

Determinants of BPMS use for knowledge management

Alicia Martín-Navarro, María Paula Lechuga Sancho and Jose Aurelio Medina-Garrido

Abstract

Purpose – Companies are increasingly implementing business process management systems (BPMSs) to support their processes. However, there is a gap in the literature regarding whether users also use BPMSs to manage the knowledge needed for processes to be completed. This study aims to analyze the factors that cause users to use BPMSs to manage the knowledge required in business processes.

Design/methodology/approach – The paper proposes an original model that integrates two successful information system models applied to BPMSs and knowledge management systems. To test the hypotheses derived from this new model, data were collected from 242 mature BPMS users from 12 Spanish and Latin American companies. Structural equation modeling with AMOS was used to examine the model.

Findings – Users' perceived usefulness of a BPMS when using it for knowledge management (KM) is the only factor influencing them to use it for KM.

Practical implications – This study has practical implications for managers wishing to successfully implement a BPMS to support processes and for employees to use the knowledge embedded in the tool. The latter will only happen if users perceive the tool's usefulness for KM.

Originality/value – To the best of the authors' knowledge, this model is the first empirically validated model to successfully analyze BPMS users' tendency to use BPMSs as a tool to support necessary KM in processes.

Keywords Business process management, Business process management system, Knowledge management, End-users, Structural equation model

Paper type Research paper

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1. Introduction

Organizations are increasingly committed to knowledge management (KM) and pay special attention to the acquisition, dissemination and application of knowledge for the development of products and services and the continuous improvement of processes (Bitkowska, 2016; Zablieth *et al.*, 2016). The latter is especially relevant for modern organizations organized by processes rather than by hierarchical and functional structures (Kohlbacher, 2010). Business process management (BPM) is a modern way of operating that is deemed important for the management, evaluation and continuous improvement of organizations' business processes (Malaurent and Avison, 2016). Because processes require the incorporation and use of knowledge, BPM and KM are closely connected and synergistically interrelated (Bitkowska, 2016). Elements of process management, such as learning by doing (Schmidt, 2011), reengineering (Hipp *et al.*, 2015), modeling (Klinkmüller and Weber, 2017) and quality management (Leu and Huang, 2011) can thus be integrated with KM (Kalpic and Bernus, 2006).

KM involves developing mechanisms that support the flow of knowledge necessary for software to automate tasks (Nakash and Bouhnik, 2021). One of the latest types of software available for automating process management is the business process management

system (BPMS) (Martín-Navarro *et al.*, 2018, 2020). This tool comprises a set of activities through which information and knowledge are transferred, converted and generated, often tacitly among group members (Nunes *et al.*, 2009). In this context, using a BPMS for KM facilitates the evaluation of KM efforts to improve business process performance (Davenport, 2010).

Several attempts have been made in the academic literature to introduce the concept of BPM in KM or KM in BPM to combine the advantages of each approach (Ramadhani and Mahendrawathi, 2019; Ranjbarfard *et al.*, 2013; Szelągowski *et al.*, 2022; Szelągowski and Berniak-Woźny, 2022b). Ramadhani and Mahendrawathi (2019) related BPM to KM in a conceptual way through social software (e.g. Wiki or Blogs). Abuezhayeh *et al.* (2021) developed a conceptual framework for improving the decision-making process through KM and BPM activities. Szelągowski and Berniak-Woźny (2019) analyzed both terms in depth under the heading “the inseparable connection between KM and BPM.” However, no prior studies have considered the use of BPMSs a KM tool. In a theoretical paper, Szelągowski *et al.* (2022) showed the advantages of integrating a BPMS with a KM system (KMS), and Szelągowski (2021) and Szelągowski *et al.* (2022) proposed the empirical validation of the connection and integration of BPMS with KMS within the context of Industry 5.0 and combining smart technologies with KM.

However, although there are KMSs on the market, other systems not explicitly designed for that purpose can have the same utility (Ma'arif *et al.*, 2019). This is the case with BPMSs, which require management of the knowledge needed to carry out business processes; otherwise, workers would not know what tasks to do, in what order, or how or when to do them. In this context, academics and managers need to know the determinants of users successfully using BPMS to manage the knowledge required for processes.

Because BPMSs incorporate knowledge both in the design phase and at each stage of process execution, it is important to analyze whether workers adequately manage this knowledge. Do workers think of BPMSs as conditioning them in their work performance or do they believe BPMSs provide them with knowledge and make it easier for them to do their jobs? Users are not always aware that BPMSs can facilitate management of the knowledge required in their tasks and continuous process improvement. This is why authors increasingly advocate development of a cohesive concept with a coherent conceptual framework that integrates BPMS with KM (Inkpen and Dinur, 1998; Ranjbarfard *et al.*, 2013; Szelągowski and Berniak-Woźny, 2019). This would allow development of effective tools and methodologies for application in large and small organizations. The theoretical and practical need to integrate BPMS with the knowledge required by processes became particularly apparent during the COVID-19 health and economic crisis. During the pandemic, there was accelerated technological development and new ways of working (Shahul Hameed *et al.*, 2021). In times of crisis, when rapid responses are necessary, it is crucial to engage in appropriate KM to facilitate and enable effective management efforts (Wang and Wu, 2021). Appropriate KM involves identifying and using relevant knowledge assets to develop strategies and make informed decisions (Nordin and Alwi, 2022). This KM entails the creation, storage, sharing and utilization of knowledge and information within an organization with the aim of providing decision-makers with accurate and timely information, insights and expertise. After overcoming the constraints of the pandemic, managers face the task of determining which technological changes and organizational routines will persist. This decision hinges on the effectiveness and efficiency of the new digitized processes, as well as the level of user acceptance of information systems (Van Looy, 2021). Given this increase in digitization of processes, organizations are now in a better position after the pandemic to improve the KM required by processes managed with BPMSs.

Based on the above, it is interesting to examine how tools that automate business processes incorporate organizational knowledge valuable to users. There is a gap in the literature here because the use of BPMSs as a tool for KM has never been tested. Due to the

significant connection between BPMSs and KM and recognizing the need to advance this area of the literature, this paper, for the first time, proposes and evaluates a model and measurement instrument that include both concepts and allow us to measure them within a business processes context (Dalmaris *et al.*, 2007). Our research analyzes the determinants of using BPMSs to support the execution of processes and the KM required in the processes. A thorough analysis of the literature shows that although some studies link KM to BPM, there is a significant gap regarding BPMSs. Because the literature has not studied BPMSs as a knowledge support tool, and KMS tools are oriented to KM but not to process management, there is a need for an integrative study of these systems (Szelągowski and Berniak-Woźny, 2022a).

To achieve our research aim, we rely on the most widely accepted model in the literature on success with information systems, namely, the information system success model (ISSM) (DeLone and McLean, 1992, 2003) and its application to BPMS (Poelmans *et al.*, 2013) and KMS (Wu and Wang, 2006). The model developed by Poelmans *et al.* (2013) is pioneering in applying the ISSM to BPMSs and is, therefore, a mandatory reference, and Wu and Wang's (2006) model is referenced in many studies on KMS, including those by Martins *et al.* (2019) and Sharma and Sharma (2019). The present study, therefore, integrates both models to evaluate the success of BPMS support, not only in process management but also in KM. The research model we propose based on this integration is this paper's major contribution. We test various hypotheses to analyze determinants of the success of BPMSs for process management and KM. The results of our statistical analysis show a final model with valuable theoretical and practical implications.

2. Background

Literature on BPM and KM has generally developed as separate disciplines. According to Couckuyt and Van Looy (2020), BPM refers to concepts, methods and techniques that support the design, configuration, implementation, management and evaluation of business processes. KM, on the other hand, is a discipline for managing an organization's knowledge creation, organization and sharing (Wahjudewantia *et al.*, 2021). However, an organization that considers both issues must manage the two in a coordinated manner (Slaviček, 2011). These two paradigms are already integrated into the professional world, and they lead to productivity gains, higher efficiency and better quality of companies' outputs. This is why academics have started to study the two concepts together (Abuezhayeh *et al.*, 2021; Martín-Navarro *et al.*, 2021a). Clearly, BPM in an organization must take into account the knowledge resources the organization possesses to ensure employees have access to the knowledge necessary to perform the specific tasks that are part of the processes (Bitkowska, 2020). However, it should be noted that not all knowledge can be mechanized (Baronian, 2022). Tacit knowledge, which resides in people's minds or arises spontaneously in interpersonal relationships, is difficult to automate. For this reason, making this type of knowledge available to the rest of the workforce is a major challenge for organizations (Tseng, 2008).

Lundvall and Nielsen (2007) argue that information and communication technologies facilitate the integration and communication of tacit knowledge, making it explicit and enabling interactive learning. Thus, once knowledge is codified in process management software, employees internalize the explicit knowledge and use it to expand, extend and rethink their own tacit knowledge or to innovate (Nonaka and Takeuchi, 1995). This spiral of KM forms a virtuous circle in which the organization tries to codify and automate useful tacit knowledge into the system. When workers assimilate and use this codified and explicit knowledge, they combine it with their own tacit knowledge, experience, spontaneous creativity or knowledge from social interactions. This process can then generate new tacit knowledge that could be valuable for updating the knowledge stored in the system, provided it improves upon previously codified knowledge and that codification is possible.

Thanks to the continuous remodeling enabled by BPMSs, processes can be improved based on individual, team and organizational knowledge. In this way, processes become increasingly flexible and adaptable to changes in the environment (Gabryelczyk and Roztocki, 2018). The challenge for organizations is to constantly accumulate knowledge and appropriately apply it to processes through technology to achieve competitive advantages and a stable market position (Bitkowska, 2020). As companies use information technologies, they acquire new software to automate processes. One of these types of software is BPMSs, which differ from other technologies due to their flexibility and ability to integrate with other tools. Their modeling capacity makes it quicker to design processes because no programming is required, thus allowing processes to change according to needs and to incorporate modelers' knowledge, which generates continuous improvements (Martín-Navarro *et al.*, 2021a). In this context, Chandrasekeran *et al.* (2022) state that the use of standard BPM software to manage business processes helps to improve KM and understanding of processes. For this reason, BPMSs add value to KM and improve organizational performance (Martín-Navarro *et al.*, 2021b).

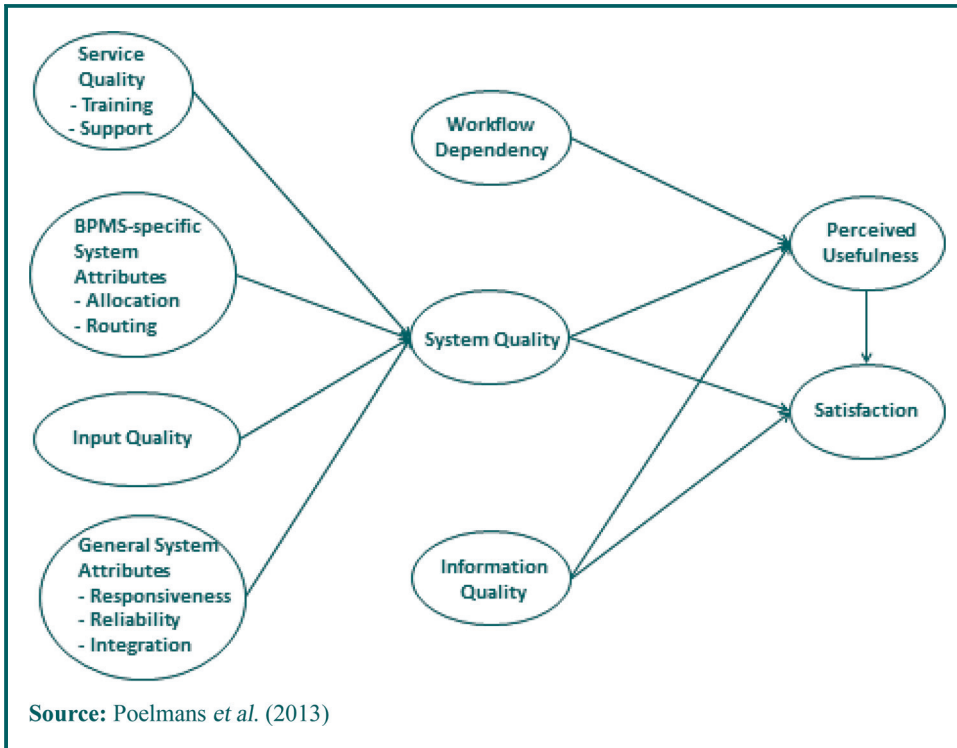
Although there is literature connecting BPM with KM, there are no empirically validated models that specifically study the relationship between BPMS software and KM (Szelągowski *et al.*, 2022; Szelągowski and Berniak-Woźny, 2022b). Whereas BPMSs allow companies to control and monitor business processes throughout the value chain (Viryasitavat *et al.*, 2020), a process-oriented KMS could be designed to allow the organization to collect and analyze data from suppliers and customers (Jung *et al.*, 2007). A priori, these two systems do not necessarily have to be interconnected or integrated. Nevertheless, the literature does provide models to assess success in the implementation of any information system, and these models could be useful when studying this relationship (DeLone and McLean, 1992, 2003). One of the most widely used models is the ISSM (DeLone and McLean, 1992). This model initially identified six different categories that contribute to systems' success:

1. system quality;
2. information quality;
3. system use;
4. user satisfaction;
5. individual impact; and
6. organizational impact. Further revisions of the ISSM added another dimension, service quality (Delone and McLean, 2003).

In the ISSM, quality (of the system, information and service) affects use and user satisfaction; the amount of use can affect the degree of user satisfaction; and use and user satisfaction impact individual performance. Finally, the sum of these individual impacts will, in turn, affect organizational performance (DeLone and McLean, 1992). ISSM is a general model applicable to any information system, and it is, therefore, useful when analyzing success in the implementation of systems related to process management, such as BPMSs or related to KM, such as KMSs. Regarding BPMSs, scholars have used the updated ISSM (Delone and McLean, 2003) to analyze the success factors of a BPMS from an end-user perspective (Poelmans *et al.*, 2013). Applying this model to analysis of BPMSs shows service quality has a positive influence on system quality. In addition, this model indicates that dependence on the system stimulates users and impacts perceived usefulness. The resulting new model (Figure 1) expands the concept of system quality by developing a multidimensional construct that includes service quality, general system attributes, specific BPMS attributes and input quality (Poelmans *et al.*, 2013).

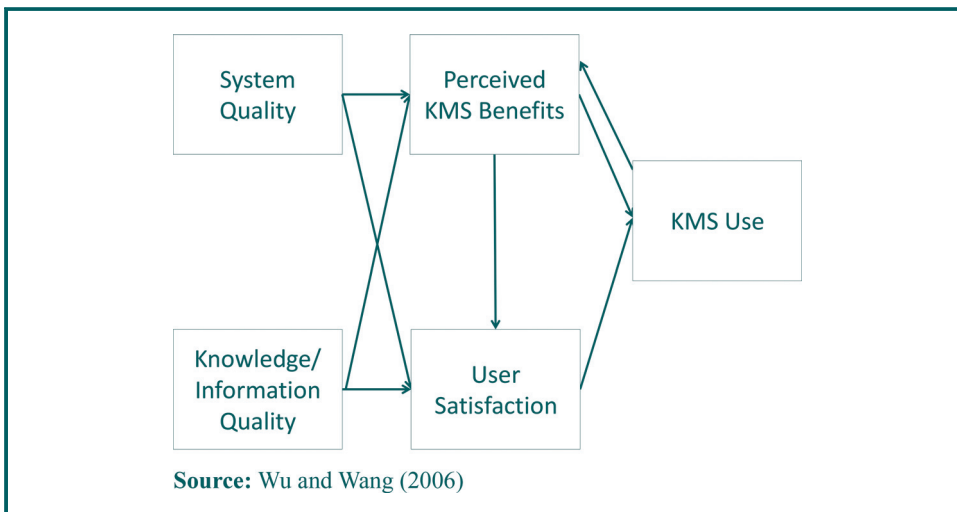
A KMS is a system mainly made available to support and improve creation and development of organizational knowledge and its subsequent storage, retrieval, distribution

Figure 1 Operational BPMS model



and use (Sambamurthy and Subramani, 2005). As with most information systems, the success of a KMS depends on its degree of use (Poston and Speier, 2005), the quality of the system and its information, user satisfaction and users' perceived usefulness (Wu and Wang, 2006). Thus, based on the original ISSM, scholars have empirically validated the success of KMSs, resulting in the well-known KMS success model (Wu and Wang, 2006), shown in Figure 2. This model verifies that technological dimensions – such as system and

Figure 2 KMS success model



information quality – and human dimensions – such as user satisfaction, perceived benefits and system use – can be considered the most appropriate constructs to measure the success of a KMS (Wu and Wang, 2006). In addition, this new model adds information and knowledge quality as measures of success.

When developing a BPMS that simultaneously considers KM, the greatest challenge is to provide an architecture that facilitates acquisition, exchange, distribution and use of knowledge among workers. Traditional workflow models are considered overly rigid for this purpose (Slaviček, 2011); therefore, a BPMS, with the flexibility its modeling allows, is more suitable.

A BPMS achieves the goal of knowledge transfer by offering synchronous or asynchronous interaction between the knowledge provider and recipient (Wu *et al.*, 2010). To analyze the success of a BPMS in KM, it is especially valuable to build a model that simultaneously considers the impact of a BPMS on processes and KM. The model we propose integrates the application of ISSM to both BPMSs (Poelmans *et al.*, 2013) and KMSs (Wu and Wang, 2006), which have only been analyzed separately in the existing literature. This model suggests, among other relationships, that system, information and knowledge quality, along with dependence on the system, affect perceived usefulness for processes, perceived usefulness for KM and user satisfaction. The latter three factors, in turn, are related to the use of the system for KM. More specifically, the model we propose is an extension of the operational BPMS model (Poelmans *et al.*, 2013), to which we add the dependent variable *system use for KM*, taken from the KMS success model (Wu and Wang, 2006). This variable helps to determine whether users use the knowledge collected by the BPMS. We also add a new construct: *perceived usefulness for KM*, which determines whether users perceive the BPMS to be useful specifically for KM. Finally, we use the concepts of both information quality and knowledge quality. In this way, we consider not only the quality of the data entered into the system but also the knowledge needed to perform the tasks.

3. Hypotheses

Our proposed new BPMS success model that considers KM features numerous determining factors, and these can be structured in three groups to facilitate understanding and increase the parsimony of the relationships between the variables considered. The first group contains determinants of the use of the system for KM. The second group includes determinants of users' satisfaction with the system and their perception that the system is useful for processes and KM. The third group comprises the determinants of system quality. This section develops these three groups and supports the hypotheses implied in the new model.

3.1 Determinants of system use for knowledge management

"System use" is the degree to which and manner in which individuals use an information system and how they consciously formulate plans to continue using it in the future (intent of use) (Ramírez-Correa *et al.*, 2015). For a BPMS, this use is mandatory, given its connection with the processes to be performed (Poelmans *et al.*, 2013). However, it is also interesting to determine acceptance and use of the system for KM because the user is not obliged to use the tool for this purpose. The use of a system for KM refers to the degree to which a user uses it to capture and apply the knowledge and information the system generates in decision-making (Wang and Yang, 2016). Heredia-Calzado and Duréndez (2019) suggest that KM encourages the use of different information systems, such as the enterprise resource planning (ERP) system. The use of information systems that support KM improves business strategies and decision-making (Jayawickrama *et al.*, 2016), and in this sense use of a KMS is an effective way to measure the success of systems with KM functionality. For

the specific case of BPMSs, a variable measuring system use for KM can be used to quantify how successfully a BPMS manages the knowledge involved in processes.

3.1.1 Impact of perceived usefulness on system use for knowledge management. The perceived usefulness of a system can determine its use (AlShibly, 2014). There is little scholarly consensus on the objective measurement of the usefulness of using a system (Clemons and Row, 1991); nonetheless, it is often measured based on the perceptions of those who use it and has been adopted as an important indicator of a system's success (Wixom and Watson, 2001). "Perceived usefulness" is the degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989) or that using a technology would improve the way in which his or her tasks are completed (AlShibly, 2014). These improvements include taking less time to get the job done, increasing efficiency and increasing accuracy (AlShibly, 2014; Teo et al., 2008).

A distinction can be made between the usefulness perceived by the user in process performance (Davis, 1989) and the usefulness perceived in generating, obtaining or distributing knowledge in the process (Wu and Wang, 2006). Based on this distinction, when using a BPMS, two different measures of perceived usefulness can be established: perceived usefulness for processes and perceived usefulness for KM.

As noted above, the use of a BPMS is mandatory for performing a process but not for KM. If users perceive that the utility of a BPMS compensates for the effort of using it, they may choose to use it for KM. However, if the tool is not helpful to users or does not provide benefits, the tool will not be used for KM (Wu and Wang, 2006) and will only be used for process automation. The literature shows that perceived usefulness determines attitudes toward certain behaviors and, in the specific case of information technologies, toward the use of certain technology (Martono et al., 2020). Previous research also shows there is a significant relationship between users' perceived usefulness of using a system and the use they ultimately make of that system. For example, Rafique et al. (2020) found a positive relationship between perceived usefulness and the use of mobile applications in a library context. Researchers have also found a positive effect of perceived usefulness on the use of mobile health apps (Kim and Han, 2020), in telemedicine (Lu and Zhang, 2017) and in the banking industry (Qureshi and Khalil, 2020) and the financial industry (Zhang and Gao, 2018), among other industries. Regarding knowledge, Unal and Uzun (2021) found a positive relationship of this kind in the use of Edmodo (a popular educational network), and Aman and Yusof (2022) found a similar positive relationship in the use of KM software. In summary, there is broad evidence that perceived usefulness is positively related to system use. This suggests that to promote the use of a KMS, it is important to ensure that users perceive the system to be useful for that purpose. Therefore, there is a relationship between perceived usefulness – both for processes and for KM – and system use for KM (Mudzana and Maharaj, 2015; Rai et al., 2002).

3.1.2 Impact of user satisfaction on system use for knowledge management. "User satisfaction" can be defined as the feeling of like or dislike toward the benefits received from interaction with the information system, and this depends on whether the system meets the user's aspirations. It is the user's emotional response resulting from interaction with the information system and depends on the difference between the user's expectations and actual performance of the technology (Subramanian et al., 2019). This perceived satisfaction is accepted as one of the most critical measures of a system's success. The greater the user satisfaction, the greater the net benefits obtained. Such benefits are generally measured in terms of organizational performance, perceived usefulness and its impact on business practices (Çelik and Ayaz, 2022).

Prior literature shows that the intention to use or actual use of an information system also depends on the user's satisfaction with the system (Chang et al., 2015a, 2015b; Rai et al., 2002). Research shows user satisfaction affects continued use of information systems such as internet applications and services (Garg and Sharma, 2020; Koukopoulos et al., 2020;

Sun and Zhang, 2021; Tam *et al.*, 2020; Udo and Philip, 2020). Similarly, as Wu and Wang (2006) found, a user's satisfaction with a KMS has a positive effect on its use. In this regard, Oppong *et al.* (2021) indicate that satisfaction is the factor that best predicts system use. In fact, many authors have verified the positive relationship between user satisfaction and system usage, confirming that satisfaction is a driver of use (Mohammadi, 2015; Pozón-López *et al.*, 2021). By analogy, user satisfaction with a BPMS's KM features (e.g. data input, incorporation of documents or sharing comments) will positively affect their use of the BPMS for KM. For this reason, user satisfaction, which is defined as an affective attitude, can influence the use of BPMS for KM.

Considering the arguments in the previous subsection, it can be inferred that perceived usefulness for process performance and perceived usefulness for KM are related to system usage for KM. In addition, in this subsection, it has been argued that user satisfaction also affects the use of or intention to use different information systems (Chang *et al.*, 2015a; Mudzana and Maharaj, 2015; Rai *et al.*, 2002). Considering the above arguments, we propose the following hypotheses:

H1. Perceived usefulness for processes is positively related to system use for KM.

H2. User satisfaction is positively related to system use for KM.

H3. Perceived usefulness for KM is positively related to system use for KM.

3.1.3 Impact of perceived usefulness on user satisfaction. Users experience satisfaction with the use of technology if they perceive its use entails some utility (Lee *et al.*, 2015; Petter *et al.*, 2008). As happens with other technologies, the perception that using a BPMS can generate utility is related to user satisfaction (Cheng, 2014; Lee *et al.*, 2015). This relationship is positive for the perceived usefulness of BPMS as a means of supporting organizational processes (Poelmans *et al.*, 2013) as well as managing knowledge (Wu and Wang, 2006). When users can improve productivity or performance, they tend to evidence a positive emotional response to the system. This means perceived usefulness contributes to user satisfaction (Kim and Lee, 2014). Thus, a user who perceives value in the BPMS will be more satisfied than a user who does not perceive value. Thus, the following hypotheses can be established:

H4. Perceived usefulness for processes is positively related to user satisfaction.

H5. Perceived usefulness for KM is positively related to user satisfaction.

3.2 Determinants of usefulness and satisfaction

3.2.1 Impact of system dependency on perceived usefulness. "System dependency" is the degree of interaction with a system users need to perform the work for which they are responsible, as well as the intensity with which they use it (Iivari, 2005). Different types of users can be distinguished according to their dependence on BPMSs. Whereas some use a BPMS as their main tool, supporting daily tasks, others use it only occasionally as a peripheral coordination tool to record or distribute some of their work results (Bowers *et al.*, 1995).

The higher a user's dependence on a BPMS, the more valuable the BPMS will be for performing work tasks. This is because the frequency of using a system has a strong impact on users' perceived usefulness of the system in task performance (Iivari, 2005). On the other hand, when the BPMS is lightly used, the user will be less likely to appreciate its value and usefulness. For this reason, dependence on a BPMS is positively related to perceived usefulness, both for supporting processes and for KM. Based on the above, we propose the following hypotheses:

H6. System dependency is positively related to the perceived usefulness for processes.

H7. System dependency is positively related to the perceived usefulness for KM.

3.2.2 Impact of system quality on satisfaction and perceived usefulness. System quality depends on the system's accessibility, flexibility, ease of use and availability (Wixom and Todd, 2005). A system is also considered to be of high quality if the data it generates are accurate, easy to use, integrated with other applications and if the answer speed is adequate (Yusof and Yusuff, 2013).

System quality can be viewed as an important component in achieving the intended objectives of stakeholders, such as individual users and organizations. DeLone and McLean (1992) applied system quality as a key construct in the ISSM. At the individual level, the quality of an information system influences users' needs and perceptions. According to this view, quality is considered "contingent and resides in the user's perception of the product" (Von Hellens, 1997, p. 801).

In this regard, if a system is of high quality, users will perceive its benefits more easily, leading to a greater perception of its usefulness (Feng *et al.*, 2014; Kulkarni *et al.*, 2006). On the other hand, a high-quality system helps its users learn how to use it with less effort and obtain faster results, which, in turn, generates greater user satisfaction (Hsiu-Fen, 2007). In addition, user satisfaction will also increase if the results obtained are very close to users' expectations (Supranto, 2011). Therefore, there is a strong relationship between system quality and user satisfaction (Sultono *et al.*, 2015). For these reasons and the specific case of BPMSs, we propose the following hypotheses:

H8. System quality is positively related to the perceived usefulness of processes.

H9. System quality is positively related to user satisfaction.

H10. System quality is positively related to the perceived usefulness of KM.

3.2.3 Impact of information and knowledge quality on perceived usefulness and satisfaction. "Information quality" can be defined as the degree to which the system generates information in a sufficient and appropriate way (Delone and McLean, 2003). Thus, information quality refers to the desirable characteristics of outputs of an information system and reflects the accuracy, completeness and format of the information (Ramírez-Correa *et al.*, 2015).

It is the user who decides whether the system provides information or knowledge. What may be knowledge for some will be considered by others to be information. Whereas some users receive information and do not take advantage of its immediate utility, others will take action, make decisions and learn from it, thereby turning it into knowledge (Arjonilla and Medina, 2009). The distinction between whether the information is simply data or knowledge depends on the moment and the task being performed, so these two concepts are not usually distinguished (Holsapple, 2004).

Information and knowledge quality is a multidimensional concept that refers to the accuracy, timeliness, completeness, relevance and consistency of information and knowledge provided by the system. When information or knowledge is generated properly, completely, error-free and in a timely manner, the individual's perception of the system usefulness will be higher (AlShibly, 2014). If the system contains information and knowledge of good quality, it meets the users' needs better, so they will probably perceive that the system contributes to improving their work performance, which increases their satisfaction level (Wang and Yang, 2016) and their perception of its usefulness. Prior literature demonstrates the positive relationships between information quality and user satisfaction (Mudzana and Maharaj, 2015; Sultono *et al.*, 2015) and between information quality and perceived usefulness by users (Wu and Zhang, 2014) for different information systems. Thus, it can be plausibly argued that information and knowledge generated by a BPMS make users perceive its usefulness and feel satisfied. For all these reasons, we hypothesize that:

- H11. Information/knowledge quality is positively related to the perceived usefulness of processes.
- H12. Information/knowledge quality is positively related to user satisfaction.
- H13. Information/knowledge quality is positively related to the perceived usefulness of KM.

3.3 Determinants of system quality

Service quality, BPMS-specific system attributes, input quality and general system attributes have been considered as clear determinants of the quality of an information system (Poelmans *et al.*, 2013; Ramírez-Correa *et al.*, 2015; Wu and Zhang, 2014).

3.3.1 Service quality. The quality of assistance received by users of an information system from a computer support department or any other responsible person determines service quality (Ramírez-Correa *et al.*, 2015). Users perceive a service to be of high quality if they feel it is provided by specialists at the time it is needed. Users also perceive the service is of quality when they have been properly trained and prepared to use it. In fact, employee training is increasingly seen as a prerequisite for the success and quality of a BPMS (Pritchard and Armistead, 1999).

3.3.2 Business process management system – specific system attributes. Regarding specific attributes of the system, BPMSs have specific features not used in other systems, such as the coordination of different tasks that are part of processes. The main aspects analyzed in the literature as support mechanisms for this coordination are routing and task allocation, that represent key characteristics for BPMS success (Casati *et al.*, 1998; Cugola, 1998). “Routing quality” measures the degree to which an information system allows end users to find tasks within a business process or return to a previous task in the process (Reijers and Poelmans, 2007). “Allocation quality” measures users’ evaluation of the information system’s selection of tasks and work documents within a particular step in the process (Reijers and Poelmans, 2007). If users perceive that the information system routes and allocates tasks correctly, their perceptions of its quality will increase.

3.3.3 Input quality. Input quality is also an important determinant of the quality of a system and is defined as “the degree to which the BPMS application enables the end user to enter data in a complete, understandable, sufficient, relevant, correct and timely way” (Poelmans *et al.*, 2013, p. 300). Ease of data entry is a variable that influences users’ perception of system quality (Poelmans *et al.*, 2013).

3.3.4 General system attributes. Finally, analyzing the determinants of a system’s quality also requires the study of its general attributes. In this sense, reliability, integration and responsiveness are relevant attributes for any type of information system. “Reliability” refers to user confidence in system operation. “Integration” means the system allows data to be included from different sources. “Responsiveness” is related to the degree to which the system delivers the required results on time. The dimensions of reliability, integration and responsiveness influence users’ perception of the system as being of high quality (Wu and Zhang, 2014).

From the four variables defined and considering their relationships with system quality, we can hypothesize that:

- H14. Service quality is positively related to system quality.
- H15. Specific system attributes are positively related to system quality.
- H16. Input quality is positively related to system quality.
- H17. General system attributes are positively related to system quality.

The relationships between the variables included in the hypotheses are shown graphically in Figure 3.

4. Research design

4.1 Sample and data collection

It was not possible to find a comprehensive list of companies that have implemented BPMSs, so sample organizations were identified through BPMS suppliers' Web pages. Data were obtained through a directed sample of users in companies that had implemented a BPMS. In information systems research, the use of directed sampling is very common (Chang *et al.*, 2015b; Mudzana and Maharaj, 2015; Hariguna *et al.*, 2016; Martín-Navarro *et al.*, 2021a). A total of 53 commercial companies that have been using a BPMS for more than two years were contacted through the BPMS managers in each organization. Of all the companies contacted, only 12 chose to participate in this research, all of which were Latin American or Spanish companies.

The data collection method was a Web-based questionnaire using Google Forms, as has been used in similar research (Hariguna *et al.*, 2016; Mudzana and Maharaj, 2015; Poelmans *et al.*, 2013). This type of method is advantageous because users can access the survey through a link and the collected data go directly to a spreadsheet, facilitating their statistical processing. The 12 commercial companies sent the questionnaire to 415 BPMS users between November and December 2018, and January and February 2019. Valid responses were received from 242 people (a 58.31% response rate). The sample's descriptive statistics are shown in Table 1.

Figure 3 Preliminary research model

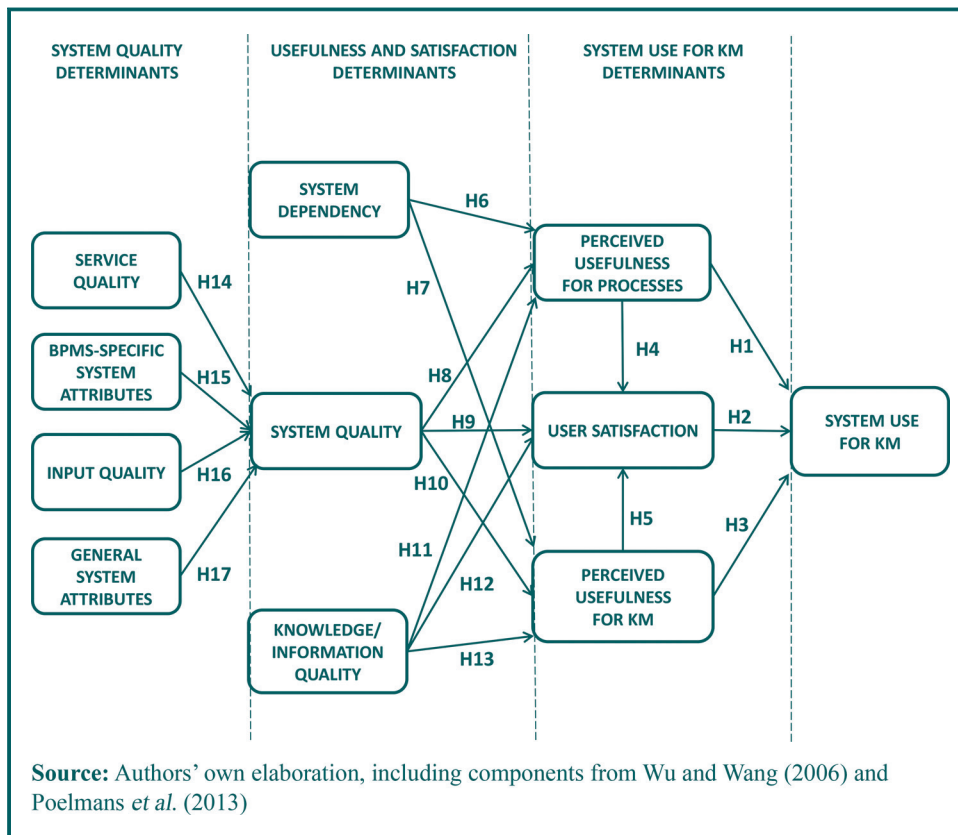


Table 1 Sample and descriptive data

<i>Demographic variables</i>		Mean	
Experience using BPMS		35.57 months	
BPMS dependency		10.29 h per week	
	<i>N</i>		<i>%</i>
<i>Gender</i>			
Male	154		63.6
Female	88		36.4
<i>Age</i>			
Under 25	6		2.5
25–40	135		55.8
41–55	88		36.4
Over 55	13		5.4
<i>Educational level</i>			
Primary	22		9.1
Secondary	182		75.2
University	38		15.7
<i>Company size (no. of employees)</i>			
1–50	32		13.2
51–100	37		15.3
101–500	62		25.6
501–1,000	56		23.1
Over 1,000	55		22.7

Source: Own elaboration

4.2 Variables and measures

The model to be tested consists of 11 variables listed below. Of the 11 variables, “system dependency” is measured by the number of hours per week that the user uses the system (Poelmans *et al.*, 2013) on a numerical scale from 0–40. All other variables are latent variables and are measured with the items shown in the Appendix. These latent variables represent reflective constructs (Petter *et al.*, 2007), and participants’ responses were articulated on a seven-point Likert Scale (Kwok, 2014; Lee *et al.*, 2015).

4.2.1 Service quality. This variable is measured through two aspects: the training users received and the support given by specialists to enable users to properly interact with the tool in their daily work (Poelmans *et al.*, 2013).

4.2.2 Business process management system – specific system attributes. This variable considers the quality of two specific aspects of BPMSs: allocation and routing. To measure allocation quality, users were asked whether the software allows them to select the records needed to perform the work and whether the system properly distributes the tasks among workmates. To measure routing quality, users were asked about predefined routing procedures, both for forward and backward routing, throughout the business process (Poelmans *et al.*, 2013).

4.2.3 Input quality. This variable assesses the data entry options the system makes available to users (Poelmans *et al.*, 2013). The items include entry facilities, help/support and an understandable method when inserting data, a means to correct or change the data and entering data when needed and in a sufficiently detailed way.

4.2.4 General system attributes. This variable consists of three general attributes: reliability, responsiveness and integration of the BPMS with other applications. “Reliability” refers to the fact that the system is available when required and works properly (Kim *et al.*, 2008). “Responsiveness” refers to the system’s speed and reaction time (Yusof and Yusuff, 2013). “Integration” refers to the ability to use the system in combination with other tools (Dečman and Klun, 2015).

4.2.5 *System quality*. This variable measures the system's ease of use, its intuitive nature and its ability to avoid errors (Rai *et al.*, 2002; Wu and Wang, 2006).

4.2.6 *Information and knowledge quality*. This variable is measured through three aspects: retrieval quality, content quality and context and linkage quality. With regard to retrieval quality, users are asked whether the information generated by the system is accurate, complete, current and sufficient and whether the quality of the output format is good (Poelmans *et al.*, 2013). Content quality is measured by questions related to the importance of the information and knowledge output, the system's ability to create documents and the logic of the content or its availability, among other questions (Wu and Wang, 2006). Context and linkage are related to the system's capacity to offer access to knowledge resources by providing useful directories and whether that knowledge can be applied to tasks (Wang and Yang, 2016; Wu and Wang, 2006).

4.2.7 *Perceived business process management system usefulness for processes*. The items used to measure this variable are related to the efficiency of tasks and if the system allows better work performance and adds value to processes (Davis, 1989; Poelmans *et al.*, 2013).

Perceived BPMS usefulness for KM. This variable measures four items: acquisition of knowledge, storage of knowledge, enhancement of job performance and the quality of employees' work life (Wu and Wang, 2006).

4.2.8 *User satisfaction*. This variable measures users' satisfaction with system effectiveness and efficiency (Poelmans *et al.*, 2013; Seddon and Kiew, 1996; Wu and Wang, 2006).

4.2.9 *System use for knowledge management*. This variable measures whether users use the system to make decisions and to capture, communicate and share knowledge (Doll and Torkzadeh, 1988; Wu and Wang, 2006).

The questionnaire was designed implementing procedural measures to mitigate the problem of common method bias (CMB) to maximize respondent motivation and capability and minimize task difficulty so that respondents were more likely to respond accurately (Podsakoff *et al.*, 2003; Podsakoff *et al.*, 2012). Additionally, CMB is usually reflected by extremely high correlations (using Pearson's correlations). A correlation value between indicators of over 0.90 suggests that data are affected by CMB (Pavlou *et al.*, 2007). In our study, correlations between constructs did not exceed this value, which indicates our data are unlikely to have CMB.

5. Method

To test our hypotheses, we conducted structural equation modeling (SEM). Our model uses both observable and latent (unobservable) variables. Latent variables represent theoretical concepts, and SEM uses indicators to measure them, providing evidence about the relations between the latent variables (Williams *et al.*, 2009). SEM methodology is applied in two stages. First, a measurement model is used to analyze the reliability and validity of constructs. Second, a structural model is applied to determine the relationships between the variables proposed in the research model (Byrne, 2016).

5.1 Measurement model

The reliability and validity of the model are shown in Table 2. The results show that the measuring instrument is valid and reliable, as there is high internal consistency for all variables. Specifically, the KMO values of the matrix are all greater than 0.8 (Kaiser, 1970), and Bartlett significance is below 0.01 (Bartlett, 1950). Similarly, all constructs show sufficient internal consistency with Cronbach's alpha of 0.7 or higher (Streiner, 2003). Finally, the composite reliability (CR) coefficient is greater than the recommended threshold of 0.7 (Prieto and Delgado, 2010).

Table 2 Reliability and convergent validity

Construct	Label	KMO	Cronbach's alpha (α)	Composite reliability (CR)	AVE
Service quality	SERVIQ	0.806	0.945	0.961	0.8609
General system attributes: reliability	RELIAB	0.692	0.797	0.882	0.7146
General system attributes: responsiveness	RESPON	0.500	0.936	0.982	0.9643
General system attributes: integration	INTEGRA	0.500	0.920	0.962	0.9274
BPMS-specific system attributes	SPECIFIC	0.794	0.854	0.908	0.7132
Input quality	INPUTQ	0.923	0.944	0.957	0.7870
System quality	SYSTEMQ	0.844	0.923	0.944	0.7716
Information and knowledge quality: retrieval quality	IKQRETRI	0.922	0.956	0.964	0.7464
Information and knowledge quality: content quality	IKQCNTN	0.915	0.962	0.969	0.8194
Information and knowledge quality: context and linkage quality	IKQCNTX	0.702	0.88	0.918	0.7385
Perceived usefulness for processes	USEFULP	0.842	0.952	0.966	0.8757
Perceived usefulness for KM	USEFULK	0.788	0.943	0.960	0.8559
User satisfaction	SATISF	0.922	0.980	0.985	0.9279
System use for KM	USE	0.852	0.956	0.966	0.8507

Source: Authors' elaboration

Convergent validity was estimated using average variance extracted (AVE). [Bagozzi and Yi \(1988\)](#) state that values greater than 0.5 can be considered to be highly significant. All factor loadings for items in the model were greater than 0.5, demonstrating adequate convergent validity. Therefore, all indicators that evaluate each construct are highly correlated with each other, indicating that they correctly measure the phenomena studied.

Discriminant validity evaluates the degree to which a given construct is different from other constructs. The procedure dictates that the square root of each construct's AVE must be higher than the correlation between that construct and all the others ([Chin, 1998](#)). [Table 3](#) shows that the square root of the AVE (on the diagonal) is higher than the existing correlations between different constructs in all cases.

The results described above indicate that our questionnaire is a valid and reliable tool, and thus SEM can be applied.

5.2 Structural model

SEM with AMOS ([Byrne, 2016](#)) was used to test our proposed model. SEM allows measurement of models with observable variables and latent variables, using multiple measures to represent the latter ([Pérez et al., 2013](#)). The SEM technique allows the

Table 3 Discriminant validity

Construct	SERVIQ	RELIAB	RESPON	INTEGRA	SPECIFIC	INPUTQ	SYSTEMQ	IKQRETRI	IKQCNTN	IKQCNTX	USEFULP	USEFULK	SATISF	USE
SERVIQ	0.9278													
RELIAB	0.440	0.8453												
RESPON	0.540	0.728	0.9820											
INTEGRA	0.520	0.486	0.540	0.9630										
SPECIFIC	0.646	0.569	0.601	0.729	0.8445									
INPUTQ	0.614	0.593	0.652	0.676	0.817	0.8879								
SYSTEMQ	0.588	0.588	0.609	0.594	0.699	0.772	0.8784							
IKQRETRI	0.590	0.600	0.663	0.627	0.758	0.834	0.800	0.8639						
IKQCNTN	0.565	0.544	0.618	0.669	0.758	0.813	0.814	0.859	0.9052					
IKQCNTX	0.498	0.443	0.480	0.588	0.618	0.661	0.651	0.630	0.738	0.8594				
USEFULP	0.588	0.510	0.570	0.608	0.743	0.767	0.783	0.854	0.842	0.694	0.9358			
USEFULK	0.605	0.446	0.491	0.554	0.672	0.668	0.675	0.723	0.769	0.750	0.812	0.9252		
SATISF	0.580	0.524	0.560	0.603	0.702	0.769	0.799	0.808	0.792	0.716	0.869	0.856	0.9633	
USE	0.534	0.345	0.363	0.499	0.583	0.563	0.546	0.597	0.656	0.655	0.687	0.770	0.702	0.9223

Source: Authors' calculations

respecification of the model, if at first it is not statistically significant, by either adding or removing relationships or parameters from the original model (Cupani, 2012; Escobedo Portillo *et al.*, 2016), and we have done this to the preliminary model proposed. As shown in Table 4, the thresholds for goodness-of-fit statistics are not met, and the model is therefore respecified. Specifically, *H1*, *H2*, *H10* and *H12* are eliminated because their *p*-values are greater than 0.05. The diagnostic stage for this respecified model is carried out again without taking into account the rejected hypotheses. Absolute fit, comparative and incremental fit statistics were used to determine the goodness-of-fit of the model analyzed. Following Giunchi *et al.* (2015), among the absolute adjustment statistics used is the CMIN/DL index, and its value must be less than 3 (Ruiz *et al.*, 2010). Model fit was ascertained using multiple fit indices, such as the comparative fit index (CFI), the Tucker–Lewis index (TLI) and the root mean square error of approximation (RMSEA). CFI and TLI measure the relative enhancement in the fit of the model over that of a baseline model (goodness-of-fit measure) where a value of one indicates the best fit (and, as in Hu and Bentler, 1999, the value must be greater than 0.90 for the fit to be satisfactory). RMSEA reflects the covariance residuals adjusted for degrees of freedom (lack-of-fit measure), which should be less than 0.08 (Ruiz *et al.*, 2010).

In the analysis of the respecified model, the absolute adjustment statistic CMIN/DL gives a result of 2.416 for a *p*-value of 0.000, so it is less than 3, which indicates a valid result. The TLI index shows a result of 0.902, the CFI has a value of 0.913 and the RMSEA statistic is 0.077 (Table 4).

Using the respecified model that is considered valid, the main hypotheses are verified.

6. Results

6.1 Determinants of system use for knowledge management

Our results show that 12 of the 17 hypotheses are supported (Table 5). *H1* and *H2* have been rejected, so the perceived usefulness for processes and user satisfaction does not influence BPMS use for KM. *H3* is supported, so the perceived usefulness of a BPMS for KM affects its use for KM. Perceived usefulness for both processes and KM also influences user satisfaction, so *H4* and *H5* are supported.

6.2 Determinants of usefulness and satisfaction

Likewise, *H6* and *H7* are supported, indicating positive relationships between system dependency and perceived usefulness for both processes and KM. It is confirmed that system quality affects perceived usefulness for processes and user satisfaction (*H8* and *H9*) but not perceived usefulness for KM (*H10* is rejected). Information and knowledge quality are positively related to perceived usefulness for processes and KM (*H11* and *H13* are supported) but not to user satisfaction (*H12* is rejected).

Table 4 Goodness-of-fit

Statistic	Optimal values	Previous model	Respecified model
<i>Absolute adjustment</i>			
CMIN/DL	<3	3.458	2.416
<i>Comparative adjustment</i>			
CFI	>0.90	0.767	0.913
TLI	>0.90	0.758	0.902
<i>Others</i>			
RMSEA	<0.08	0.101	0.077

Sources: Authors' calculations based on Ruiz *et al.* (2010) and Hu and Bentler (1999)

Table 5 Hypothesis test results

No.	Description	Result
H1	Perceived usefulness for processes is positively related to system use for KM	Rejected
H2	User satisfaction is positively related to system use for KM	Rejected
H3	Perceived usefulness for KM is positively related to system use for KM	Supported
H4	Perceived usefulness for processes is positively related to user satisfaction	Supported
H5	Perceived usefulness for KM is positively related to user satisfaction	Supported
H6	System dependency is positively related to the perceived usefulness of processes	Supported
H7	System dependency is positively related to the perceived usefulness of KM	Supported
H8	System quality is positively related to the perceived usefulness of processes	Supported
H9	System quality is positively related to user satisfaction	Supported
H10	System quality is positively related to the perceived usefulness of KM	Rejected
H11	Information/knowledge quality is positively related to the perceived usefulness of processes	Supported
H12	Information/knowledge quality is positively related to user satisfaction	Rejected
H13	Information/knowledge quality is positively related to the perceived usefulness of KM	Supported
H14	Service quality is positively related to system quality	Supported
H15	Specific system attributes are positively related to system quality	Rejected
H16	Input quality is positively related to system quality	Supported
H17	General system attributes are positively related to system quality	Supported

Source: Own elaboration

6.3 Determinants of system quality

Finally, *H14*, *H16* and *H17* are supported, confirming the impacts of service quality, input quality and general system attributes on system quality. *H15* is not supported, so it cannot be said that BPMS-specific system attributes affect system quality.

Figure 4 shows the standardized path coefficients, which indicate the strength of the relationships between the variables, and the value of the “coefficient of determination” or “r-squared value” (R^2), which represents the amount of variance explained by each independent variable. Relationships that do not support the hypotheses are shown by dashed arrows. The values of R^2 show the variance of each endogenous variable explained by the independent variables with which it is related. The variable “system use for KM” has a variance of 58% and is only explained by the perceived usefulness for KM. “Perceived usefulness for processes,” with an explained variance of 69%, receives the impact of three variables: system dependency, system quality and information and knowledge quality, the latter having the strongest relationship.

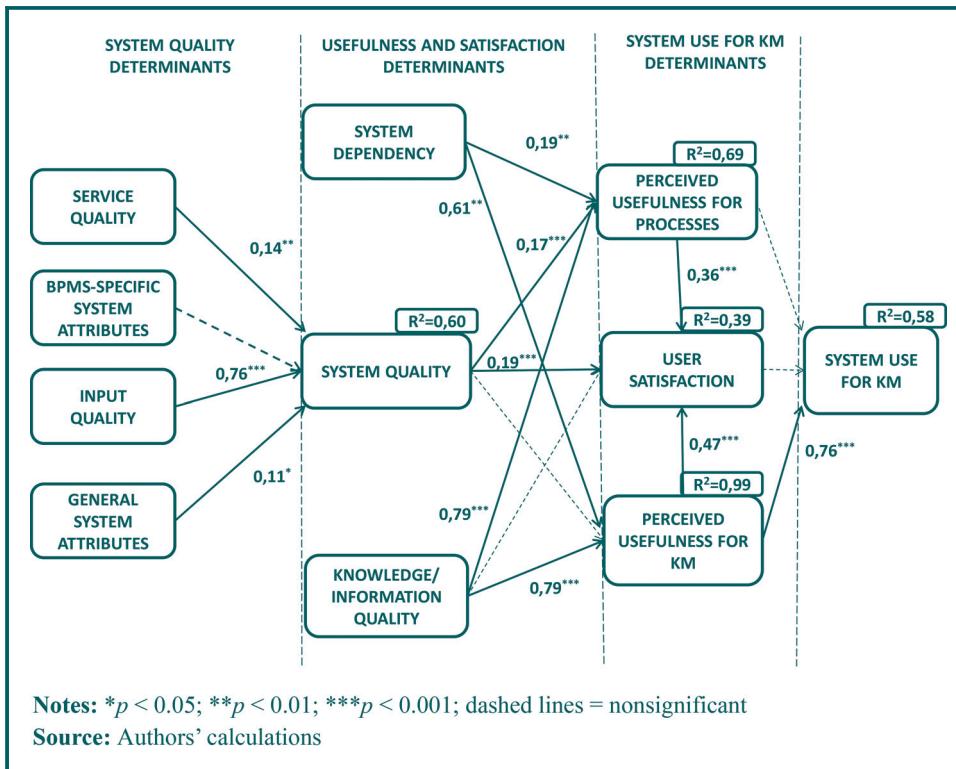
“User satisfaction” is explained with an R^2 of 39% by perceived usefulness for both processes and KM, as well as by system quality, with perceived usefulness for KM contributing the most. “Perceived usefulness for KM” is almost entirely explained by system dependency (with an R^2 of 99%) and is explained to a lesser extent by information and knowledge quality.

Finally, “system quality” has 60% of the variance explained, mainly by input quality and, to a lesser extent, by service quality and general system attributes.

7. Discussion

Previous research has shown that perceived usefulness is a dominant factor that increases the use of information systems. In this regard, Wang and Li (2019) confirm the positive effect of perceived usefulness on the use of systems on travel review websites. Our model separates perceived usefulness for processes from perceived usefulness for KM when using a BPMS for KM. Our results indicate that perceived usefulness for processes has no impact on the use of the system specifically for KM. However, users do use the system for KM if they perceive it to be useful for KM, which advances research in this field

Figure 4 Structural model results



(Huang, 2019; Jahmani *et al.*, 2018). That is, even if users determine that a BPMS is useful for processes, this does not mean they will also use it to manage the knowledge these processes require. One possible explanation is that the use of a BPMS is mandatory in organizations for process management (Poelmans *et al.*, 2013) but not for KM. Thus, the BPMS's usefulness for KM, as perceived by users, does relate positively to the use of the system for KM. This confirms and strengthens the findings of other studies that find empirical evidence of this relationship for other information systems, such as the use of electronic documentation systems (AlShibly, 2014). In short, it can be said that when BPMS users find the system useful for KM, they are more likely to use it for that purpose.

The results also confirm that the perceived usefulness of BPMS, both for processes and KM, has a positive effect on user satisfaction. This finding reinforces previous studies that independently analyze the impact of the perceived usefulness of BPMSs on satisfaction (Poelmans *et al.*, 2013; Lee *et al.*, 2015; Unal and Uzun, 2021; Martono *et al.*, 2020). Yet we do not find empirical evidence of a positive effect of user satisfaction on the use of a BPMS for KM. Although this result contrasts with that of Garg and Sharma (2020), who found this positive relationship for the specific case of e-learning, it is in line with the study by Huang (2019), who similarly found no positive relationship between satisfaction and system use for KM. We understand that contextual and worker-related factors could explain why this hypothesis is not supported. Among other factors, we can cite the type of task, type of sector, the complexity of the industry, type of process and discretionary behavior of the user. These factors are likely to determine whether the user uses the knowledge embedded in the BPMS.

Our work also confirms previous findings in the literature regarding the positive effect of users' system dependency on the perceived usefulness of the system for processes (Alotaibi and Alshahrani, 2022; Dokhanian *et al.*, 2022; Poelmans *et al.*, 2013). However, our

study also adds a positive, unprecedented and even more highly statistically significant relationship between system dependency and perceived usefulness for KM. This relationship suggests that the more that users use a BPMS, the more opportunity they will have to realize it is also a useful tool for KM.

From the analysis of the effects of BPMS quality, positive relationships with perceived usefulness for processes and user satisfaction are deduced. These results are consistent with the literature studying the positive impact of the quality of various information systems on user satisfaction (Nuryanti *et al.*, 2021; Salameh *et al.*, 2018; Vijai, 2018). These results are also consistent with the work of Daryanto (2022), who found positive effects of system quality and perceived usefulness on user satisfaction for the TNI AD Personnel Information System (Sisfopers) in a study conducted in the Indonesian Army Crypto and Cyber Center. Conversely, our findings contradict studies that found no evidence of such links with user satisfaction (Mudzana and Maharaj, 2015). However, contrary to our expectations, the quality of a BPMS is not positively related to its perceived usefulness for KM. This result is consistent with those of Wu and Wang (2006), who also found no empirical evidence of this relationship for the specific case of KMSs. It can, therefore, be inferred that although users of a high-quality BPMS are more likely to be satisfied with the system and find it useful in their daily work, this quality does not mean they will perceive it as useful for managing valuable knowledge for different tasks.

With respect to the information and knowledge quality provided by a BPMS, our study determines this has a positive influence on the perceived usefulness of processes, confirming the findings of previous studies (Poelmans *et al.*, 2013; Alotaibi and Alshahrani, 2022; Dokhanian *et al.*, 2022). In addition, our results confirm that this variable also has a positive effect on the perceived usefulness of KM. However, the information and knowledge quality are not determining factor for BPMS user satisfaction, contrary to what is argued in the literature (Poelmans *et al.*, 2013). Therefore, our study suggests that users of a BPMS find it useful to have information and knowledge quality from the system, but this does not generate satisfaction. Motivation theories can shed some light on this contradictory result. According to Herzberg's motivation-hygiene theory, the absence of hygiene factors causes demotivation, but their presence is not a motivating element (Herzberg, 1968). We can draw an analogy with user satisfaction and user motivation, although they are not conceptually the same. Our results show that users are not particularly satisfied if the information is of good quality and correct. However, the perception of incorrect information can cause job dissatisfaction.

Finally, analysis of the different dimensions that make up the quality of a BPMS (system quality) shows the positive effects of service quality (which includes the training and technical support users receive), input quality and general system attributes. The strong positive relationship between input quality and system quality is worth noting. These results are consistent with previous studies (Poelmans *et al.*, 2013; Purwanto *et al.*, 2020). However, no effects on system quality were found for the specific attributes of BPMSs, contradicting previous results from the literature (Poelmans *et al.*, 2013). This lack of confirmation may be because BPMS users are not aware of how tasks are allocated and routed. Users do not notice those tasks the system performs automatically and instead simply receive, perform and report their own tasks, not knowing the complete process path. Thus, the allocation and routing of tasks, which are part of the specific attributes of a BPMS, are, therefore, functions users cannot perceive and value properly.

8. Conclusions

We created a preliminary model to analyze the success of the use of a BPMS for KM, combining two models validated in the literature for BPMS (Poelmans *et al.*, 2013) and KMS success (Wu and Wang, 2006). We statistically analyzed and verified this novel model and found that among the determinants of the use of a BPMS for KM, usefulness perceived by

users for KM is the only factor that directly impacts system use for KM. Moreover, this usefulness is almost entirely explained by the information and knowledge quality provided by the BPMS and by users' system dependency. Contrary to expectations, neither the perceived usefulness for KM nor the use of the BPMS for KM depends on system quality.

8.1 Contributions to theory

Prior literature highlights the importance of KM when conducting processes (Wu and Chen, 2014). An essential part of this literature analyses the benefits of digitizing processes, and the KM required (Mirzaee and Ghaffari, 2018). In this regard, Marjanovic (2022) points out the importance of improving knowledge-intensive business processes. Furthermore, the practical implications of Serenko's (2022) study highlight the importance of automating knowledge-centric business processes. Our work contributes to this literature by verifying the potential of information systems that support business processes to incorporate the knowledge necessary for these processes. Our findings also provide additional contributions to academic research. First, our work is the first empirical study to demonstrate how BPMS can and should be used for KM. Other conceptual papers link BPMS and KM; however, according to various studies led by Szelągowski (Szelągowski, 2021; Szelągowski *et al.*, 2022; Szelągowski and Berniak-Woźny, 2019, 2022a, 2022b), it is still necessary to gather empirical evidence demonstrating the role of BPMSs in managing knowledge required for processes.

Second, this study contributes to research on BPMSs by providing empirical verification of a new success model of BPMS use for KM. The integrated model we develop represents a specific advance over baseline models for understanding the success of BPMSs (Poelmans *et al.*, 2013) and KMSs (Wu and Wang, 2006). Thus, our results are based on a coherent construction in previous literature but develop a new and original theoretical model. In addition, BPMSs can integrate the knowledge required both for the adequate performance of processes and for their continuous improvement.

Third, we find no evidence of a relationship between the specific attributes of a BPMS and its quality. However, we find that the factors affecting BPMS quality are the same as those affecting any other information technology: service quality, input quality and general system attributes, with input quality having the most impact on system quality.

Fourth, our study contributes to understanding of the determinants and antecedents of the success of BPMSs from the perspective of end users in commercial companies. We extend empirical evidence related to the pioneering work of Poelmans *et al.* (2013), who tested their theoretical model on a sample of government agencies and suggested extending their research to other types of organizations.

Fifth, our study responds to calls from Wang *et al.* (2021) and Li and Zhu (2022), who studied the influence of system quality on user satisfaction, among other variables, and proposed future lines of research to extend their analysis to different contexts. Furthermore, our findings regarding the determinants of perceived usefulness for processes reinforce those obtained for other information systems (Alkhawaja *et al.*, 2022; Fauzi *et al.*, 2022). In this regard, we argue that system dependency, system quality and knowledge/information quality are determinants of perceived usefulness for processes managed by BPMSs.

A final theoretical contribution is that our evidence suggests that when assessing the success of a BPMS for KM, it is the perceived usefulness for KM of the users that determines the use of the BPMS for knowledge sharing and retrieval.

8.2 Contributions to practice and society

The findings of this study have practical implications. To optimize the knowledge applied to the implementation of processes, management should encourage the use of a BPMS for

KM. To this end, it is advisable to increase users' perceptions of the usefulness of the system for KM. In turn, this utility will be mainly driven by the information and knowledge quality the BPMS generates and by users' dependence on the BPMS in their daily work. We also recommend improving the quality of the system because this will increase user satisfaction. Generally, users will perceive higher system quality when data entry is of high quality and, to a lesser extent, when support services are of high quality and general system attributes are adequate. For the user to perceive quality in data input, the system must allow data entry to be simple, complete, understandable, sufficient, relevant, correct and timely. The user will perceive service quality if adequate technical support and training in the use of the system are offered. Finally, improving the overall attributes of the system means improving reliability (user confidence that the system is error free) and enabling integration of data from different sources and the system's ability to respond in a timely manner.

From a technical viewpoint, another practical recommendation is to make users and modelers aware of the importance of using the BPMS's KM tools in an intelligent way. For example, BPMSs allow modelers to include a description of each task when they are designing it. This description can include instructions and applied knowledge on how to perform those tasks, transferring know-how to users. The BPMS can also incorporate a document repository, attaching documents needed to perform the tasks or any relevant information needed by users. Furthermore, because BPMSs allow modification of the design of the processes at any time, modelers can update the processes by incorporating user suggestions. In addition, such systems allow users who have completed a task to add comments that will be helpful for subsequent tasks in the process. In summary, the use of the technical functionalities of a BPMS can support users by providing the knowledge needed to perform the tasks (Castaneda and Toulson, 2021). These tools allow the incorporation of tacit knowledge, previously residing only in the minds of workers, into work routines.

8.3 Limitations

A critical analysis of research methods and conceptualization almost inevitably indicates some limitations, and these limitations should be taken into account when interpreting this research. Hence, the validity of our findings cannot be established on the basis of this single study because the evidence is limited to the 12 companies consulted, all of which are in the private sector. Validation of our results requires the same study to be conducted using other samples in contexts both similar and different. Furthermore, other variables – such as managers' attitudes or organizational culture – may influence the results obtained (Wu and Wang, 2006). Nevertheless, including additional variables would have unduly increased the complexity of our model, and the search for a model as economical as possible weighed against such inclusion.

The lack of a robust theory on the success of BPMSs and their relationship with KM meant that our theoretical model was developed using studies of different types of information systems. Therefore, it is not possible to compare our results with similar findings in the BPMS literature. On the other hand, our theoretical model shares a common limitation with all studies that include information systems usage models and an information/knowledge quality variable. This limitation is related to the task context and the knowledge required in each process. Undoubtedly, both factors can affect the quality of the information or knowledge embedded in the system. For example, for simple product assembly processes that can be modeled in a simple way, the necessary knowledge could be explicit and easily incorporated into the system. However, the process would become more complicated if, for example, we analyze the process of an auditor's service to a client. In the latter example, the knowledge required to perform the service would be implicit in the worker's mind, and its modeling in a BPMS would be very complex. Accordingly, this type of knowledge cannot be made explicit or recorded in the same way as in the first example.

It should be noted that a BPMS is not a static repository of knowledge. The knowledge embedded in a BPMS is continuously evolving because it is connected to processes whose modeling and execution specifications are constantly changing and improving. An expert user who spends many hours using a BPMS is likely to incorporate more knowledge than a sporadic or novice user who uses the system less and is purely a consumer of the knowledge that others have added. For this reason, one limitation of this study is that it does not discriminate the use of BPMSs for KM according to whether the user is an expert or a novice. Although this limitation is common throughout the literature applying information systems usage models, in our model, the variable system dependency (measured by the number of hours of system usage per week) would partially alleviate this limitation if used for intergroup comparison. A final limitation of this study is that our sample comprises users who use different BPMSs, which could have different characteristics. With an adequately large sample size, it is advisable to make intergroup comparisons among users according to the type of BPMS used.

8.4 Future agenda

Future research should strengthen our results using longitudinal studies. Comparisons with different cultural contexts are also suggested. Considering cultural differences, results are likely to vary for samples featuring organizations from other countries.

Regardless of the information system that supports KM, workers' positive intention to share tacit knowledge depends on their attitude and ability and whether the subjective norms of their social environment support this behavior (Ajzen, 1991, 2002), and the latter may differ between countries. Both longitudinal analyses and international comparisons would allow construction and reinforcement of theoretical proposals and would consolidate management theory on the role of BPMSs in KM. Furthermore, as mentioned in the discussion of study limitations in Section 8.3, we propose future studies to analyze the roles of different types of processes, different BPMSs and user experience (comparing expert versus novice users) in the relationships of the proposed model.

This study analyzes the use of BPMSs for KM in commercial enterprises. Although there is literature on the success of BPMSs in public administration (Poelmans *et al.*, 2013), no prior studies in that sector focus on their use for KM. Therefore, future research may test our theoretical model in a public administration context. Finally, BPMS user satisfaction is an important measure of the success of this type of system (Poelmans *et al.*, 2013). However, in the results of this study, user satisfaction is weakly explained by other variables. An important line of future work would be to investigate what other exogenous variables explain this satisfaction.

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Appendix. Questions used in the survey

Service quality

- SERVIQ1. The formation/training that I received was good.
- SERVIQ2. In general, I received sufficient training to be able to work with the system.
- SERVIQ3. In general, I'm being supported to be able to work properly with the system.
- SERVIQ4. I receive sufficient support to work with the system.

Source: [Poelmans et al. \(2013\)](#)

General system attributes

- RELIAB1. The system is available when I require it.
- RELIAB2. The information that I use remains in the system (it does not get lost).
- RELIAB3. The system works correctly (it does not get stuck).
- RESPON1. The reaction time of the system is correct.
- RESPON2. The speed of the system is sufficient for my purposes.
- INTEGRA1. I can use the system in combination with other tools (word, excel, e-mail...)
- INTEGRA2. Tools, such as word, excel, e-mail..., are well integrated into the system

Source: [Poelmans et al. \(2013\)](#)

Business process management systems – specific system attributes

- SPECIFIC1. The system allows selecting files/work items from the activity received to be able to perform it.
- SPECIFIC2. The system (re)distribute files/work items among your colleagues with the same role.
- SPECIFIC3. The system forwards work items to the next step/activity.
- SPECIFIC4. The system can put work items back into previous steps.

Source: [Poelmans et al. \(2013\)](#)

Input quality

- INPUTQ1. I have sufficient data entry facilities in the system.
- INPUTQ2. I can insert the data in a clear and understandable way (with convenient windows, menu's, fields. . .).
- INPUTQ3. I have sufficient means to correct and/or change the data in the system.
- INPUTQ4. I have sufficient help/support when inserting data (e.g. drop down lists, search facilities, preentered data. . .).
- INPUTQ5. I can enter data when you need to enter data in the system.
- INPUTQ6. I can enter the data in sufficiently detailed way.

Source: [Poelmans et al. \(2013\)](#)

System quality

- SYSTEMQ1. The system was easy to learn.
- SYSTEMQ2. The system is easy to use.
- SYSTEMQ3. The system does what I want it to do (without too much effort).
- SYSTEMQ4. The system is user friendly.
- SYSTEMQ5. The system is stable (It is tested and does not produce errors).

Source: [Poelmans et al. \(2013\)](#), [Wu and Wang \(2006\)](#) and [Rai et al. \(2002\)](#)

Information and knowledge quality

- IKQRETRI1. The information is reliable and accurate.
- IKQRETRI2. The information is complete.
- IKQRETRI3. The information is readable and easy to understand on the screen.
- IKQRETRI4. Electronic presentation/format of the information (on the screen) is adequate.
- IKQRETRI5. Printed version/presentation of the information is adequate.
- IKQRETRI6. The speed with which the information can be gathered/retrieved is adequate.
- IKQRETRI7. The information is updated in the system.
- IKQRETRI8. The available information in the system is sufficient for my tasks.
- IKQRETRI9. I have sufficient access to the information available in the system.
- IKQCNTN1. The system makes it easy for me to create knowledge documents.
- IKQCNTN2. The words and phrases in contents provided by the system are consistent.
- IKQCNTN3. The content representation provided by the system is logical and fit.
- IKQCNTN4. The knowledge or information provided by the system is available at a time suitable for its use.
- IKQCNTN5. The knowledge or information provided by the system is important and helpful for my work.
- IKQCNTN6. The knowledge or information provided by the system is meaningful, understandable and practicable.
- IKQCNTN7. The knowledge classification or index in the system is clear and unambiguous.
- IKQCNTX1. The system provides contextual knowledge or information so that I can truly understand what is being accessed and easily apply it to work.
- IKQCNTX2. The system provides complete knowledge portal so that I can link to knowledge or information sources for more detail inquire.

- IKQCNTX3. The system provides accurate expert directory (link, yellow pages. ...).
- IKQCNTX4. The system provides helpful expert directory (link, yellow pages) for my work.

Source: [Poelmans et al. \(2013\)](#) and [Wu and Wang \(2006\)](#)

Perceived usefulness for processes

- USEFULP1. The system is very well suited to do the tasks that it is supposed to do.
- USEFULP2. Using the system enables me to handle my cases/work items well.
- USEFULP3. In using the system, I can do my tasks in the process more efficiently.
- USEFULP4. The system really has added value in the business process.

Source: [Davis \(1989\)](#) and [Poelmans et al. \(2013\)](#)

Perceived usefulness for knowledge management

- USEFULK1. The system helps me acquire new knowledge and innovative ideas.
- USEFULK2. The system helps me effectively manage and store knowledge that I need.
- USEFULK3. My performance on the job is enhanced by the system.
- USEFULK4. The system improves the quality of my work life.

Source: [Wu and Wang \(2006\)](#)

User satisfaction

- SATISF1. Currently, I am really satisfied with the the system.
- SATISF2. I am satisfied that the system meet my knowledge or information processing needs.
- SATISF3. I am satisfied with the system effectiveness.
- SATISF4. I am satisfied with the system efficiency.
- SATISF5. Overall, I am satisfied with the system.

Source: [Poelmans et al. \(2013\)](#), [Seddon and Kiew \(1996\)](#) and [Wu and Wang \(2006\)](#)

System use for knowledge management

- USE1. I use the system to help me make decisions.
- USE2. I use the system to help me record my knowledge.
- USE3. I use the system to communicate knowledge and information with colleague.
- USE4. I use the system to share my general knowledge.
- USE5. I use the system to share my specific knowledge.

Source: [Doll and Torkzadeh \(1988\)](#) and [Wu and Wang \(2006\)](#)

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