical contributions, our study entails some limitations and opens opportunities for future research. Since our work was geographically limited, subsequent work could use the proposed research models to replicate BIS adoption and/or BIS impact on firm performance within other environments, such as other countries, and also in different firm-size segments to advance our understanding of BIS adoption and/or

BIS impact on firm performance. Further, because BIS as part of the ERP was recognized as playing an important role in BIS adoption, we urge academics to further explore its role in other related research areas, and to develop analogous determinants when studying other IT/IS innovations. Finally, we encourage scholars to develop similar research models for other IT/IS innovations and to test them in various environments.

We hope that all phases of this work inspire future attempts to elaborate on our findings. As part of future work, we propose the tentative integrative conceptual model set out in Figure 11, which should direct future research to a more comprehensive study of BIS adoption and post-adoption activities, which also investigates the direct effects of the adoption determinants on the impact of BIS on firm performance, in order to understand these potential direct relationships (Picoto et al., 2014).

Figure 11. Tentative integrative conceptual model of BIS adoption and its impact on firm performance



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APPENDICES

LIST OF APPENDICES

Appendix A: Semi-structured interview guide for the first phase – identification of BIS-related determinants (in the Slovenian language)

Dejavniki privzemanja PIS

Zap. št.: _____

Datum: _____ Od: _____ Do: _____

☐ odločevalec

☐ strokovnjak

Ime in priimek: _____

Podjetje: _____

Delovno mesto: _____

Št. let na tem del. mestu: _____

Št. let ukvarjanja z PIS: _____

Lestvica (velja za celoten vprašalnik):

1 - sploh se ne strinjam
2 - v precejšnji meri se ne strinjam
3 - v manjši meri se ne strinjam
4 - se niti ne strinjam, niti strinjam
5 - v manjši meri se strinjam
6 - v precejšnji meri se strinjam
7 - popolnoma se strinjam

a) Kaj vse je vplivalo na to, da ste privzeli PIS (Kaj vse po vašem mnenju vpliva na to, da MSP podjetje privzame PIS)?

b) V kakšni meri se strninjate s trditvijo, da je posamezen, spodaj navedeni, dejavnik vplival na privzemanje PIS v vašem podjetju (da dejavnik vpliva na privezemanje PIS v MSP)?

#	*dejavnik/skupina*	*opis*	*1*	*2*	*3*	*4*	*5*	*6*	*7*

c) Menite, da bi bil nabor dejavnikov drugačen, če bi bilo vaše podjetje veliko (če je podjetje veliko)? Katere dejavnike bi po vašem mnenju nabor vseboval v tem primeru, katerih ne, in zakaj?

#	*dejavnik/skupina*	*razlika*

d) V kakšni meri se strninjate s trditvijo, da so posamezne, spodaj navedene, skupine dejavnikov vplivale na privzemanje PIS v vašem podjetju (da skupine vplivajo na privezemanje PIS v MSP)?

#	*dejavnik/skupina*		*1*	*2*	*3*	*4*	*5*	*6*	*7*
1.	dejavniki okolja								
2.	organizacijski dejavniki								
3.	tehnološki dejavniki								

1. **Dejavniki okolja**

V kakšni meri se strninjate s trditvijo, da so posamezne, spodaj navedene, skupine dejavnikov vplivale na privzemanje PIS v vašem podjetju (da skupine vplivajo na privezemanje PIS v MSP)?

#	*dejavnik/skupina*		*1*	*2*	*3*	*4*	*5*	*6*	*7*
1.1.	vplivi povezanih podjetij								
1.2.	vplivi konkurence								
1.3.	vplivi strank								
1.4.	vplivi branže in trga								
1.5.	vplivi partnerjev								
1.6.	vplivi regulatorjev								
1.7.	vplivi dobaviteljev								
1.8.	ostali (širši) vplivi okolja								

2. **Organizacijski dejavniki**

V kakšni meri se strninjate s trditvijo, da so posamezne, spodaj navedene, skupine dejavnikov vplivale na privzemanje PIS v vašem podjetju (da skupine vplivajo na privezemanje PIS v MSP)?

#	*dejavnik/skupina*		*1*	*2*	*3*	*4*	*5*	*6*	*7*
2.1.	karakteristike								
2.2.	sodelovanje								
2.3.	zmožnosti/značilnosti								
2.4.	vodenje								
2.5.	resursi								

3. **Tehnološki dejavniki**

V kakšni meri se strninjate s trditvijo, da so posamezne, spodaj navedene, skupine dejavnikov vplivale na privzemanje PIS v vašem podjetju (da skupine vplivajo na privezemanje PIS v MSP)?

#	*dejavnik/skupina*		*1*	*2*	*3*	*4*	*5*	*6*	*7*
3.1.	inovacija (PIS)								
3.2.	tehn. pripravljenost								

e) V kakšni meri se strninjate s trditvijo, da je posamezen, spodaj navedeni, dejavnik vplival na privzemanje PIS v vašem podjetju (da dejavnik vpliva na privezemanje PIS v MSP)?

#	*dejavnik/skupina*		*1*	*2*	*3*	*4*	*5*	*6*	*7*
1.	dejavniki okolja								
1.1.	vplivi povezanih podjetij								
1.1.1.	vertikalne povezave	Prenosi tehnologij in inovacij skozi vertikalne povezave med hčerinskimi podjetji in matičnimi družbami.							
1.2.	vplivi konkurence								
1.2.1.	pritiski konkurence	Pritisk, ki izhaja iz grožnje izgube konkurenčne prednosti.							
1.2.2.	mimetični pritiski	Mimetični pritiski predstavljajo spreminjanje podjetja s ciljem posnemanja ostalih podjetij v posl. okolju.							
1.3.	vplivi strank								
1.3.1.	pritiski kupcev	Povratne informacije in zahteve s strani kupcev kot pospeševalec privzemanja.							
1.3.2.	izboljšana storitev	Želja po izboljšanju storitve za stranke.							
1.4.	vplivi branže in trga								
1.4.1.	pričakovanja tržnih trendov	Pričakovanja trendov trga lahko silijo podjetje v privzemanje inovacije s ciljem pridobitve konkurenčne prednosti.							
1.4.2.	kompleksnost panoge in trga	Stopnja kompleksnosti panoge in trga.							
1.4.3.	pritiski panoge	Prizadevanja panožnih združenj ali lobističnih skupin za razglasitev standardov, povezanih z inovacijo in vzpodbujanje privzemanja.							
1.5.	vplivi partnerjev								
1.5.1.	odvisnost od partnerja	Potencialna moč partnerja pri vzpodbujanju privzemanja inovacije.							
1.5.2.	učinki mreženja	Povečevanje sodelovanja s partnerji v skupini za povečanje učinkov inovacije.							
1.5.3.	pritiski partnerjev	Pritiski partnerjev za uvedbo PIS.							
1.5.4.	partnersko zaupanje	Pričakovanje da partner ne bo izkoristil naše ranljivosti, če bo imel priložnost.							
1.5.5.	partnerjeva pripravljenost	Primeri, ko je podjetje motivirano in pripravljeno na privzemanje, a tega ne more storiti zaradi nepripravljenih partnerjev.							
1.6.	vplivi regulatorjev								
1.6.1.	zakonodajne ovire	Pomanjkanje zakonodaje in predpisov v zvezi z uporabo inovacije.							
1.6.2.	podpora oblasti	Vzpodbujanje širjenja uporabe PIS s strani oblasti.							

1.7.	vplivi dobaviteljev								
1.7.1.	zunanja podpora	Možnost zunanje podpore za implementacijo in uporabo IS.							
1.7.2.	tržne aktivnosti ponudnika	Opredeltev in predstavitev inovacije ter aktivnosti ponudnika za zmanjšanje zaznanega tveganja s strani potencialne stranke.							
1.8.	ostali (širši) vplivi okolja								
1.8.1.	prisilni pritiski	Formalni in neformalni pritiski izvajani na podjetje s strani ostalih podjetij od katerih je podjetje odvisno.							
1.8.2.	kritični obseg	Pogostost uporabe inovacije v poslovnem okolju.							
1.8.3.	kulturne razlike	Kulturne razlike med državami.							
1.8.4.	normativni pritiski	Zaznana stopnja privzemanja pri partnerjih in stopnja promoviranja uporabe IT in posebno inovacije s strani oblasti in branžnih ustanov.							
1.8.5.	socialni vplivi	Privlačnost podjetja, ki privzema, za javnost, potencialne investitorje in ostala podjetja.							
2.	organizacijski dejavniki								
2.1.	karakteristike								
2.1.1.	funkcijska širina	Število strateških funkcij, ki so upravljane interno, kot nasprotje zunanjemu izvajanju dejavnosti (outsourcingu).							
2.1.2.	globalni domet	Geografski obseg operacij podjetja na globalnem trgu.							
2.1.3.	stopnja diverzifikacije	Diverzifiksacija v smislu izdelkov (širitev ponudbe), trgov in tehnologij.							
2.1.4.	lastnosti podjetja	Lastnosti, kot so branža, vrsta produkta itd.							
2.1.5.	starost podjetja	Število let od ustanovitve do danes.							
2.1.6.	obstoj podružnic	Obstoj podružnic podjetja.							
2.1.7.	velikost	Št. zaposlenih ali skupni prihodki od prodaje.							
2.2.	sodelovanje								
2.2.1.	komunikacija	Komunikacijski procesi, ki širijo znanje in prepričevanje v privzemanje.							
2.2.2.	konflikt	Stopnja konflikta ali pomanjkanja konsenza v podjetju.							
2.2.3.	povezanost	Stopnja povezanosti oseb v socilane mreže.							
2.2.4.	povezave	Formalne in neformalne povezave med zaposlenimi.							
2.2.5.	sodelovanje uporabnikov	Sodelovanje uporabnikov v procesu privzemanja.							

2.2.6.	delovne skupine	Uporaba medoddelčnih delovnih skupin in njihovih sposobnosti pri reševanju ključnih problemov.							
2.3.	zmožnosti/značilnosti								
2.3.1.	zmožnost absorbcije	Zmožnost izkoriščanja obstoječega znanja s strani ključnih uporabnikov.							
2.3.2.	organizacijska kultura	Obnašanje in pomeni, ki jih osebe povežejo s svojimi dejanji. Vključuje vrednote podjetja, vizije, norme, delovni jezik, sisteme, simbole, prepričanja in navade.							
2.3.3.	inovativnost	Inovativnost oz. odprtost za nove ideje, kot aspekt kulture podjetja.							
2.3.4.	predhodne izkušnje z uporabo IT	Predhodne izkušnje z uporabo IT.							
2.3.5.	nagnjenost k spremembam	Nagnjenost zaposlenih k spremembam (vključno s spremembami v zvezi z novo IT).							
2.3.6.	zadovoljstvo s sedanjim stanjem	Zadovoljstvo s sedanjim stanjem lahko ovira privzemanje inovacij.							
2.3.7.	odprtost sistema	Stopnja odprtosti sistema za inovacije od zunaj.							
2.4.	vodenje								
2.4.1.	centralizacija	Stopnja centralizacije odločanja v podjetju.							
2.4.2.	formalizacija	Obseg uporabe pravil in formalnih postopkov v podjetju.							
2.4.3.	podpora vodstva	Obseg zagotovljenih resursov in podpore inovaciji s strani vodstva.							
2.4.4.	kompleksnost vodenja / zaznane ovire	Stopnja kompleksnosti in tveganja zaradi sprememb v procesih in organizacijskih prilagajanj, potrebnih za privzemanje inovacije.							
2.4.5.	vodstveni odnosi	Potencialni konflikti med managerji, ki se lahko pojavijo med procesom privzemanja zaradi različnih stališč glede vlog, odgovornosti, prioritet itd.							
2.4.6.	zagovornik	Obstoj pomembnega posameznika, ki znotraj podjetja promovira inovacijo.							
2.4.7.	nagnjenost k tveganju	Stopnja nagnjenosti podjetja k tveganju.							
2.5.	resursi								
2.5.1.	razvojne kompetence	Zmožnost podjetja da interno razvije znanje za rešitev ali ga že ima na voljo preko povezanih IT podjetij.							
2.5.2.	velikost IT oddelka	Obstoječe IT funkcije in dedicirano IT osebje v podjetju.							
2.5.3.	IT znanje	IT izkušnje v smislu znanja posameznikov in v oganizaciji.							

2.5.4.	podatkovno okolje podjetja	Kvaliteta upravljanja s podatkovnimi viri.							
2.5.5.	pripravljenost podjetja	Stopnja ozaveščenosti, zavezanosti, vodenja in pripravljenosti resursov glede privzemanja.							
2.5.6.	rezerva	Človeški resursi, ki so na voljo za proces privzemanja.							
3.	tehnološki dejavniki								
3.1.	inovacija (PIS)								
3.1.1.	kompleksnost	Stopnja dojemanja inovacije, kot relativno zahtevne za razumeti in uporabljati.							
3.1.2.	pričakovane koristi	Stopnja dojemanja inovacije kot boljše od alternativne rešitve.							
3.1.3.	možnost opazovanja inovacije	Stopnja vidnosti/dostopnosti rezultatov inovacije za ostale potencialne privzemnike.							
3.1.4.	možnost preizkusa inovacije	Stopnja zmožnosti preizkušanja inovacije na omejenem obsegu.							
3.1.5.	zaznano tveganje	Stopnja (tehničnega ali drugega) tveganja, povezanega s privzemanjem ali uporabo inovacije.							
3.1.6.	zaznava strateške vrednosti	Zaznava strateške vrednosti opredeljuje, kako lahko inovacija pomaga pri strateških aktivnostih podjetja.							
3.1.7.	kompatibilnost procesov	Stopnja kompatibilnosti inovacije z obstoječimi vrednotami, izkušnjami in potrebami.							
3.1.8.	finančni resursi / strošek	Količina potrebnih / razpoložljivih finančnih sredstev za privzemanje.							
3.2.	tehn. pripravljenost								
3.2.1.	negotovost standardov	Nezmnožnost predvideti ali bodo PIS standardi obveljali in ali bodo prinašali predvidene rezultate.							
3.2.2.	razpoložljivost tehnologije	Razpoložljivost ustrezne tehnologije zunaj podjetja.							
3.2.3.	ustreznost tehnologije	Kako dobro obstoječa tehnologija ustreza socioekonomskem sistemu podjetja.							
3.2.4.	tehnološka infrastruktura	Razpoložljivost potrebne tehnološke infrastrukture.							
3.2.5.	integracija tehnologije	Stopnja prisotnosti različnih tehnologij in aplikacij v omrežju.							
3.2.6.	tehnološka pripravljenost	Razpoložljivost IT resursov, potrebnih za privzemanje, znotraj podjetja.							

f) Menite, da bi bil nabor dejavnikov drugačen, če bi bilo vaše podjetje veliko (če je podjetje veliko)? Katere dejavnike bi po vašem mnenju nabor vseboval v tem primeru, katerih ne, in zakaj?

#	*dejavnik/skupina*	*razlika*

g) Obstajajo po vašem mnenju še drugi dejavniki, ki vplivajo na privzemanje PIS in jih predhodno nismo omenili? Če da, kateri ter v kakšni meri se strninjate s trditvijo, da je posamezen vplival na privzemanje PIS v vašem podjetju (da vpliva na privezemanje PIS v MSP)?

#	*dejavnik/skupina*	*opis*	*1*	*2*	*3*	*4*	*5*	*6*	*7*

Beležke:

Appendix B: Semi-structured interview guide for the second phase – selection of key determinants (in the Slovenian language)

Dejavniki privzemanja PIS 2

Ime in priimek: _____

Razvrstite spodaj navedene dejavnike privzemanja poslovnointeligenčnih sistemov (PIS) v malih in srednje velikih podjetjih po pomembnosti tako, da jim dodelite vrednosti od 1 do 23, kjer velja:

23 = **najpomembnejši** dejavnik 1 = najmanj pomemben dejavnik

dejavnik	*opis dejavnika*	*pomembnost*
finančni resursi / strošek	Količina potrebnih / razpoložljivih finančnih sredstev za privzemanje oz. cena PIS.	
inovativnost podjetja	Inovativnost oz. odprtost za nove ideje, kot aspekt kulture podjetja.	
kompleksnost PIS	Stopnja dojemanja PIS, kot relativno zahtevnega za razumeti in uporabljati.	
lastnosti podjetja	Lastnosti, kot so panoga/dejavnost, vrsta produkta itd.	
možnost preizkusa PIS	Stopnja zmožnosti preizkušanja PIS na omejenem obsegu.	
nagnjenost k spremembam	Nagnjenost zaposlenih k spremembam (vključno s spremembami v zvezi z novim PIS).	
obstoj podružnic	Obstoj podružnic podjetja.	
organizacijska kultura	Vključuje vrednote podjetja, vizije, norme, delovni jezik, sisteme, simbole, prepričanja in navade.	
PIS je del ERP	Primer, ko je PIS del ERP (celovite informacijske rešitve) podjetja.	
podatkovno okolje podjetja	Kvaliteta upravljanja s podatkovnimi viri (urejeni podatki in baze podatkov).	
podpora vodstva	Obseg zagotovljenih resursov in podpore inovaciji s strani vodstva.	

pričakovane koristi od PIS	Pričakovane koristi od PIS oz. stopnja dojemanja PIS kot boljšega od alternativne rešitve.	
pripravljenost podjetja	Stopnja ozaveščenosti, zavezanosti, vodenja in pripravljenosti resursov glede privzemanja.	
rezerva	Človeški resursi, ki so na voljo za proces privzemanja PIS.	
sodelovanje uporabnikov	Sodelovanje uporabnikov v procesu privzemanja PIS.	
stopnja diverzifikacije	Diverzifiksacija (raznovrstnost) podjetja v smislu izdelkov (širina ponudbe), trgov in tehnologij.	
strokovnost kadra	Stopnja strokovnosti zaposlenih na področjih, pomembnih za podjetje in privzemanje.	
tržne aktivnosti ponudnika PIS	Opredeltev in predstavitev PIS ter aktivnosti ponudnika za zmanjšanje zaznanega tveganja s strani potencialne stranke.	
velikost podjetja	Glede na število zaposlenih ali skupne prihodke od prodaje.	
zadovoljstvo s sedanjim stanjem	Zadovoljstvo s sedanjim stanjem lahko ovira privzemanje inovacij.	
zagovornik	Obstoj pomembnega posameznika, ki znotraj podjetja promovira inovacijo.	
zaznava strateške vrednosti PIS	Zaznava strateške vrednosti opredeljuje zaznavo, kako lahko PIS pomaga pri strateških aktivnostih podjetja.	
zunanja podpora	Možnost zunanje podpore za implementacijo in uporabo PIS.	

Appendix C: Measurement items in Understanding the determinants of business intelligence system adoption stages in small and medium enterprises

Constructs	*Items*	*References*
Relative advantage/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): RA1 - BIS allow companies to make right decisions and to take right actions. RA2 - BIS improve the quality of decisions and actions. RA3 - BIS enhance the effectiveness of decisions and actions in companies. RA4 - BIS enable to perform decisions and actions more quickly. RA5 - BIS give a greater control over a business.	our own because of specifics of BIS; basis was: (Ifinedo, 2011; Moore & Benbasat, 1991; Oliveira et al., 2014)
Cost/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): C1 - BIS are more cost effective than other types of information systems. C2 - Organization can avoid unnecessary cost and time by using BIS. C3 - BIS save costs related to time and effort.	(A. Y.-L. Chong & Chan, 2012)
BIS is part of ERP/R	We consider *Enterprise resource planning* (ERP) as a business management software that a company can use to collect, store, manage and interpret data from many business activities. Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): BPE1 - BIS is built-in in our ERP. BPE2 - Our ERP incorporates BIS. BPE3 - BIS was provided as an integrated part of our ERP.	our own (Puklavec et al., 2014)
Management support/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): MS1 - Our management actively participates in establishing a vision and formulating strategies for utilizing BIS. MS2 - Our management communicates its support for the use of BIS. MS3 - Our management is likely to take risk involves in implementing BIS.	(A. Y.-L. Chong & Chan, 2012)
Rational decision-making culture/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): RDMC1 - Our company encourages to make informed decisions. RDMC2 - Our company encourages to look for data/information to inform decision-making. RDMC3 - Our company shows organization-wide respect for measuring and evaluating evidence when making decisions. RDMC4 - Our company encourages decision-making processes that include quantitative/numeric analysis.	(Kulkarni & Robles-Flores, 2013)
Project champion/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): PC1 - BIS have strong advocates in our company. PC2 - There are one or more people in our company who are enthusiastically pushing for BIS. PC3 - There are one or more people in our company who are constantly praising BIS benefits.	(Gu et al., 2012) + added PC3
Organizational data environment/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): ODE1 - The data currently available in our company is of high quality. ODE2 - The data that we currently use in our company is reliable. ODE3* - We have clear agreement on a common set of data definitions and business rules in our company at this time.	(Ramamurthy et al., 2008)

	ODE4 - Overall, information is shared openly throughout our organization. * - inversed (original: *We do not have…*)	
Organizational readiness/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): OR1 - Our company knows how information technology (IT) can be used to support our operations. OR2 - Our company has a good understanding of how BIS can be used in our business. OR3 - We have the necessary technical, managerial and other skills to implement BIS. OR4 - Our business values and norms would not prevent us from adopting BIS in our operations. OR5 - Our company possesses sufficient resources (financial, technological…) to adopt BIS.	(Ifinedo, 2011) + resources (OR5)
External support/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): ES1 - There are businesses in the community, which provide technical support for effective use of BIS. ES2 - Technology vendors actively market BIS by providing incentives for adoption. ES3 - Technology vendors promote BIS by offering free training sessions.	(Premkumar & Roberts, 1999) - adopted to BIS
Evaluation/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): E1 - Our company collects information about BIS with the possible intention of using it. E2 - Our company has conducted a pilot test to evaluate BIS. E3 - Our company intends to use BIS if possible.	(Chan & Chong, 2013)
Adoption/R	A1 - At what stage of BIS adoption is your organization currently engaged? - Not considering. - Currently evaluating (e.g.. in a pilot study). - Have evaluated, but do not plan to adopt this technology. - Have evaluated and plan to adopt this technology. - Have already adopted BIS. A2 - If you're anticipating that your company will adopt BIS in the future. How soon do you think it will happen? - Not considering. - In more than 5 years. - Between 2 and 5 years. - Between 1 and 2 years. - In less than 1 year. - Have already adopted BIS.	Thiesse et al. 2011)
Use/R	U – Our company uses BIS technology/solution of (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): - Analyses - Reporting - Planning - Dashboard - Data mining - Forecasting - Alerting - Benchmarking - Other, please specify	our own, based in (Zhu et al., 2006)

Note: R - reflective

Appendix D: Survey Adoption of business intelligence systems in small and medium enterprises

Adoption of Business Intelligence Systems in Small and Medium Enterprises

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Survey short title: Adoption of BIS in SME
Survey long title: Adoption of Business Intelligence Systems in Small and Medium Enterprises
Question number: 37
Survey is closed.
Active from: 19.04.2015 Active until: 19.07.2015
Author: borutp@yahoo.com Edited: borutp
Date: 01.02.2015 Date: 17.04.2016
Description:

Welcome!

Thank you for the time you are taking to complete this survey. The aim of this research is to better understand adoption of business intelligence systems in small and medium enterprises.

The questionnaire should take approximately 15 minutes to complete. Your responses are completely anonymous and will be used in aggregated way and only for the purpose of this study.

Borut Puklavec, Faculty of Economics Ljubljana University
with mentors Aleš Popovič and Tiago Oliveira

D1 - What is your position in the company?

CEO
Manager
Head of IT
IT specialist
Head of analyses department
Analyst
BI Project manager
Head of accountancy department
Accountant
Other (please specify):

D2 - Which country is your company registered in?

Albania
Austria
Bosnia and Herzegovina
Bulgaria
Croatia
Germany
Greece
Hungary
Italy
Macedonia
Montenegro
Poland
Portugal
Romania
Serbia
Slovenia
Switzerland
Other (please specify):

D3 - What is the industry of your company?

Agriculture, forestry and fishing
Mining and quarrying
Manufacturing
Energy

Water supply, sewerage, waste management
Construction
Commerce
Transporting and storage
Accommodation and food service activities
Information and communication
Financial and insurance activities
Real estate activities
Professional, scientific and technical activities
Administrative and support service activities
Public administration and defense, compulsory social security
Education
Human health and social work activities
Arts, entertainment and recreation
Other (please specify):

D4 - Is your company operating local or international?

local
international

D5 - In which year your company was established? (If you cannot specify exact year, please specify an approximation.)

In the year: ☐

S1 - What is the number of employees in your company?
(If you cannot specify exact number, please specify an approximation.)

☐ employees

S2 - How much turnover did your company had in last business year?

0 - 2 million €
2 - 10 million €
10 - 50 million €
over 50 million €
not applicable

X0 - *We consider Business Intelligence Systems (BIS)* *as tools and systems that allow a company to gather, store, access and analyze corporate data to aid in decision-making, including (but not limited to) technologies/solutions for Analyses, Reporting, Planning, Dashboard, Data mining, Forecasting, Alerting and Benchmarking. (Datalab Zeus is an example of BIS.)*

\- - -

Please rate the degree to which you agree with the following statements.

Scale:

1 - Strongly disagree
2
3
4
5
6
7 - Strongly agree
X - Not applicable

RA - Relative advantage

	1	2	3	4	5	6	7	X
BIS allow companies to make right decisions and to take right actions.								
BIS improve the quality of decisions and actions.								
BIS enhance the effectiveness of decisions and actions in companies.								
BIS enable to perform decisions and actions more quickly.								
BIS give a greater control over a business.								

C - Cost

	1	2	3	4	5	6	7	X
BIS are more cost effective than other types of information systems.								
Organization can avoid unnecessary cost and time by using BIS.								
BIS save costs related to time and effort.								

X1 - Please rate the degree to which you agree with the following statements.

Scale:

1 - Strongly disagree

2

3

4

5

6

7 - Strongly agree

X - Not applicable

We consider Enterprise resource planning (ERP) *as business management software that a company can use to collect, store, manage and interpret data from many business activities.*
(Datalab Pantheon is an example of an ERP.)

- - -

BPE - BIS is part of ERP

	1	2	3	4	5	6	7	X
BIS is built-in in our ERP.								
Our ERP incorporates BIS.								
BIS was provided as an integrated part of our ERP.								

MS - Management support

	1	2	3	4	5	6	7	X
Our management actively participates in establishing a vision and formulating strategies for utilizing BIS.								
Our management communicates its support for the use of BIS.								
Our management is likely to take risk involves in implementing BIS.								

RDMC - Rational decision-making culture

	1	2	3	4	5	6	7	X
Our company encourages to make informed decisions.								
Our company encourages to look for data/information to inform decision-making.								
Our company shows organization-wide respect for measuring and evaluating evidence when making decisions.								
Our company encourages decision-making processes that include quantitative/numeric analysis.								

PC - Project champion

	1	2	3	4	5	6	7	X
BIS have strong advocates in our company.								
There are one or more people in our company who are enthusiastically pushing for BIS.								
There are one or more people in our company who are								

	1	2	3	4	5	6	7	X
constantly praising BIS benefits.								

ODE - Organizational data environment

	1	2	3	4	5	6	7	X
The data currently available in our company is of high quality.								
The data that we currently use in our company is reliable.								
We have clear agreement on a common set of data definitions and business rules in our company at this time.								
Overall, information is shared openly throughout our organization.								

OR - Organizational readiness

	1	2	3	4	5	6	7	X
Our company knows how information technology (IT) can be used to support our operations.								
Our company has a good understanding of how BIS can be used in our business.								
We have the necessary technical, managerial and other skills to implement BIS.								
Our business values and norms would not prevent us from adopting BIS in our operations.								
Our company possesses sufficient resources (financial, technological…) to adopt BIS.								

ES – External support

	1	2	3	4	5	6	7	X
There are businesses in the community, which provide technical support for effective use of BIS.								
Technology vendors actively market BIS by providing incentives for adoption.								
Technology vendors promote BIS by offering free training sessions.								

X3 - Please rate the degree to which you agree with the following statements.

Scale:

1 - Strongly disagree

2

3

4

5

6

7 - Strongly agree

X - Not applicable

E - Evaluation

	1	2	3	4	5	6	7	X
Our company collects information about BIS with the possible intention of using it.								
Our company has conducted a pilot test to evaluate BIS.								
Our company intends to use BIS if possible.								
Cost reduction was important when our firm was considering BIS.								
Process improvement was important when our firm was considering BIS.								

A - Adoption

	1	2	3	4	5	6	7	X
Our company invests resources to adopt BIS.								
Business activities in our company require the use of BIS.								
Functional areas in our company require the use of BIS.								

A4 - At what stage of BIS adoption is your organization currently engaged?

Not considering.
Currently evaluating (e.g. in a pilot study).
Have evaluated, but do not plan to adopt this technology.
Have evaluated and plan to adopt this technology.
Have already adopted BIS.

A5 - If you're anticipating that your company will adopt BIS in the future. How soon do you think it will happen?

Not considering.
In more than 5 years.
Between 2 and 5 years.
Between 1 and 2 years.
In less than 1 year.
Have already adopted BIS.

X4 - Please rate the degree to which you agree with the following statements.

Scale:

1 - Strongly disagree

2

3

4

5

6

7 - Strongly agree

X - Not applicable

U - Use

Our company uses BIS technology/solution of:

	1	2	3	4	5	6	7	X
Analyses								
Reporting								
Planning								
Dashboard								
Data mining								
Forecasting								
Alerting								
Benchmarking								
Other (please specify):								

URU - Routine use

	1	2	3	4	5	6	7	X
Our use of the BIS has been incorporated into our regular work practices.								
Our use of the BIS is pretty much integrated as part of our normal work routine.								
Our use of the BIS is now a normal part of our work.								

UIU - Innovative use

	1	2	3	4	5	6	7	X
We often use more features than the average user of the BIS to support our work.								
We often use more overlooked aspects of the BIS to support our work.								
We use the BIS in novel ways to support our work.								
We often look for new functions in the BIS to support our work.								

IFP - Impact on firm performance

	1	2	3	4	5	6	7	X
In terms of its business impacts on the organization, the BIS has been a success.								
BIS has seriously improved my organization's overall business performance.								
From the perspective of my organization, the benefits of BIS outweigh the costs.								
BIS has had a significant positive effect on my organization.								

X5 - Please indicate the extent to which your BIS have impact in...

Scale:

1 - Strongly insignificant

2

3

4

5

6

7 - Strongly significant

X - Not applicable

IMS - Impact on marketing and sales

	1	2	3	4	5	6	7	X
Sales increasing								
Widening sales area								
Product and service innovation improvement								
Customer service improvement								
Customer satisfaction increasing								

IMIO - Impact on management and internal operations

	1	2	3	4	5	6	7	X
Making the corporate systems and information accessible from any location								
Increasing control								
The staff motivation increasing								
Improving decision-making								
Increasing organization profitability								
Better information quality								
Making internal operations more efficient (e.g.: speed up processing, reduce bottlenecks, reduce errors, notification, control emergencies)								
Increasing staff productivity								
Facilitating communication among employees								
The compression of business processes								
The organizational flexibility								
Reducing the number of employees								
Reducing administration workload								
Improved employee effectiveness								
Improved employee learning								

IP - Impact on procurement

	1	2	3	4	5	6	7	X
Inventory costs reduction								
Improving the coordination with suppliers								
Decreasing the procurement costs								
Facilitate inventory management								
Facilitating communication with suppliers								

Appendix E: Measurement items in Justifying business intelligence adoption in small and medium enterprises: effect of business intelligence systems use on firm performance

Constructs	*Items*	*References*
Routine use/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): URU1 - Our use of the BIS has been incorporated into our regular work practices. URU2 - Our use of the BIS is pretty much integrated as part of our normal work routine. URU3 - Our use of the BIS is now a normal part of our work.	(Saga & Zmud, 1994)
Innovative use/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): UIU1 - We often use more features than the average user of the BIS to support our work. UIU2 - We often use more overlooked aspects of the BIS to support our work. UIU3 - We use the BIS in novel ways to support our work. UIU4 - We often look for new functions in the BIS to support our work.	(Ahuja & Thatcher, 2005; Hsieh & Wang, 2007)
Impact on marketing and sales/F	Please indicate the extent to which your BIS have impact in... (1- Strongly insignificant; 2; 3; 4; 5; 6; 7- Strongly significant; X - Not applicable) IMS1 - Sales increasing IMS2 - Widening sales area *IMS3 - Product and service innovation improvement IMS4 - Customer service improvement *IMS5 - Customer satisfaction increasing * - deleted due to multicollinearity problems	(Picoto et al., 2014) - adopted to BIS
Impact on management and internal operations/F	Please indicate the extent to which your BIS have impact in... (1- Strongly insignificant; 2; 3; 4; 5; 6; 7- Strongly significant; X - Not applicable) IMIO1 - Making the corporate systems and information accessible from any location * IMIO2 - Increasing control IMIO3 - The staff motivation increasing IMIO4 - Improving decision-making IMIO5 - Increasing organization profitability * IMIO6 - Better information quality IMIO7 - Making internal operations more efficient (e.g.: speed up processing, reduce bottlenecks, reduce errors, notification, control emergencies) IMIO8 - Increasing staff productivity * IMIO9 - Facilitating communication among employees * IMIO10 - The compression of business processes * IMIO11 - The organizational flexibility IMIO12 - Reducing the number of employees IMIO13 - Reducing administration workload * IMIO14 - Improved employee effectiveness * IMIO15 - Improved employee learning * - deleted due to multicollinearity problems	(Picoto et al., 2014)

Impact on procurement /F	Please indicate the extent to which your BIS have impact in... (1- Strongly insignificant; 2; 3; 4; 5; 6; 7- Strongly significant; X - Not applicable) IP1 - Inventory costs reduction IP2 - Improving the coordination with suppliers IP3 - Decreasing the procurement costs IP4 - Facilitate inventory management *IP5 - Facilitating communication with suppliers * - deleted due to multicollinearity problems	(Picoto et al., 2014)
Impact on firm performance/R	Please rate the degree to which you agree with the following statements (1- Strongly disagree; 2; 3; 4; 5; 6; 7- Strongly agree; X - Not applicable): IFP1 - In terms of its business impacts on the organization, the BIS has been a success. IFP2 - BIS has seriously improved my organization's overall business performance. IFP3* - From the perspective of my organization, the benefits of BIS outweigh the costs. IFP4 - BIS has had a significant positive effect on my organization. * - inversed (original: *…the costs of BIS outweigh the benefits.*)	(Picoto et al., 2014)

Note: F - formative; R - reflective

Appendix F: Outer weights and loadings in Justifying business intelligence adoption in small and medium enterprises: effect of business intelligence systems use on firm performance

Path	Outer Weights	P Values	Outer Loadings	P Values
IMS1 -> IMS	0.471**	0.015	0.903***	0.000
IMS2 -> IMS	-0.005	0.981	0.834***	0.000
IMS4 -> IMS	0.613***	0.000	0.945***	0.000
IMIO1 -> IMIO	0.340***	0.003	0.925***	0.000
IMIO3 -> IMIO	-0.150	0.199	0.718***	0.000
IMIO4 -> IMIO	0.194	0.105	0.891***	0.000
IMIO5 -> IMIO	0.078	0.528	0.816***	0.000
IMIO7 -> IMIO	0.345**	0.010	0.933***	0.000
IMIO8 -> IMIO	0.231	0.116	0.914***	0.000
IMIO12 -> IMIO	-0.012	0.885	0.590***	0.000
IMIO13 -> IMIO	0.044	0.620	0.694***	0.000
IP1 -> IP	0.141	0.427	0.898***	0.000
IP2 -> IP	0.476*	0.055	0.917***	0.000
IP3 -> IP	-0.058	0.785	0.846***	0.000
IP4 -> IP	0.516***	0.006	0.942***	0.000

Note: * - significance at $p < 0.10$; ** - significance at $p < 0.05$; *** - significance at $p < 0.01$.

Appendix G: Summary in the Slovenian language/Daljši povzetek disertacije v slovenskem jeziku

PRIVZEMANJE POSLOVNOINTELIGENČNIH SISTEMOV V MALIH IN SREDNJIH PODJETJIH

1 UVOD

1.1 Opredelitev problematike

Za sodobna podjetja, ki želijo uspeti, je pomembno, da razumejo, kako lahko informacijska tehnologija (IT) pomaga pri vzpostavitvi pomembne konkurenčne prednosti (Popovič et al., 2010). Informacijska tehnologija in informacijski sistemi (IT/IS) predstavljajo pomemben del investicij podjetij, investicij, za katere upajo, da bodo prinesle doprinos na področjih, kot sta učinkovitost in učinkovitejše vodenje (Agarwal & Prasad, 1998). Tehnološke inovacije so pogosto zaznane kot glavno gonilo produktivnosti podjetij. Vendar bodo koristi, ki izvirajo iz inovacij, v primeru obstoja ovir za privzemanje obetajočih inovacij, prisotne le v omejenem obsegu (Zhu, Kraemer, & Xu, 2006). Zato je zelo pomembno razumevanje procesa in dejavnikov privzemanja in uporabe IT/IS (Karahanna et al., 1999). Kljub pomembnosti razumevanja procesa in dejavnikov privzemanja in uporabe IT/IS pa pušča omejevanje znanja na zgolj privzemanje in dejavnike privzemanja vrzel na znanstvenem področju IT/IS in posledično v našem poznavanju vloge IT/IS pri kreiranju vrednosti za podjetje ter pri povečevanju uspešnosti in učinkovitosti poslovanja.

V smislu podpore odločanju so se poslovnointeligenčni sistemi (PIS) pojavili kot tehnološka rešitev, ki ponuja podatkovno integracijo in analitične sposobnosti za oskrbo deležnikov na različnih organizacijskih nivojih s koristnimi informacijami za namene odločanja (Turban et al., 2010). Raziskave s področja IS že dalj časa poudarjajo pozitivni učinek informacij, ki izvirajo iz uporabe PIS, na poslovno odločanje, še posebno v primerih, ko podjetje deluje v visoko konkurenčnem okolju (Popovič et al., 2012). Medtem ko pregled literature z različnih raziskovalnih področij ne izkazuje pomanjkanja definicij PIS (Elbashir et al., 2008; Trkman et al., 2010; Watson, 2009; Williams & Williams, 2007; Wixom & Watson, 2010), smo se v tem delu odločili za uporabo naslednje definicije: kvalitetne informacije v dobro zasnovani shrambi podatkov, združene z uporabniškimi aplikacijami, ki uporabnikom omogočajo pravočasen dostop, učinkovito analizo in intuitivno predstavitev pravih informacij, kar jim omogoča ustrezno ukrepanje ali pravilne odločitve (Popovič et al., 2012). Preučevanje privzemanja PIS je ključno za razumevanje vrednosti in učinkovitosti implementacije tovrstnih sistemov.

Čeprav sta poslovnointeligenčni sistemi (PIS) na eni kakor tudi privzemanje informacijskih sistemov (IS) na drugi strani, posamezno dobro raziskani znanstveni področji, pa obstaja pomembna znanstvena vrzel na samem področju privzemanja poslovnointeligenčnih sistemov, kakor tudi na področju preučevanja vloge PIS pri kreiranju vrednosti za podjetje ter pri povečevanju uspešnosti in učinkovitosti poslovanja.

Obstoječe znanstvene raziskave kažejo na razlike med PIS in ostalimi IS v več pogledih (Popovič et al., 2012). Ključne razlike lahko združimo v naslednje glavne točke: Kot prvo je uporaba PIS v osnovi prostovoljna, koristi PIS pa so v primerjavi z operativnimi IS izražene bolj indirektno in dolgoročno. Kot drugo so uporabniki tipično intelektualni delavci na višjih organizacijskih nivojih. Nadalje: zbrane informacije so bolj agregirane skozi celotno organizacijo in več je souporabe teh informacij. Kot naslednje lahko navedemo strukturiranost uporabniških potreb in procesov v katerih so IS uporabljani, ki je v primeru PIS precej nižja, prav tako pa je nižja tudi strukturiranost navodil za uporabo PIS, saj je uporaba praviloma orientirana bolj raziskovalno in inovativno. Ne nazadnje je pri PIS fokus usmerjen bolj v potrebne podatke in njihovi ustreznosti in ne toliko v tehnološke rešitve. Prav tako podatki v kontekstu PIS prihajajo tudi iz zunanjih virov in ne le iz procesa samega. Z ozirom na navedene ključne razlike močno verjamemo, da je za popolno razumevanje ključnih dejavnikov privzemanja PIS potreben razvoj integrativnega modela privzemanja, ki bo upošteval obstoječe modele privzemanja IT/IS in jih nadgradil tako, da bo ustrezal specifikam PIS.

Medtem ko se nekatere obstoječe raziskave s področja PIS primarno osredotočajo na velika podjetja (npr. Popovič et al., 2012; Wixom & Watson, 2010; Yeoh et al., 2008), smo sami zaznali kot pomembno, da postavimo našo raziskavo v kontekst malih in srednje velikih podjetij (MSP). Zaradi specifik MSP, namreč, manj finančnih in človeških resursov, večjih tveganj, tesnejšega sodelovanja s partnerji, itd. (Eikebrokk & Olsen, 2007), ter zaradi njihove pomembnosti pri gospodarskem razvoju in oživljanju držav, tehnološkemu napredku ter ustvarjanju novih delovnih mest (Fink, 1998), smo prepričani, da lahko, z raziskovanjem privzemanja PIS v tovrstnih gospodarskih entitetah, pomembno znanstveno prispevamo obravnavanemu področju raziskovanja PIS.

Kot odgovor na zgoraj navedeno smo se odločili raziskati dejavnike privzemanja PIS ter vpliva PIS na uspešnost in učinkovitost poslovanja v malih in srednjih podjetjih (MSP) na nivoju podjetja, ter razviti in potrditveno testirati integralna modela privzemanja in vpliva PIS na uspešnost in učinkovitost poslovanja. Pri tem smo se osredotočili na (i) poglobljeno celovito preučitev ustrezne znanstvene literature z namenom odkritja kandidatov za dejavnike privzemanja PIS; (ii) izvedbo kvalitativne raziskave, ki je zožila seznam kandidatov za dejavnike ter odkrila nove, v obstoječi literaturi še neraziskane dejavnike; (iii) razvoj poglobljenega konceptualnega modela privzemanja, ki bo temeljil na obstoječih modelih privzemanja na nivoju podjetja ter na rezultatih kvalitativne raziskave; (iv) testiranje hipotetičnega modela in identificiranje dejavnikov, ki vplivajo na privzemanje

PIS v MSP; (v) raziskavo vplivov dejavnikov privzemanja na različne faze privzemanja; in (vi) razvoj in testiranje konceptualnega modela za oceno dejavnikov vpliva PIS na uspešnost in učinkovitost poslovanja MSP.

1.2 Področje raziskovanja in raziskovalna vprašanja

Namen raziskave je na podlagi konstruiranja in potrditvenega testiranja integralnih konceptualnih modelov privzemanja PIS ter vpliva PIS na uspešnost in učinkovitost poslovanja, identificirati determinante teh procesov v MSP na nivoju podjetja.

Na znanstvenem področju modelov privzemanja na nivoju podjetja obstajata dve izstopajoči teoriji, ki sta široko sprejeti in uporabljani tudi kot osnova za ostale teorije (Chong et al., 2009): prvi model je *Diffusion of innovation* (DOI) (Širjenje inovacij) (Rogers, 1995), drugi model pa je *The technology-organization-environment* (TOE) *framework* (Sistem tehnologije, organizacije in okolja) (Tornatzky & Fleischer, 1990). DOI je teorija, ki izpostavlja tri skupine dejavnikov vpliva na organizacijsko privzemanje (Rogers, 1995). Ti dejavniki zajemajo individualne – vodstvene – značilnosti (nagnjenost k spremembam), notranje značilnosti organizacijske strukture (centralizacijo, kompleksnost, formalizacijo, mreženje, organizacijsko ohlapnost, velikost) in zunanje značilnosti organizacije (odprtost sistema). Na drugi strani je teorija TOE naslednjih treh skupin dejavnikov (Tornatzky & Fleischer, 1990): okolje zunanjih funkcij (značilnosti panoge in struktura trga, infrastruktura za tehnološko podporo, zakonski predpisi), organizacija (formalne in neformalne povezave, komunikacijski procesi, velikost, ohlapnost) in tehnologija (dostopnost, značilnosti).

Zgoraj predstavljeni teoriji, skupaj z naslednjimi, pripadata skupini najbolj uporabljanih teorij s področja privzemanja tehnologij: *Technology acceptance model* (TAM) (Model sprejemanja tehnologije) (Davis, 1985, 1989; Davis et al., 1989), *Theory of planned behavior* (TPB) (Teorija načrtovanega vedenja) (Ajzen, 1991) in *Unified theory of acceptance and use of technology* (UTAUT) (Združena teorija sprejemanja in uporabe tehnologij) (Venkatesh et al., 2003). Ker pa sta v tej skupini le teoriji DOI in TOE tisti, ki obravnavata tematiko privzemanja na ravni podjetja (Oliveira & Martins, 2011), smo sprejeli odločitev, da za osnovo našega modela uporabimo slednji.

Za boljše razumevanje glavnih dejavnikov privzemanja PIS dodajamo tretji model z imenom *Iacovou* (Iacovou et al., 1995), ki je v izpeljan iz teorije modela TOE (Oliveira & Martins, 2011), vendar je za našo raziskavo pomemben, saj je bil razvit skozi raziskavo MSP in kot tak nudi dober vpogled v privzemanje IT v MSP. Model Iacovou predlaga tri skupine dejavnikov, temelječih na raziskavi MSP (Iacovou et al., 1995), in sicer zaznane koristi inovacij, organizacijsko pripravljenost (viri financiranja, IT viri) in zunanje pritiske (pritisk konkurence, moč poslovnih partnerjev).

Upoštevajoč izzive preučevanja privzemanja PIS ter razlike med PIS in ostalo IT pridemo do zaključka, da je potrebno kombinirati različne konceptualne modele in ustrezne konstrukte. Na ta način pridemo do zanesljivega vpogleda v preučevan pojav privzemanja (Oliveira & Martins, 2011). Tako so nekateri predlagani dejavniki iz zgornjih teorij združeni, nekateri ne vplivajo na privzemanje PIS in kot taki niso vključeni, nekateri dejavniki pa zaradi specifik PIS v zgornjih modelih niso zajeti in so bili dodani zgolj na podlagi naše kvalitativne raziskave. Eden izmed glavnih ciljev naše raziskave je tako identifikacija teh dejavnikov.

V namene raziskovanja vplivov uporabe PIS na uspešnost in učinkovitost poslovanja smo v našo študijo vključili še teorijo *Resourced-based view* (RBV). RBV, ki izvira iz znanstvenega področja strateškega managementa, se uporablja tudi na področju raziskav IT/IS, (npr. Picoto et al., 2014; Soares-Aguiar & Palma-dos-Reis, 2008; Zhu & Kraemer, 2005; Zhu, Kraemer, & Xu, 2006), kjer večinoma služi za razlago kreiranja konkurenčnih prednosti podjetij na podlagi njihovih IT resursov (Soares-Aguiar & Palma-dos-Reis, 2008). Po RBV se pri kombiniranju različnih resursov lahko ustvarjajo performančne prednosti, vendar morajo ti heterogeni resursi predstavljati ekonomsko vrednost, obenem pa morajo biti zahtevni za imitiranje, relativno redki, ter slabo mobilni med podjetji (J. Barney, 1991; Zhu & Kraemer, 2005).

Glavno raziskovalno vprašanje naše raziskave je: Kateri so glavni dejavniki privzemanja PIS v MSP, upoštevajoč značilnosti PIS?

Poleg glavnega raziskovalnega vprašanja odgovarjamo še na naslednja povezana vprašanja: najprej identificiramo, katere so posebnosti privzemanja PIS v MSP v različnih fazah privzemanja; nadalje definiramo, kakšna je relativna značilnost posameznega dejavnika privzemanja PIS; v nadaljevanju iščemo odgovor na vprašanje, kateri dejavniki vzpodbujajo privzemanje PIS v MSP; ne nazadnje nas zanima, kakšni so vplivi uporabe PIS na splošno uspešnost in učinkovitost poslovanja MSP.

1.3 Opredelitev znanstvenega prispevka

Skozi raziskavo je bil razvit konceptualni model z identificiranimi dejavniki privzemanja, ki je bil tudi empirično testiran in ustrezno interpretiran. Glede na to, da po našem najboljšem vedenju tak model še ni obstajal in glede na zgoraj opisano pomembnost raziskovalnega področja, menimo, da so rezultati raziskave relevantni za znanost na štiri načine. Kot prvo raziskava s širitvijo na privzemanje PIS prispeva k raziskovalnemu področju privzemanja IT/IS inovacij. Raziskali smo, kako se privzemanje PIS razlikuje od ostalega privzemanja in kakšne so na tem področju posebnosti privzemanja v MSP. Opredeljeni in testirani so bili tudi dejavniki privzemanja po posameznih fazah privzemanja PIS, kar po našem najboljšem vedenju do sedaj še ni bilo izvedeno. Kot drugo s tem delom prispevamo k raziskovalnemu področju PIS, saj je pojasnjeno, kakšne so

značilnosti privzemanja PIS na ravni podjetja in kakšna je vrednost PIS v smislu vpliva uporabe na uspešnost in učinkovitost poslovanja. Kot naslednje naša raziskava prispeva k poznavanju posebnosti MSP na področju privzemanja PIS. Nadalje pričujoča raziskava nudi validiran model vpliva PIS na uspešnost in učinkovitost poslovanja, pojasnjujoč vlogo PIS pri kreiranju vrednosti za podjetje ter pri vzpodbujanju uspešnosti in učinkovitosti. Ter ne nazadnje: razvit model privzemanja je uporaben tudi v nadaljnjih raziskavah, kar je tudi predlagano.

Menimo, da smo z objavo odgovorov na zastavljena raziskovalna vprašanja, ponudili relevantne rezultate tudi za razvijalce in svetovalce s področja PIS, saj jim ponujamo možnost globljega razumevanje procesa privzemanja PIS. Temelječ na pomembnosti PIS, so rezultati relevantni tudi za posamezna podjetja, seveda če načrtujejo privzemanje ali so že v fazi privzemanja PIS, pa tudi v slučaju potrebe po vzpodbujanju uporabe PIS kot dejavnika uspeha podjetja.

V vseh treh člankih so implikacije ugotovitev raziskav analizirane posebej za znanstvene in strokovne namene. Upoštevajoč v člankih opisanih prispevkov raziskav ter dejstva o pomembnosti PIS lahko ugotovimo, da pričujoča doktorska disertacija prispeva ne le k teoriji PIS temveč tudi k splošni znanosti na področju IS, saj so PIS pomemben del znanstvenega področja IS.

1.4 Opis raziskovalne metodologije

Za dosego zgoraj opisanega namena raziskave smo izvedli štiristopenjsko študijo, kjer prva in druga faza predstavljata obširni pregled literature ter eksploratorno raziskavo, skozi kateri smo definirali dejstva za nadaljnje modeliranje in pripravo predlaganih konceptualnih modelov privzemanja ter vpliva PIS na uspešnost in učinkovitost poslovanja. Tretja in četrta faza pa predstavljata dve konfirmatorni, kvantitativni raziskavi, ki oba modela preverjata.

Kvantitativno raziskavo smo izvedli z uporabo 10 polstrukturiranih intervjujev v živo. Intervjuji so bili izvedeni v dveh fazah. Intervjuvanci so bili izbrani s kriterijskim vzorčenjem med podjetji, velikosti MSP, identificiranimi kot aktivnih v privzemanju PIS (štirje), ter šestimi strokovnjaki za PIS. Vsi izbrani sogovorniki so ustrezno seznanjeni s področjem privzemanja PIS v MSP.

V tretji fazi raziskave je bilo najprej izvedeno modeliranje konceptualnega modela privzemanja. Ker privzemanje kompleksne tehnologije, kot so PIS zahteva kombinacijo več kot enega teoretičnega modela s ciljem doseči pravilno razumevanje procesa privzemanja, je bil konstruiran integralni model. Integralni model privzemanja PIS temelji na treh zgoraj opisanih, splošno sprejetih modelih privzemanja IT: TOE, DOI in Iacovou (Oliveira & Martins, 2011). Vsak od navedenih modelov namreč obravnava področje IS in

s tem tudi PIS na delno specifičen način. Za razumevanje privzemanja PIS pa je pomembno upoštevanje tako skupnih točk modelov kot tudi njihovih specifik. Na tej točki odkrita dejstva iz prve faze raziskave o specifikah PIS v primerjavi z ostalo IT predstavljajo dopolnitev integralnega modela, s katerim smo tako zasledovali optimalno ustreznost modela za raziskovani pojav privzemanja PIS. Kot naslednje smo veljavnost predlaganega modela empirično testirali za tri faze privzemanja: evalvacijo, privzemanje in uporabo (Thong, 1999; Zhu, Kraemer, & Xu, 2006).

V četrti fazi raziskave smo razvili konceptualni model za preverjanje dejavnikov vpliva PIS na uspešnost in učinkovitost poslovanja. Model temelji na fazi uporabe inovacije po teoriji DOI in na teoriji RBV ter je razširjen s spoznanji proučevanja ostale IT/IS literature. Veljavnost predlaganega modela z odvisnimi spremenljivkami parcialnih vplivov PIS na uspešnost in učinkovitost poslovanja in končne odvisne spremenljivke splošnega vpliva na uspešnost in učinkovitost poslovanja je bila nato empirično preverjena.

V konfirmatornih študijah tako tretje kot četrte faze smo uporabili primarne podatke, zbrane v MSP jugovzhodne Evrope. Podatke smo zbirali s pomočjo spletne storitve za anketiranje, ki omogoča izdelavo, izvedbo in osnovno analizo spletnih anket. Povabilo k izpolnitvi ankete je bilo preko elektronske pošte poslano 2024 MSP iz najrazličnejših sektorjev dejavnosti, za katere smo kontaktne podatke zbrali in združili iz različnih javno dostopnih virov. Da bi zagotovili karseda visoko stopnjo vsebinske veljavnosti, smo v vabilu zaprosili za sodelovanje tisto osebo v podjetju, ki je najbolj kvalificirana za področje PIS.

Podatki so bili zbrani sredi leta 2015. V 12 tednih smo pridobili skupno 181 uporabnih odgovorov, kar ustreza odzivni stopnji 8,9 %. Nižjo odzivno stopnjo od pričakovane (pričakovali smo odzivno stopnjo med 10 in 20% (Buonanno et al., 2005; Hsu et al., 2006; Oliveira & Martins, 2010; Soares-Aguiar & Palma-dos-Reis, 2008)) pripisujemo dejstvu, da smo ciljali celotno področje MSP, torej tako podjetja, ki PIS privzemajo ali nameravajo privzemati, kot tudi tista, ki tega ne nameravajo, ne glede na to, v kakšni meri so seznanjena s PIS. Kljub nižji odzivni stopnji pa je bil naš vzorec dovolj velik za ustrezno podstat testiranja modela, saj je bilo povabilo za sodelovanje poslano dovolj veliki skupini podjetij.

Pred objavo vprašalnika in pošiljanjem vabil je bil vprašalnik z namenom zagotovitve vsebinske veljavnosti pregledan s strani skupine šestih raziskovalcev s področja IS in strokovnjakov s področja poslovne inteligence. Vsi člani omenjene skupine so na področju privzemanja PIS ustrezno podkovani. Na podlagi podanih mnenj smo izvedli nekaj sprememb vprašalnika, ki je bil nato za potrditev veljavnosti in zanesljivosti pilotno testiran na 25, iz vzorca naključno izbranih podjetjih. Pri večini vprašanj smo uporabili 7-stopenjsko Likertovo lestvico, kjer je bilo z 1 označeno popolno nestrinjanje z navedeno trditvijo, s 7 pa popolno strinjanje z le-to.

Za testiranje raziskovalnega modela smo izbrali uporabo multivariantne analize odvisnosti z modeliranjem z linearnimi strukturnimi enačbami, ang. *Structural equations modeling* (SEM). Zaradi kompleksnosti modela, ki je bil razvit na novo in je kot tak znanstveno še netestiran in ker smo pričakovali nenormalno porazdelitev enot v podatkih, smo identificirali metodo delnih najmanjših kvadratov, ang. *Partial least squares* (PLS) kot najprimernejšo metodo za analizo (Chin, 1998; Chin et al., 2003).

1.5 Struktura disertacije

Vsled opisanega raziskovalnega pristopa je ta disertacija strukturirana kot zbirka treh znanstvenih člankov. Čeprav predstavlja posamezen članek samostojno enoto, pa skozi celotno disertacijo teče rdeča nit, ki sledi strukturi raziskave.

Posameznemu članku je posvečeno samostojno poglavje z lastnimi ključnimi besedami, uvodom, teoretičnim ozadjem, predstavitvijo raziskovalnega modela (razen v drugem poglavju), predstavitvijo raziskovalne metodologije, rezultati, razpravo in sklepi. Za razliko pa je uporabljena literatura iz vseh treh člankov predstavljena v skupnem poglavju na koncu disertacije.

Sama struktura disertacije je urejena po sledečem vzorcu: Povzetku, ključnim besedam in uvodu sledi poglavje, posvečeno prvemu članku, ki nudi celoviti pregled obstoječe literature obravnavanega področja, ter opis eksploratorne raziskave skupaj z ugotovitvami. Tretje poglavje predstavlja prvo izmed dveh konfirmatornih študij, študijo privzemanja PIS. V tem poglavju je predstavljen konceptualni model za preverjanje dejavnikov privzemanja na različnih fazah privzemanja, torej evaluaciji, privzemanju in uporabi, ki primarno odgovarja na raziskovalno vprašanje, kateri dejavniki so značilni za privzemanje PIS v MSP na nivoju podjetja. Druga izmed dveh konfirmatornih študij, študija vpliva uporabe PIS na uspešnost in učinkovitost poslovanja, je predstavljena v četrtem poglavju. To poglavje obravnava konceptualni model za preverjanje dejavnikov vpliva PIS na uspešnost in učinkovitost poslovanja, ter tako odgovarja na raziskovalno vprašanje, kako uporaba PIS vpliva na kreiranje vrednosti ter na uspešnost in učinkovitost poslovanja MSP.

Pričujoče delo se nato nadaljuje s petim poglavjem, v katerem je podan sklep s povzetkom dognanj, do katerih smo prišli z raziskavami, ki so ključni del te disertacije. Naslednje poglavje je poglavje s seznamom literature, ki mu sledijo priloge, med katerimi je tudi ta daljši povzetek v slovenskem jeziku.

2 ISKANJE DEJAVNIKOV PRIVZEMANJA POSLOVNOINTELIGENČNIH SISTEMOV: EKSPLORATORNA RAZISKAVA MALIH IN SREDNJIH PODJETIJ

Prvi članek predstavlja celovit pregled literature ter eksploratorno raziskavo skupaj z njunimi ugotovitvami. Namen tega dela raziskave je identificirati dejavnike privzemanja PIS na nivoju podjetja, ki so obenem značilni za MSP in bodo v nadaljevanju vodili razvoj in testiranje modela privzemanja PIS v domeni MSP. Skozi izvedbo polstrukturiranih intervjujev s strokovnjaki za PIS in predstavniki podjetij, ki privzemajo, ali so privzela PIS, ter kombiniranjem teh rezultatov z rezultati celovitega pregleda literature s področja privzemanja informacijske tehnologije/informacijskih sistemov (IT/IS), smo identificirali ključne kandidate za dejavnike privzemanja ter poglobljeno razumevanje privzemanja PIS v MSP.

Izčrpen pregled literature nam je zagotovil trden temelj za nadaljnjo raziskavo. Skozi pregled literature s področja privzemanja IT/IS identificiranih 69 potencialnih dejavnikov privzemanja PIS v MSP smo uporabili kot podlago za kvalitativno raziskavo.

Polstrukturirani intervjuji v živo, ki smo jih kot metodologijo uporabili v kvalitativni raziskavi, so bili izvedeni z dvofaznim pristopom. Prva faza je bila izvedena v dveh delih, in sicer smo najprej izvedli nestrukturirani del, nato pa še strukturirani. V nestrukturiranem delu smo intervjuvancem zastavljali vprašanja, brez seznanitve z listo potencialnih dejavnikov, ki smo ga pridobili na podlagi pregleda literature. V drugem, strukturiranem delu pa smo jim zastavljali vprašanja, povezana z determinantami, pridobljenimi skozi pregled literature. Uporabili smo 7-stopenjsko Likertovo lestvico, kjer je bilo z 1 označeno popolno nestrinjanje glede vpliva posamezne potencialne determinante na privzemanje PIS, medtem ko je 7 predstavljalo popolno strinjanje. Analiza nestrukturiranega dela je v drugo fazo prispevala 10 kandidatov za dejavnike, ki so morali zadovoljiti kriterij ocene 6 ali več, ter izpostavitve s strani vsaj dveh intervjuvancev. Strukturirani del prve faze je v drugo fazo raziskave prispeval nadaljnjih 13 kandidatov za dejavnike, štirje pa so se ujemali z dejavniki iz nestrukturiranega dela.

V drugi fazi raziskave smo zaprosili intervjuvance, da razvrstijo oz. rangirajo izbrane determinante iz prve faze po pomembnosti. Na ta način nam je druga faza dala listo enajstih kandidatov za dejavnike privzemanja PIS. Rezultati so pokazali, da večina identificiranih dejavnikov spada v organizacijski kontekst (6), medtem ko štirje spadajo v tehnološki kontekst in le en v kontekst okolja. Med identificiranimi kandidati posebej izpostavljamo dejavnik PIS je del ERP (celovite informacijske rešitve), ki je plod te kvalitativne študije in ga po našem najboljšem vedenju do sedaj ni obravnavalo še nobeno znanstveno delo. Identificirani kandidati za dejavnike so bili v nadaljevanju uporabljeni za konstruiranje konceptualnega modela privzemanja PIS v MSP.

3 RAZUMEVANJE DEJAVNIKOV POSAMEZNIH FAZ PRIVZEMANJA POSLOVNOINTELIGENČNIH SISTEMOV

Drugi članek je posvečen prvi od dveh konfirmatornih študij – raziskavi privzemanja PIS. V tej fazi raziskave smo razvili konceptualni model za presojo dejavnikov privzemanja PIS v fazah evaluacije, privzemanja in uporabe. Model temelji na dveh priznanih konceptih privzemanja: *Diffusion of innovation* (DOI), ter *The technology-organization-environment* (TOE) *framework*, ki ju razširjamo in dopolnjujemo z ugotovitvami naše predhodne študije. Pri testiranju konceptualnega modela smo uporabili podatke, zbrane med 181 malimi in srednjimi podjetji.

Na podlagi rezultatov smo identificirali sedem dejavnikov (*strošek, PIS je del ERP, podpora vodstva, racionalna kultura odločanja, zagovornik projekta, podatkovno okolje podjetja,* in *pripravljenost podjetja*) kot statistično značilnih za različne faze privzemanja. Rezultati so nadalje pokazali, da je najpomembnejši dejavnik privzemanja PIS v MSP zagovornik projekta, s čimer naša raziskava potrjuje rezultate predhodnih raziskav (Bose & Luo, 2011; Chong et al., 2009; Gu et al., 2012; Hwang et al., 2004) in jih razširja na znanstveno področje PIS.

Med ostalimi rezultati izpostavimo še ugotovitev, da dejavnik *pričakovane koristi* ni značilen za privzemanje PIS v MSP. Ta ugotovitev se razlikuje od ugotovitev sorodnih študij privzemanja IT/IS, ki so za različno IT oz. IS generalno potrdile dejavnik pričakovane koristi kot značilen za privzemanje IT/IS (Chwelos et al., 2001; Ifinedo, 2011; X. L. Li et al., 2011; Oliveira et al., 2014; Premkumar & Roberts, 1999; Ramamurthy et al., 2008; Tsai et al., 2010). Vzrok za tako odstopanje pojasnjujemo s splošnim sprejetjem mnenja, da PIS predstavljajo koristi za podjetje tako med podjetji, ki se za privzemanje PIS odločijo, kot tudi med tistimi, ki se za to ne odločijo. Tako so torej ostali dejavniki tisti, ki zasenčijo vpliv pričakovanih koristi, ter odločilno vplivajo na privzemanje.

Z identifikacijo za privzemanje PIS značilnih dejavnikov, uvedbo dejavnika PIS je del ERP, kot novega dejavnika privzemanja PIS, ter s proučevanjem direktnih in skupnih vplivov dejavnikov v raziskavi, naše delo predstavlja dober vpogled v odločitve podjetij glede privzemanja ter pomembno širi splošno teoretično poznavanje vloge tehnoloških, organizacijskih in okoljskih dejavnikov privzemanja PIS v različnih fazah le-tega. Večina obstoječih študij se namreč posveča le fazi privzemanja, kar ne daje dovolj celovite slike celotnega procesa privzemanja, ki zajema faze *evaluacije, privzemanja* in *uporabe*. Poleg opisanih teoretičnih prispevkov znanosti pa pričujoča raziskava nudi tudi praktične koristi za managerje in ponudnike tovrstnih rešitev.

Kljub znanstvenim in praktičnim prispevkom pa ima obravnavana študija tudi določene omejitve, ki ne nazadnje odpirajo možnosti za nadaljnje raziskovanje. Kot prvo naj omenimo, da je pričujoče delo v glavnem osredotočeno na privzemanje PIS v MSP ter da

je geografsko omejeno. Prihodnje raziskave bi se tako lahko posvetile testiranju predlaganega raziskovalnega modela v ostalih okoljih, kot so drugačne velikosti podjetij, druge države itd. Na ta način bi se naše poznavanje privzemanja PIS še dodatno razširilo. Nadalje pozivamo raziskovalce, da nadaljujejo z raziskavami dejavnika PIS je del ERP, saj se je potrdil kot pomemben dejavnik privzemanja PIS v MSP, obenem pa je zaenkrat to še v veliki meri neraziskan pojav. V nadaljnjih raziskavah bi se podobni dejavniki lahko razvili in testirali (v različnih okoljih) tudi za ostala področja IT/IS inovacij.

4 UTEMELJEVANJE PRIVZEMANJA POSLOVNOINTELIGENČNIH SISTEMOV: VPLIV UPORABE POSLOVNOINTELIGENČNIH SISTEMOV NA USPEŠNOST IN UČINKOVITOST POSLOVANJA

V tretjem članku poročamo o drugi konfirmatorni raziskavi, posvečeni vplivom PIS na uspešnost in učinkovitost poslovanja. V tej fazi raziskave smo razvili konceptualni model za presojo dejavnikov vpliva PIS na uspešnost in učinkovitost poslovanja. Model temelji na zadnji fazi privzemanja – uporaba, kot jo opisuje teorija DOI – ter na teoriji *Resource-based view* (RBV), ki ju razširjamo s spoznanji iz ostale preučevane IT/IS literature o privzemanju. Konceptualni model obsega dve neodvisni spremenljivki privzemanja, *rutinska uporaba* in *inovativna uporaba,* tri odvisne spremenljivke parcialnih vplivov PIS (*vpliv na trženje in prodajo*, *vpliv na management in interne operacije,* in *vpliv na naročanje*), ter končno odvisno spremenljivko *vpliv na uspešnost in učinkovitost poslovanja*. Pri testiranju konceptualnega modela, smo uporabili podatke, zbrane med 181 MSP.

Rezultati kažejo, da ima uporaba PIS pozitiven in značilen vpliv na poslovno vrednost PIS (parcialne vplive), ter da parcialni vplivi PIS razlagajo značilno velik del vpliva PIS na varianco uspešnosti in učinkovitosti poslovanja, čeprav vse spremenljivke parcialnih vplivov ne kažejo značilnega vpliva na uspešnost in učinkovitost. Poleg tega sta bili tako rutinska, kot inovativna uporaba, identificirani kot statistično značilni za vse dimenzije parcialnih vplivov PIS.

Rezultati, ki kažejo, da ima uporaba PIS večji vpliv na prodajo in trženje ter na management in interne operacije kot pa na naročanje, so konsistentni z ugotovitvami Picota et al. (2014), ki takšne rezultate razlagajo s težnjami nabavnega osebja po delovanju v tradicionalnem delovnem okolju, za razliko od prodajnega ali podpornega osebja. Če to razmišljanje razširimo z našimi ugotovitvami, lahko delni vzrok za nastali pojav pripišemo nuji prodajnega osebja po bolj inovativnem delovanju, saj je velikokrat bolj izpostavljeno visoko konkurenčnemu poslovnemu okolju kot osebje na področju naročanja.

Tudi ta del naše raziskave ima določene omejitve, med katerimi sta najpomembnejši geografska omejitev študije ter omejitev le-te na področje MSP. Tako za prihodnje raziskave predlagamo geografsko širitev študije, ter njeno izvedbo na različnih velikostnih

skupinah podjetij. Poleg tega predlagamo vključitev dejavnikov privzemanja oz. uporabe PIS v raziskovalni model, in sicer z namenom identifikacije prednikov uporabe PIS ter širitve razumevanja tega pojava. Ne nazadnje želimo vzpodbuditi raziskovalce k razvoju in testiranju podobnih raziskovalnih modelov tudi za ostala področja IT/IS inovacij in sicer v različnih okoljih.

5 SKLEP

Za MSP predstavljajo PIS koristno orodje, predvsem v visoko konkurenčnih in negotovih poslovnih okoljih. Pričujoče delo razlaga, kako tehnološki, organizacijski in okoljski dejavniki vplivajo na posamezne faze privzemanja PIS ter kako uporaba PIS vpliva na uspešnost in učinkovitost poslovanja. Celovito proučevanje ustrezne znanstvene literature v prvi fazi naše raziskave nam je dalo ugotovitve, ki so v povezavi z rezultati kvalitativne študije tvorile pregled dejavnikov, za katere smo pričakovali potrditev značilne vloge pri privzemanju PIS v MSP. Z uporabo dvostopenjskega pristopa smo namreč identificirali kandidate za dejavnike privzemanja PIS v SME z namenom oblikovanja kompaktnega seznama dejavnikov, ki so vstopili v nadaljnje empirično konfirmatorno testiranje tretje faze te raziskave.

V tretji fazi raziskave smo med MSP izvedli empirično študijo z namenom testiranja raziskovalnega modela in preverjanja hipotez. Ta faza našega dela prispeva k boljšemu razumevanju privzemanja PIS na nivoju podjetja, saj po našem najboljšem vedenju tega specifičnega znanstvenega področja do sedaj ni raziskala še nobena obstoječa študija. Tretja faza pričujoče raziskave nudi tudi veljavno ter zanesljivo orodje za napovedovanje privzemanja PIS, ki med drugim vključuje dejavnik, imenovan PIS je del ERP, ki je kot tak prvič vključen v znanstveno raziskavo privzemanja.

Večina raziskav s področja privzemanja IT inovacij se osredotoča na samo fazo privzemanja. Gledano s perspektive celotnega procesa privzemanja je to le ena izmed faz tega procesa. Naša raziskava v tem pogledu spada med relativno redke študije, ki so se osredotočile na celovito preučevanje treh faz privzemanja, torej evaluacije, privzemanja in uporabe. Poleg tega smo se v tretji fazi raziskave posvetili tudi preučevanju tako neposrednega kot tudi skupnega učinka neodvisnih spremenljivk na odvisne. Na ta način smo dosegli globlje razumevanje pojava privzemanja, saj evalvacija, privzemanje in uporaba niso samostojni procesi, temveč so povezane in soodvisne faze širšega procesa privzemanja. Tretja faza predstavlja tudi pomemben napredek v teoretičnem poznavanju vloge tehnoloških, organizacijskih in okoljskih dejavnikov skozi različne faze privzemanja PIS. Ne nazadnje so rezultati tega dela raziskave v veliki meri praktično uporabni tako za managerje kot za ponudnike tovrstnih rešitev, saj nudijo možnost poglobljenega razumevanja vpliva različnih dejavnikov na privzemanje PIS, kar jim je lahko v veliko pomoč pri praktični izvedbi privzemanja.

V zadnji fazi naše raziskave smo proučevali vplive uporabe PIS na različne dimenzije parcialnih vplivov PIS na uspešnost in učinkovitost poslovanja. Tudi v tej fazi smo izvedli empirično študijo med MSP z namenom testiranja raziskovalnega modela in preverjanja hipotez. Rezultati tega dela raziskave so pokazali, da ima uporaba PIS pozitivno in značilno korelacijo z dimenzijami parcialnega vpliva PIS na uspešnost in učinkovitost poslovanja, ter da parcialni vplivi razlagajo znaten del variance vpliva PIS na splošno uspešnost in učinkovitost poslovanja, čeprav le dve spremenljivki parcialnih vplivov (natančneje vpliv na trženje in prodajo ter vpliv na management in interne operacije, ne pa tudi vpliv na naročanje) kažeta značilen vpliv na splošno uspešnost in učinkovitost poslovanja.

Četrta faza naše raziskave prispeva k razumevanju vrednosti PIS na nivoju podjetja, saj po našem najboljšem vedenju še nobena obstoječa raziskava ni proučevala tega pojava na obravnavanem znanstvenem področju. Nadalje naša raziskava nudi veljavno in zanesljivo orodje za napovedovanje vplivov na uspešnost in učinkovitost poslovanja kot rezultat uporabe PIS. Medtem ko se večina obstoječih znanstvenih raziskav osredotoča zgolj na proučevanje uporabe privzete inovacije, smo se pri naši raziskavi posvetili tudi analizi vplivov PIS na uspešnost in učinkovitost poslovanja. Poleg tega smo omogočili globlje razumevanje pojava uporabe inovacije, saj smo dani pojav proučevali ločeno za rutinsko in inovativno uporabo. Ta del naše raziskave predstavlja pomemben napredek v teoretičnem razumevanju vpliva rutinske in inovativne uporabe PIS na različne dimenzije parcialnih vplivov PIS na uspešnost in učinkovitost poslovanja, ki so vpliv na trženje in prodajo, vpliv na management in interne operacije, in vpliv na naročanje. Ne nazadnje rezultati tega dela raziskave predstavljajo praktično vrednost za managerje in ponudnike obravnavanih sistemov, saj je poznavanje različnih dejavnikov pomembno za učinkovito realizacijo zaključnih faz procesa privzemanja.

Upamo, da bodo vse faze naše raziskave vzpodbujale nadaljnje raziskovanje tega področja ter da bodo za to tudi nudile ustrezne temelje. Za prihodnje študije predlagamo okvirni integrativni konceptualni model, ki je predstavljen na koncu pričujočega dela. Pričakujemo, da lahko takšen pristop pripelje bodoče raziskave do celovitejših študij privzemanja PIS v vseh njegovih fazah, npr. s proučevanjem direktnih vplivov dejavnikov privzemanja PIS na uspešnost in učinkovitost poslovanja s ciljem razumevanja teh potencialnih direktnih povezav (Picoto et al., 2014).