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UNDERSTANDING THE SUCCESS FACTORS IN ADOPTING BUSINESS PROCESS MANAGEMENT SOFTWARE: CASE STUDIES

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ABSTRACT

A number of studies on the successes and failures of business process management (BPM) have been conducted with the aim of identifying BPM adoption success factors. The complex and comprehensive nature of BPM has resulted in the lack of a generally accepted framework for successful BPM adoption. One general means of ensuring BPM success is through the adoption of business process management software (BPMS). The fact that there is currently no consensus as to a generally accepted definition of BPM software makes it difficult to define the criteria for its selection. There are several reasons for this: (i) the size and complexity of the field, (ii) determining business needs is not always straightforward, and (iii) the BPM software market is complex and its features and capabilities vary greatly across vendors. In this article, we examine the contextual and technical perspectives of BPMS adoption and related critical success factors (CSF). The goal of this study was to propose BPMS selection guidelines with regard to the organizational, environmental and technological CSFs of BPMS adoption, to support decision makers in selecting the right BPMS. To accomplish this, we applied a multiple-case study approach and carried out a set of interviews in companies that have fully or partly adopted BPMS. Semi-structured interviews were used to gather quantitative data for those topics that can be evaluated numerically, and qualitative contextual (organizational and environmental) CSFs relevant for BPMS adoption success.

KEY WORDS

business process management, business process management software, critical success factors, case study, Croatia

CLASSIFICATION

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INTRODUCTION

Since the 1990s, the concept of business process management (BPM) has been widely recognized within the academic community. It is commonly implemented in large organizations for business process documentation, design, automatization and performance improvement [1]. Although the goals of BPM initiatives vary from organizational change and restructuring to the introduction of innovative business process management software (BPMS), their adoption is very often one of its inevitable perspectives.

According to Harmon [2] "no one is exactly sure what BPM software means or how BPM software products will evolve". Its origins can be found in workflow management software, document management software, business intelligence software, business rules engines and enterprise application integration tools [3]. Nowadays, the most important functionalities of these tools are integrated together into generic software, called BPM software [4], which supports the definition, modelling, analysis, execution and tracking of business processes. New emphasis has been placed on the integration of BPM initiatives and Service Oriented Architecture (SOA) projects, as a deep understanding of the organization's business processes is considered one of the critical success factors (CSF) for the implementation of sophisticated SOA infrastructure [2]. Several categories are still distinguished on the BPM software market, such as: BPM software, suites, systems and tools [5]-[7]. However, for the purposes of this article, the generic term – "business process management software" (BPMS) is used.

To clarify, the difference between two similar terms "adoption" and "implementation" is discussed briefly. According to Bosilj Vukšić, Milanović Glavan and Suša [8] "BPM implementation is the introduction of BPM concepts while BPM adoption is the acceptance of those concepts in the organization". Others argue that BPM adoption covers all aspects of managing processes in a company [9], [10]. It encompasses the entire BPM lifecycle: from process identification and modelling phase, to business process monitoring, measurement and optimization [7]. For the purpose of this study, BPM/BPMS adoption is understood as the use and application of BPM concepts/BPM software in any of the BPM lifecycle phases.

While the advantages of BPM adoption in organizations are clear, high risks of implementation failure have been pointed out by both BPM experts and practitioners [10]. Consequently, there are many studies focusing on the success factors for BPM initiatives [11], [12]. While most have focused on systematization and analysis of CSFs of the entire BPM, the main research goal of this article was to analyse both the contextual and technical perspective of BPMS adoption and the related CSFs. To achieve this goal, a set of interviews was conducted. The research model was developed on the basis of (1) a literature overview, and (2) feedback from BPM business practitioners, i.e. members or leaders of BPM teams from participating organizations, thus giving additional value to this study. A multiple case-study approach was applied to answer the research questions, as follows:

RQ1. What is the relevance of both contextual (organizational and environmental) and technical CSFs for BPMS selection and for adoption success?

RQ2. How have organizations adopted BPMSs; which are the most important benefits and advantages; which issues and obstacles were identified?

The applicative goal of this study is to propose BPMS selection guidelines concerning the organizational, environmental and technological CSFs of BPMS adoption.

The structure of the article is as follows. After the introduction, the theoretical background relevant to this study is presented and a short review of studies on the different perspectives of BPM adoption and its success factors is provided. Next, the development of the research

model is discussed and the empirical research design and data collection described. The case study findings are presented, analysed and discussed. Finally, the implications for research and practice are systemized and conclusions are given.

THEORETICAL BACKGROUND

OVERVIEW OF CONTEXTUAL AND TECHNOLOGICAL BPMS ADOPTION SUCCESS FACTORS

During the past decade, many studies have been conducted on BPM successes and failures with the aim of identifying BPM adoption success factors. However, due to the complexity and the holistic nature of BPM, there is still not a generally accepted framework for successful BPM adoption [13]. Some authors, such as vom Brocke, Zelt and Schmiedel [14], argue that BPM should be contextual, and they derived four groups of factors crucial for BPM: (1) the initiative's goals and objectives, (2) process characteristics, (3) specifics about the organization and (4) the influence of the broader business environment. Buh, Kovačič and Štemberger [10] presented a list of 13 CSFs of BPM adoption, which also listed information technology. Trkman [12] suggested that "BPM adoption CSFs are closely interrelated thus should be considered simultaneously as a set of inter-related pointers". Both Trkman [12] and vom Brocke, Zelt and Schmiedel [14] observed that CSFs are case-specific and change over time due to external influences. Furthermore, [10], [15] analysed CSFs through the stages of BPM adoption to show that these are specific for each stage of the adoption process.

BPM initiatives inevitably comprise BPMS adoption, whether BPMS is used as a tool for business process innovation and optimization, or as a platform for business application development. Nowadays BPMSs cover a wide range of features, from business process modelling and analysis, to process enactment, monitoring and controlling. Further, BPMS capabilities for integration within a given IT infrastructure and their interoperability with other systems are considered crucial for their successful adoption [16]. Though BPMS characteristics are very important for the initiative's success, it is clear that various factors causing the success or failure of BPMS adoption need to be considered. In addition to the technical dimensions, Bernroider and Bernroider [17] and Rijers [16] distinguished the importance of management, human and process issues in BPMS adoption. The list of BPMS adoption CSFs presented by Ravesteyn and Jensen [18] contains both IT and management related factors. Their study proposed a BPMS implementation method based on critical success factors of BPM implementation and situational factors that are organization specific. Therefore, in this study, CSFs are explored from both the contextual and technological dimension and discussed as an inter-connected set.

BPM Initiative Goals, Objectives and Scope

The literature review indicates that BPM researchers have identified various types of relationships between CSFs and the BPM initiative goals and objectives. Malinova, Hribar and Mendling [13] claimed that BPM goals and objectives can be categorized into two groups. The first is related to business (e.g. process standardization, process performance optimization, cost reduction), while the second relates to the technical requirements (e.g. BPMS implementation, process automatization). A different perspective is given by Rosemann [19], who differentiated exploitation and exploration BPM goals. According to vom Brocke, Zelt and Schmiedel [14], exploitation relates to incremental changes, quality management techniques and compliance in order to achieve operational excellence, while exploration BPM goals are focused on process innovation using creative management approaches and new technologies. According to de Morais et al.[20], BPM goals and scope can be explored through the phases of the BPM lifecycle models.

Process Characteristics Affecting BPM Initiatives

Process characteristics play an important role in BPM initiatives. While BPM is traditionally focused on well-structured, highly repetitive business processes, attempts to manage and optimize unstructured, knowledge intensive and very complex business processes are highly challenging [21]. Other frequently mentioned process characteristics for which the specific BPM approach must be adapted are creative processes, processes with a high value contribution (e.g. core processes, customer-oriented processes, end-to-end processes), processes with high variability, and interdependent processes [14]. The diversity of organizational processes requires a customized approach toward change: greater agility, flexibility and autonomy of process participants, new BPM methods and adopted information technology.

Organizational Characteristics and BPM Initiatives

The list of organizational success factors related to BPM very often includes: strategic alignment, top management support, process oriented structure (e.g. process owners, process managers, centres of excellence), organizational culture and other social aspects (e.g. communication and inter-departmental cooperation), employee skills, knowledge and education and project management [12]. The main findings of the research conducted by Ravesteyn and Batenburg [23] shows that alignment of the BPM project to the strategic business goals, strong top-management support and organizational culture play key roles in the success of BPM initiatives. According to de Bruin and Doebeli [24], the efforts to improve "BPM soft factors", such as organizational culture and personal involvement, can lead organizations to successful change.

Though the majority of organizational factors is BPM specific, generic factors such as the size of organization, ownership, revenue or business sector, can also affect BPM success [18]. Some authors stress that BPM adoption goes through five stages [10], [15], from "BPM awareness and understanding" and "desire to adopt BPM" to the phases of "BPM project" and "BPM program", and finally finishing with the phase "productisation of BPM". Thus, it is important for an organization to be aware of the organizational pre-requisites that should be met to launch a BPM initiative. Once a BPM initiative is successfully finished, the organizational characteristics are changed and the organization can move to the next BPM adoption stage.

BPM and the External Environment

Many authors agree that the external environment is influential 0[27]. According to vom Brocke, Schmiedel and Zelt [14], the most important environmental factors are competitiveness and uncertainty. The agility and flexibility of business processes can help to meet the requirements of a highly competitive market. On the other hand, traditional BPM approaches may be quite ineffective for organizations in time-sensitive and innovative industries. In the case of market uncertainty, additional capabilities such as business activity management, real-time analytics and process mining should be in the focus of BPM.

Role of BPMS Characteristics

BPMS characteristics have a very important role for the initiative's success and have thus been examined by numerous authors. According to Bosilj Vukšić, Brkić and Baranović [28], the most important factors relating to the technical perspectives of BPMS adoption are: (1) BPMS capability; (2) BPMS compatibility; (3) BPMS complexity; (4) BPMS vendor's reputation and maturity; (5) BPMS availability to support demo version; (6) BPMS implementation costs and benefits; and (7) measurement of implementation results.

The results were compiled from: (1) a theoretical background as a result of the retrieval of peer-reviewed articles in journal and conference publications in Scopus and Web of Science (WoS) databases; and (2) feedback from business practice which was compiled in the study by Boots [29]. These results are further described, analysed and used as a basis for developing the research model of this study.

RESEARCH METHODOLOGY

DEVELOPMENT OF THE RESEARCH MODEL

The research model was developed on the basis of the previous literature review. Two categories of contextual CSFs (organizational and environmental) are systemized in Table 1. The CSFs are briefly described and the sources cited.

Table 2 presents five categories of technological CSFs for BPMS adoption according to the findings of Bosilj Vukšić, Brkić and Baranović [28] and to the results of the literature review conducted for the purpose of this study. Each technological CSF category is defined, the related sourced cited and the detailed description of the CSF substance given.

The literature analysis findings presented in Tables 1 and 2 answer the first research question **RQ1** about the contextual and technological BPMS adoption factors from the perspective of academics and researchers. These findings were then used to create the study structure and content.

The domain of data (property) that will be used to describe and subsequently measure individual CSFs depends on the nature and definition of CSF itself. Roughly speaking, the domain of these data can belong to one of two groups: (i) the qualitative, textual, descriptive domain, or (ii) the quantitative, numeric domain. The measuring instrument of this study used texts as the qualitative domain, and integers ranging from 1 to 5 as the quantitative domain. The instrument for detecting the identified CSFs should consider the domains associated with an individual CSF. The domain identified as appropriate for a particular CSF is listed in the column "Domain of the measured property" in Tables 1 and 2.

STUDY DESIGN

Since multi-case studies of contextual and technical CSFs of BPMS adoptions are quite scarce, our research approach was to conduct interviews in three organizations. The advantage of the case study research method is in its ability to provide a deeper understanding of the field. For example, Van Belle and Reed [45] claimed that "in a case of the interdependence between variables and the non-measurability/intrinsic complexity of some of the variables qualitative case study approach should be chosen since it provides richer and more subtle explanations than statistics". Opdenakker [46] noted that the interview is a core data collection technique in qualitative research, while Eisenhardt [47] specified case study data collection methods as "a combination of interviews, questionnaires and observations".

Though the results of single-case studies on BPM adoption are well-accepted [10], for the purpose of this article an exploratory qualitative, multiple-case study approach was applied. According to Yin [48], a multiple case study analysis is considered the most suitable in examining real-life situations when "why" and "how" questions are asked. The novelty of this study is the use of both a semi-structured and in-depth interview approach, thus giving interviewees the opportunity to evaluate BPMS characteristics, and also to comment on the contextual BPMS adoption issues, to reveal their perceptions and to describe their experiences in the field.

Table 1. Organizational and environmental dimension of BPMS adoption.

Contextual dimension	CSFs of BPMS adoption	Domain of the measured property	Source
Organization (ORG)	(ORG-1) *Goals and objectives of the initiative*: exploitation vs. exploration BPM goals; goals related to business and/or to technical requirements; goals related to the phases of BPM lifecycle models or to the stages of BPM adoption.	text	de Morais et al., 2014 [20]; Buh, Kovačič and Indihar Štemberger, 2015 [10]; Rosemann, 2010 [15]; vom Brocke, Zelt and Schmiedel, 2016 [14]; Rosemann, 2014 [19]; Malinova, Hribar and Mendling, 2014 [13]
	(ORG-2) *Scope of BPM initiative:* BPM lifecycle phases are defined by different authors in a similar way, such as (1) process identification; (2) process discovery; (3) process analysis; (4) process redesign; (5) process implementation; and (6) process monitoring and controlling.	text	Dumas et al., 2013 [7]
	(ORG-3) *Internal processes characteristics* (especially those in the focus of the BPM initiative): well-structured, highly repetitive business processes vs. unstructured, knowledge intensive and complex processes; processes with high variability, interdependent processes, creative processes, processes with a high value contribution.	text	Marjanovic and Freeze, 2012 [21]; vom Brocke, Zelt and Schmiedel, 2016 [14]
	(ORG-4) *BPM oriented organizational factors*: strategic alignment, top management support, process-oriented structure, process performance measurement, people, organizational culture and other social aspects.	text	Trkman, 2010 [12]; Bai and Sarkis, 2013 [22]; Malinova, Hribar and Mendling, 2014 [13]; Ravesteyn and Batenburg, 2010 [23]; de Bruin and Doebeli, 2009 [24]; Glavan, 2011 [30]
	(ORG-5) *Generic organizational factors*: size of organization, ownership, revenue or business sector.	integer $\in \{1, \ldots, 5\}$	Ravesteyn and Jansen, 2009 [18]
	(ORG-6) *BPM adoption stage*: (1) awareness and understanding of BPM; (2) desire to adopt BPM; (3) BPM project; BPM program; (5) productisation of BPM.	integer $\in \{1, \ldots, 5\}$	Rosemann, 2010 [15]; Buh, Kovačič and Indihar Štemberger, 2015 [10]
Environment (ENV)	(ENV-1) *External factors*: competitiveness and uncertainty of the business environment.	text	vom Brocke, Schmiedel and Zelt, 2016 [14]; Peronja, 2015 0; Skrinjar and Trkman, 2013 [26]; Bitkowska, 2015 [27]

Table 2. Technological dimension of BPMS adoption.

Category of the technological dimension	CSFs related to the category	Domain of the measured property	Source
BPMS capability (CAP): "comprises elements and functionalities, or BPMS architecture" [32]-[35].	CAP-1: Process modelling, analysis and design; CAP-2: Business rules; CAP-3: Reporting, analytics, monitoring; CAP-4: Social BPM; CAP-5: Process strategy subsystem; CAP-6: Low-code development; CAP-7: Enactable models and process engine; CAP-8: Mobile & tablet functionalities; CAP-9: Web platform, cloud capabilities; CAP-10: Security and reliability	integer $\in \{1, \ldots, 5\}$	Bernroider and Bernroider, 2008 [17]; Cingil, Ozturan and Erdem, 2012 [38]; Delgado et al., 2015 [39]; Mejri and Ghanouchi, 2015 [40]; Poelmans, Reijers and Recker, 2013 [4]; Ravasan. Rouhani and Hamidi, 2014 [41]; Štemberger, Bosilj-Vukšić and Jaklič, 2009 [42]; Meidan et al., 2017 [43]
BPMS compatibility (COMPA): "is defined as the alignment of IT innovation with the standards, requirements, needs and beliefs" [36].	COMPA-1: Existence of compatibility; COMPA-2: Simplicity of integration	integer $\in \{1, \ldots, 5\}$	Bernroider and Bernroider, 2008 [17]; Cingil, Ozturan and Erdem, 2012 [38]; Poelmans, Reijers and Recker, 2013 [4]; Ravasan, Rouhani and Hamidi, 2014 [41]; Štemberger, Bosilj-Vukšić and Jaklič, 2009 [42];
BPMS complexity (COMPL): "comprises the overall impression of simplicity of implementation including the level of skills required and learning curve" [34]-[36].	COMPL-1: BPMS implementation complexity; COMPL-2: Simplicity of BPMS use; COMPL-3: BPMS user interface complexity	integer $\in \{1, \ldots, 5\}$	Bernroider and Bernroider, 2008 [17]; Blumberg et al., 2013 [44]; Cingil, Ozturan and Erdem, 2012 [38]; Poelmans, Reijers and Recker, 2013 [4]; Štemberger, Bosilj-Vukšić and Jaklič, 2009 [42]
BPMS vendor's reputation and maturity (REP): "a focus has to be put on vendor's knowledge, experience, service, maintenance and presence on a local market" [29] .	REP-1: Vendor maturity; REP-2: Presence on the local market; REP-3: BPMS documentation; REP-4: BPMS installation and maintenance	integer $\in \{1, \ldots, 5\}$	Meidan et al., 2017 [43]; Delgado et al., 2015 [39]; Mejri and Ghanouchi, 2015 [40]; Poelmans, Reijers and Recker, 2013 [4]; Ravasan, Rouhani and Hamidi, 2014 [41]; Štemberger, Bosilj-Vukšić and Jaklič, 2009 [42]; Bernroider and Bernroider, 2008 [17]
BPMS implementation costs and benefits (COST): "IT innovation enables costs cutting and increase of profit" [37].	COST-1: BPMS implementation costs in relation to budget	integer $\in \{1, \ldots, 5\}$	Delgado et al., 2015 [39]; Ravasan, Rouhani and Hamidi, 2014 [41]; Štemberger, Bosilj-Vukšić and Jaklič, 2009 [42]

DEVELOPMENT OF THE RESEARCH INSTRUMENT AND DATA COLLECTION

To answer the main research question, a set of face-to-face interviews was conducted. The interviews took place in May and June 2017. The interview consisted of two parts. Qualitative data were collected through the in-depth interview, in which interviewees answered questions in free-form. The semi-structured part of the interview was used to collect quantitative data, in which interviewees were asked to evaluate statements on the Likert scale. For each statement, interviewees were asked to give an importance score on a scale from 1 to 5, with the meaning: 1 = "not important at all"; 2 = "of little importance"; 3 = of average importance"; 4 = "very important"; 5 = "absolutely essential". The option "X = I don't know" was also available.

The interview was structured into 4 sections:

Part 1	Generic contextual questions on the CSFs presented in Table 1 (ORG-5 and ORG-6);
Part 2	Questions related to organizational and environmental dimension of the BPMS adoption initiative based on CSFs presented in Table 1 (ORG-1; ORG-2; ORG-3; ORG-4 and ENV-1);
Part 3	Evaluation of statements about BPMS characteristics/features (technology dimension of BPMS adoption), based on CSFs presented in Table 2;
Part 4	Questions about BPMS adoption success (the most important results, benefits, obstacles and issues of BPMS adoption), according to the major issues that BPM users identified at the strategic, tactical and operational level in BPM initiatives [49].

Participating organizations were identified through communications with the leading BPM experts in Croatia. The criteria for the selection were that (1) the organization has successfully adopted BPMS and (2) that its BPM practitioners and experts were willing to participate in this study. BPMS adoption is considered successful if the initiative's results satisfactorily met the pre-determined goals [50].

This study examined three BPMS adoption initiatives (two in Croatian organizations and one in an organization from Bosnia and Herzegovina). The interviews were conducted in Croatian. For each initiative, both the BPM practitioner and BPM expert were interviewed. Data were collected from six interviews, but only the results of the interviews with BPM practitioners of the organizations are reported here in order to identify the BPMS adoption issues as perceived by the business users. BPM practitioners are the employees involved in BPMS adoption. Each interview lasted from 90-120 minutes and was conducted in three phases: (1) data collection; (2) data analysis – in order to summarize the main findings and to assess any inconsistencies in the interviewees' estimates of statements or misunderstanding of questions; (3) the interviewees' confirmation of the results. In the case of ambiguity, interviewees were asked first to clarify their answers or to recheck the estimates and then to confirm the results. Due to the interviewees' experience in BPM initiatives, no questions were answered with "X = I don't know". The collected data were coded using Word and Excel spreadsheets.

Following data entry, the results were analysed according to the success factors identified in Tables 1 and 2 for each initiative.

CASE STUDIES: ANALYSIS AND DISCUSSION

GENERIC CONTEXTUAL DATA ABOUT ORGANIZATIONS AND BPM INITIATIVES

Data on the organizations' generic characteristics (related to CSFs from Table 1, ORG-5) and about BPM adoption stage (related to CSFs from Table 1, ORG-6) were collected within Part 1

of the interviews. Interviewees were capable of answering all questions, since they were educated on BPM, they possessed the practical knowledge and skills required to conduct BPM projects, and were actively involved in BPM initiatives in their organizations either as team members or team leaders. Analysis of these data provided the "big picture" about the organizations and their approach to BPM adoption.

The first organization (hereinafter: *Organization A*), is based in Croatia and comes from the public sector. It has less than 50 employees and is involved with coastal liner services. Organization A grants concessions to Croatian coastal liners and manages activities related to the beneficial rights of coastal liner tickets, thus enabling the residents of Croatian islands to travel at discounted prices. The first BPM project was started in 2014. It lasted for one year and was not followed by any other projects. The initiative was launched as a "one-time project", and thus it can be assumed that Organization A is in the third stage of BPM adoption. Bizagi BPM Suite was used to develop a new business application to support the selected process. Additionally, several software tools and platforms were used, such as: Visual Paradigm for UML, SQL Server 2012, .NET Framework 4.4, ASP.NET MVC and WCF.

The second organization (hereinafter: *Organization B*) comes from the telecommunications industry and provides telecommunication services: fixed, mobile and Internet connecting services. It is a large company from Bosnia and Herzegovina with more than 1000 employees and with revenues exceeding EUR 50 million in 2016. Organization B has ongoing cooperation with many domestic and foreign companies and provides Bosnia and Herzegovina citizens and business entities with high-quality telecom services. The strategic approach towards "BPM as a program which comprises a series of projects" was introduced in 2016, thus having the characteristics of the fourth stage of BPM adoption. The first initiative started in 2016 and was completed within ten months. Oracle Business Process Management Suite 12c was used for BPMS development. This initiative resulted in the successfully implemented BPMS that supports three business processes.

The third organization (hereinafter: *Organization C*) is an important Croatian international airport with some 370 employees and with almost 3 million passengers in 2017. Due to its geographic position, it has a seasonal character, thus offering flights to various European cities during the summer months. The organisation's approach to BPM is "strategic and continuous", putting it in the final, fifth stage of BPM adoption. The first BPM initiative began in 2002 and was followed by many others, covering all phases of the BPM lifecycle. Software AG (previously ARIS) was implemented and is used as the basic software platform for BPMS development.

ORGANIZATIONAL AND ENVIRONMENTAL CONTEXTUAL FACTORS OF BPMS ADOPTION: FROM THE PERSPECTIVE OF BPM PRACTITIONERS

Table 3 presents the most important findings about the qualitative data collected in Part 2 of the interviews. These findings give the answers to the first research question (**RQ1**) about the organizational and environmental factors that are relevant for BPMS adoption according to BPM practitioners. The answers were systemized as defined in Table 1.

The analysis of the organizations' generic data shows that these organizations differ in relation to ownership, size, industry and process characteristics. Their BPM initiatives have varying scope, objectives and goals and fall into different BPMS adaptation stages. Organization A can be considered to be in the third stage of BPM adoption, Organization B is in the fourth, while Organization C is in the fifth stage according to Rosemann [15] and Buh, Kovačič and Indihar Štemberger [10]. Despite these differences, the introduction of BPM was triggered by similar business drivers: (1) the success of these organizations depends on the

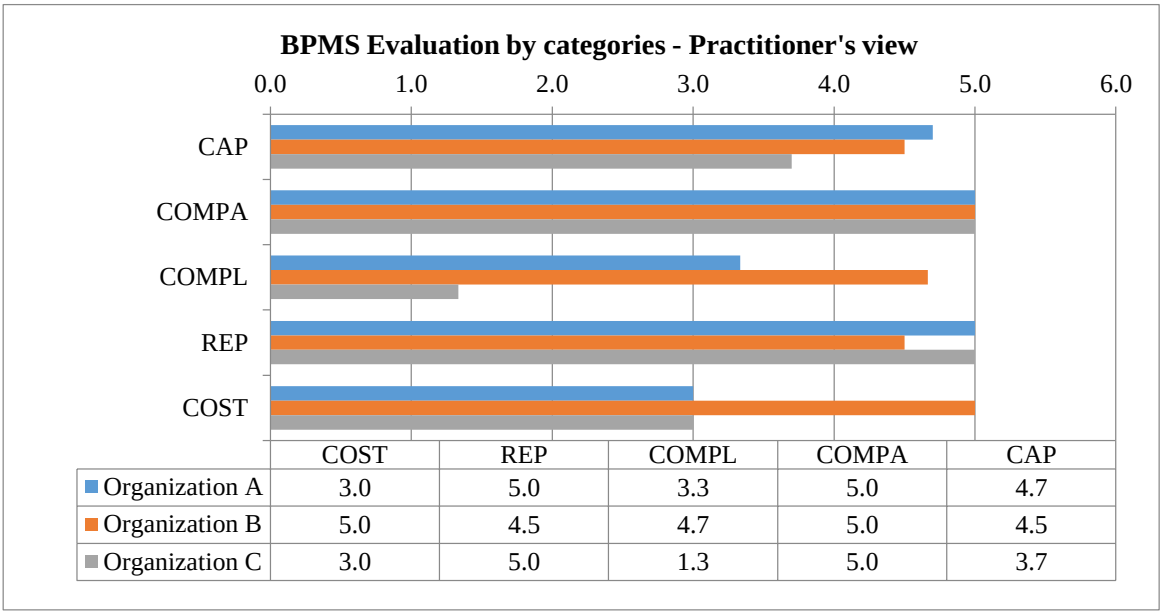
Table 3. Organizational and environmental factors of BPMS initiative adoption.

Factor	Organization A	Organization B	Organization C
ORG-1	The goals are: (1) to model, analyse and improve the process of granting transport tickets with beneficial rights for passengers and vehicles in liner shipping and coastal maritime traffic; (2) to develop and implement a software platform and web services to support this process; and (3) to enable data transfer and information exchange with external Information Systems (shorter ISs).	The goals are: (1) to model and analyse 15 end-to-end business processes; (2) to develop and implement BPMS for three processes, i.e. procurement, contracting and filing lawsuits; and (3) to implement business applications to support the selected processes.	The BPM program comprises several projects with specific goals that span: (1) modelling and analysis of processes related to aircraft, passenger and luggage arrival/departure; (2) development and implementation of process performance management system; (3) introduction of dashboarding/reporting system; and (4) simulation/optimization of the selected processes.
ORG-2	BPM initiative scope comprises phases 1-5 of the BPM lifecycle.	All BPM lifecycle phases (1-6) are comprised within the scope of initiative.	All BPM lifecycle phases (1-6) are comprised within the scope of initiative.
ORG-3	Internal processes are well-defined and documented, internal working procedures exist, the majority of employees work in administrative, highly-repetitive processes, though some processes are unstructured and knowledge intensive.	Functional siloes and process gaps are evident; business processes are not standardized; it is difficult to monitor, control and measure end-to-end business processes; process-oriented KPIs are not defined; many processes have high variability and are interdependent.	Internal processes are standardized and documented; working procedures and norms are defined; internal process quality must be at the highest level; total quality management and risk management are applied.
ORG-4	Presence of traditional hierarchical organizational structure and hierarchy culture; process positions or roles are not established; organization is not process-oriented, though employees are motivated for change.	Divisional organizational structure is established; employees are partly educated about BPM prior to the launch of the initiative; BPM is defined by top-management as a strategic goal of the organization.	BPM initiatives are completely aligned with the strategic goals of the organization; process performance monitoring, measurement and management is extremely important due to the seasonal character of business; employees are familiar with BPM; existence of process owners and process managers.
ENV-1	The perception of service quality provided to Croatian citizens is crucial for success; EU and government policy and regulations have a very strong impact; processes depend on several acts and regulations.	Highly competitive market has a strong impact on the organization; EU and government regulations in the field of telecommunications influence the business.	Competition and uncertainty influence the business; flexible and agile reaction to environmental changes are crucial; communication and interaction with the external bodies/institutions is constant and intensive due to the nature of the business; several business processes are outsourced, thus relations with business partners are very important.

quality of services provided to users (customers, business partners or citizens), thus the organizations are customer-oriented and aim to meet customer requirements; and (2) external environment factors strongly influence these organizations (the most important environmental factors for organizations B and C are competitiveness and uncertainty, while government policy and regulations have a strong impact on Organization A).

RELEVANCE OF TECHNOLOGICAL FACTORS: BPM PRACTITIONER EVALUATION AFTER BPMS ADOPTION

In Part 3 of the interview, interviewees evaluated the relevance of BPMS characteristics and features prior to implementation (i.e. during the process of BPMS selection) and following completion of the initiative. The ratings of technological factors after BPMS adoption are presented here, as the experience and knowledge of BPM practitioners who were actively involved in BPMS adoption could serve as a guideline for BPMS selection in the future. Since the interviewees from Organizations A and B assessed only a few of the BPMS characteristics "prior to implementation" and "after adoption" differently, these issues are briefly discussed. Figure 1 presents the average grades of five categories within the technological dimension after BPMS adoption.



	COST	REP	COMPL	COMPA	CAP
Organization A	3.0	5.0	3.3	5.0	4.7
Organization B	5.0	4.5	4.7	5.0	4.5
Organization C	3.0	5.0	1.3	5.0	3.7

Figure 1. Technological dimension categories of BPMS adoption – average ratings (as evaluated by BPM practitioners after BPMS adoption).

Figure 2 depicts the results of evaluation of BPMS technological characteristics after adoption. The results were analysed and discussed, giving the answers to the first research question (**RQ1**) from the BPM practitioners' point of view.

BPMS Compatibility and Vendor's Reputation and Maturity

The average grades presented in Figure 1 show that according to BPM practitioners, BPMS compatibility (COMPA) and BPMS vendor's reputation and maturity (REP) are uniform and scored the highest among categories of this dimension after BPMS adoption.

All interviewees evaluated both BPMS compatibility factors as "absolutely essential"; i.e. the existence of BPMS compatibility with the existing IT infrastructure (COMPA-1) and the simplicity of the existing ISs and BPMS integration (COMPA-2) were given the highest could occur due to inadequate consultant maturity.

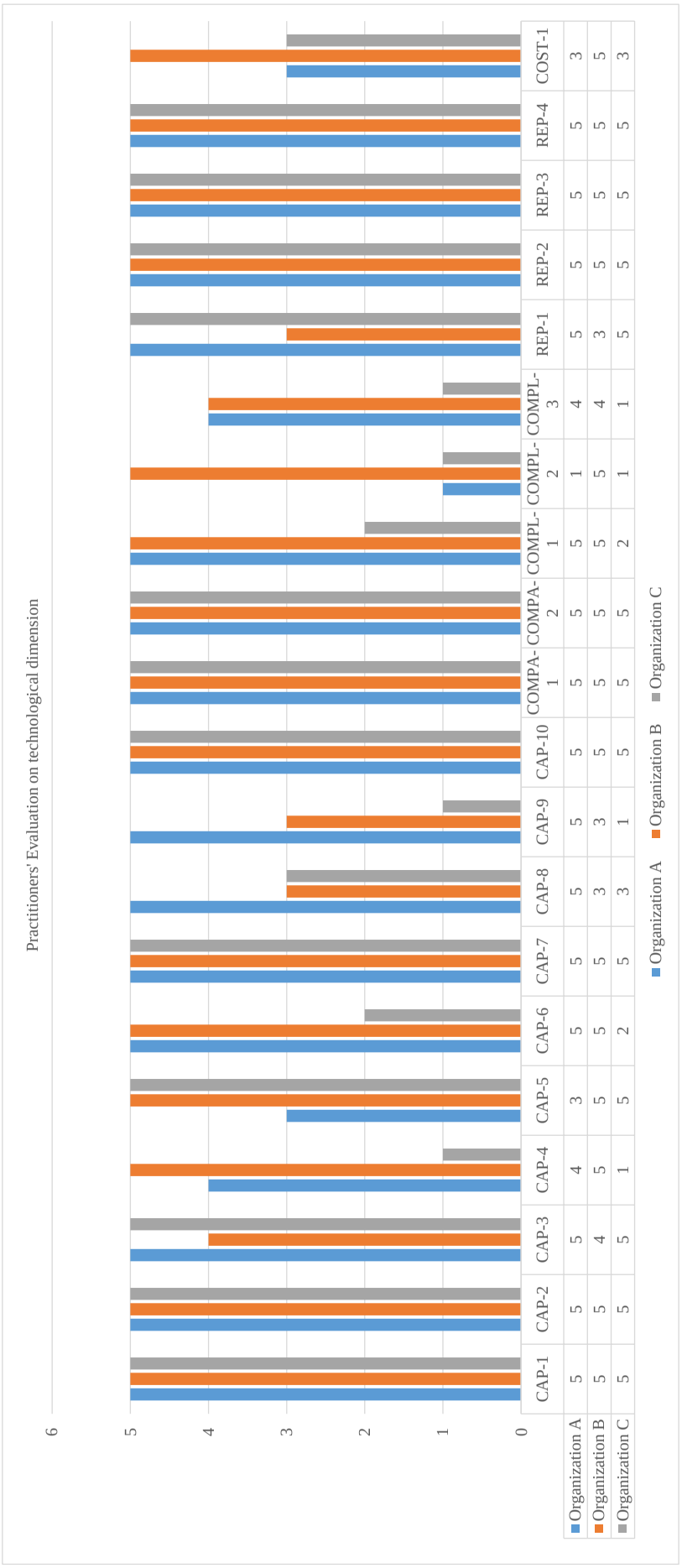


Figure 2. BPM practitioners' evaluation of technological dimension factors (as evaluated by BPM practitioners after BPMS adoption).

grade (5). Similar results were obtained for the category of BPMS vendor's reputation and maturity (REP). BPMS vendor's knowledge, experience and presence on the local market (REP-2), BPMS documentation (REP-3), service, and maintenance (REP-4) were scored as having the highest relevance (i.e. "absolutely essential") for all interviewees. While vendor maturity (REP-1) is "absolutely essential" for organizations A and C, this was not the case for Organization B. According to the interviewee from Organization B, this factor is "of average importance". This is likely explained by the fact that this was the first BPMS implementation in Organization B. Thus, the BPM practitioner did not perceive the issues and problems that could occur due to inadequate consultant maturity.

BPMS Capability

The average scores for the BPMS capability category (as presented in Figure 1) were very similar for Organization A (4,7) and Organization B (4,5), while the average grade given by Organization C was somewhat lower (3,7).

The best graded factors within this category (Figure 2) were: process modelling, analysis and design functionality (CAP-1); business rules support (CAP-2); existence of enactable models and process engine functionality (CAP-7); and BPMS security and reliability (CAP-10). During BPMS selection, the interviewees assessed these factors as "absolutely essential" for the success of their initiatives.

For Organization C, both the availability of advanced reports and analytics (big data, real-time intelligence, predictive analytics, dashboards) based on data collected during the simulation and process runtime (CAP-3) and the process strategy subsystem development (CAP-5) were scored to have the highest relevance for the project goals. The interviewee from Organization A estimated that the reporting and analytics feature (CAP-3) was "absolutely essential" while it is "very important" according to the interviewee from Organization B. While this grade fits well to the BPM initiative goals of Organization B, this is not the case for Organization A. The main goal of the BPM project in Organization A was to develop a software platform and web services to support process execution. Consequently, the relevance of this feature was of "average importance" during BPMS selection. The BPM practitioner changed their attitude about the potential usefulness of this feature after BPMS adoption.

The relevance of the process strategy subsystem (CAP 5) was of "average importance" for Organization A due to the nature of the BPM initiative ("BPM project as a one-time initiative"). On the other hand, this feature was "absolutely essential" for Organization B due to its strategic approach toward BPM as a mechanism to drive business.

Since the most important goal of BPM in Organization C was process optimization, BPMS was only "a tool" to achieve it. Thus the functionality of low-code development (CAP-6) was of "little importance" for the interviewee from Organization C. On the other hand, low-code development was "absolutely essential" for Organizations A and B, as business applications and BPMS development were the main focus of their initiatives.

The nature of internal processes (rigid business rules, standardized and inflexible procedures, processes mainly executed on a ramp or runaway, seasonal and external staff participation) resulted in the assessment of support to human collaboration and social media integration (CAP-4) and Web platform, cloud capabilities (CAP-9) as "absolutely irrelevant" for Organization C. The organizational factors and external environment of Organization A (public services provided to Croatian citizens, a requirement for strong IT integration and data transfer with ISs of business partners and other organizations from the government sector) affect the high ratings of social BPM support (4) and Web platform/cloud capabilities (5). Due to the highly competitive market and customer orientation, social BPM features were

evaluated as "absolutely essential" for Organization B, while Web platform and cloud capabilities were of "average importance".

Since the BPM initiative in Organization A aims to provide a simple and efficient communication platform for all process participants (i.e. business users, government institutions and citizens), mobile and tablet functionalities (CAP-8) were considered "absolutely essential". Prior to BPMS implementation, this factor was evaluated as "very important", indicating a change in attitude about its relevance after adoption. For organizations B and C, this feature was of "average importance".

BPMS Complexity

The average ratings given to the BPMS complexity category after BPMS adoption were the lowest in comparison to other categories of the technological dimension (Fig. 1). Additionally, the scores given within this category were quite heterogeneous, as presented in Figure 2.

The lowest scores were given by Organization C due to its long-time experience in BPM (a continuous set of projects over the past 15 years) and a high level of knowledge about BPM and IT. BPMS implementation complexity (COMPL-1) was scored as being of "little importance", while the simplicity of BPMS use (COMPL-2) and the ease of user interface usage (COMPL-3) were of "no importance at all" for Organization C.

The relevance of BPMS implementation complexity (COMPL-1) was "absolutely essential" for Organizations A and B while the ease of user interface usage (COMPL-3) was of "high importance" for both organizations after BPMS adoption. The relatively high relevance of these factors for Organizations A and B is aligned with their status as "novices in BPM", i.e. both organizations are in the lower BPMS adoption stages in comparison to Organization C.

The complexity of BPMS use (COMPL-2) was of "high importance" for Organization B, hence this score is well aligned with the above conclusions. Quite unexpectedly, the same factor (COMPL-2) was "of no importance" for Organization A. This situation can be explained as follows: (1) users have adequate knowledge of IT and BPMS usage; and (2) the selected BPMS are relatively simple to use.

Finally, it must be pointed out that according to the opinions of the BPM practitioners, these factors (COMPL-1, COMPL-2 and COMPL-3) were of "average importance" during the process of BPMS selection in Organization B. However, its relevance increased after adoption due to the issues and obstacles faced by the organization while implementing BPMS.

BPMS Costs

While BPMS implementation costs (COST-1) were of "average importance" for Organizations A and C, this factor was essential for Organization B. The reason can be found in the fact that Organization B initiated a comprehensive, time consuming and financially demanding BPM program. The scope of the BPM project launched by Organization A was much narrower, while Organization C conducted a continuous series of relatively small projects over a long period, thus requiring a relatively lower budget share for each project.

DISCUSSION ABOUT BPMS ADOPTION RESULTS AND SUCCESS FACTORS

Part 4 of the interview covered the major issues related to the success of BPMS adoption. The most important findings are presented and discussed in this section, thus providing answers to the second research question (**RQ2**) about the benefits and advantages, but also about the issues and obstacles of BPMS adoption initiatives. The differences in technological CSF assessment prior to and after BPMS implementation are also discussed here.

BPMS ADOPTION IN ORGANIZATION A

The most important result of BPM initiative in Organization A is the new software platform that manages the process of granting transport tickets for 130 000 citizens with beneficial rights and their vehicles in liner shipping and coastal maritime traffic. Additionally, the reporting IS was developed and data made available to relevant users (citizens and employees of government organizations). The BPMS was adequately selected: Bizagi BPM Suite functionalities were tailored to the BPM initiative goals and the cost was appropriate. BPMS functionalities were used to (1) model and design the selected process, and (2) build process application. Though minimal coding was required to turn business process models into a web application, additional software tools were also used. The implemented BPMS and developed business applications entirely fulfilled the expectations, though the relevance of both advanced reports and analytics (CAP-3) and mobile and tablet access to BPMS (CAP-8) were graded too low prior to implementation. After adoption, the interviewee decided to give the highest score to these CSFs. Business partner data transfer and IS integration was noted as a project risk, though these obstacles were successfully overcome.

The CSFs of the organizational dimension fit well with the characteristics of the third stage of BPMS adoption. Top management supported the BPM initiative and understood its importance. The BPM initiative was defined as a strategic goal for the organisation. Employees were motivated to accept changes in working procedures, thus a lack of BPM knowledge and education did not influence project success. Process jobs and roles were not established, since this was an individual project, and not a continuous and strategic BPM approach.

The influence of the external environment was of the highest importance for this project. The slowness and resistance of business partners and other government organizations to introduce changes in their external business processes was a great obstacle for this project. Therefore, the government support and willingness to amend and adopt the law and regulations to ensure alignment with the project's goals were crucial for the BPM success. Several acts and regulations were amended and adopted to support this initiative, such as: (1) Regulation on the conditions and evaluation of the criteria for the award of concession and contract on public services for public transport in liner shipping and coastal maritime traffic; (2) Rules of compliance for ships and ship-operators participating in public transport in liner shipping and coastal maritime traffic; (3) Rules on the conditions and procedures for granting beneficial rights in public transport in liner shipping and coastal maritime traffic; and (4) Decision on the amount of the discount on regular prices for transport tickets with beneficial rights for the passengers and vehicles in public transport in liner shipping and coastal maritime traffic.

BPMS ADOPTION IN ORGANIZATION B

The results of BPMS adoption in Organization B were: (1) business process repository with AS-IS and TO-BE models of 15 core (end-to-end) business processes; (2) business process analysis results, and (3) a software platform to manage and support three processes (procurement, contracting and filing lawsuits). To achieve the initiative's goals, a complex, powerful and expensive BPMS was selected. While the functionalities of the Oracle BPM Suite 12c fully met the requirements, this was not the case for external consultants. Though the social BPM (CAP-4), i.e. the ability to support human collaboration and integration with social media and the low-code development (CAP-6) functionalities were graded as "very important" prior to implementation, after adoption these factors were evaluated as "absolutely essential". Similarly, BPMS complexity (COMPL-1; COMPL-2 and COMPL-3) was beyond expectations. The ratings of these CSFs, which were given excessively low scores prior to implementation, were rated with the highest scores after the adoption of BPMS. Despite the complexity, the selection of BPMS was a good business decision since it will be capable of meeting the requirements of future initiatives.

During implementation, several issues in BPM were identified at different organizational levels, such as: (1) inadequate top-management support, lack of widespread employee awareness of BPM importance in the organization, (2) lack of standards and lack of BPM education at the tactical level; and (3) miscommunication of BPMS capabilities at the operational level. The comprehensive scope of the project was considered a great challenge of this initiative. However, due to the intensive efforts of project team members, these issues were successfully resolved. Following completion of the initiative, the organizational characteristics were typical for the fourth stage of BPMS adoption: design of a roadmap for BPM adoption; employee acceptance of business process terminology; introduction of process roles; establishment of a business process governance officer during the initiative.

A highly competitive external environment was a driver of the BPMS initiative and this partly affected BPMS adoption. Due to constant change on the market, the business process models were amended during the BPM initiative, thus causing changes to business processes in the organization. Consequently, certain processes were re-modelled, which required additional effort, though this did not affect the successful completion of the project (within budget and on time).

BPMS ADOPTION IN ORGANIZATION C

The results of BPMS adoption in Organization C indicate the presence of all phases of the BPM lifecycle, such as:

- Process identification – the process landscape is identified, process owners identified and strategic process goals defined using BSC (Balanced Scorecard) functionality;
- Process discovery – AS-IS business process repository is developed, low-level details of documenting of passenger service and aircraft ground handling processes modelled, process performance goals defined and quick-wins implemented;
- Process analysis – passenger service and aircraft ground handling AS-IS processes analysed in relation to organizational units' time and cost, simulation and what-if analysis of flight departures process conducted, performance issues identified and optimization priorities assigned;
- Process redesign – analysis of resources capacity and utilization is conducted, process changes and optimization proposed, TO-BE models of passenger service and aircraft ground handling processes designed;
- Process implementation – business process changes are implemented, the concept of change management introduced, new business applications procured and implemented to support the changed business processes;
- Process monitoring and control – process performance monitoring system for passenger service and aircraft ground handling processes is developed and implemented, dashboarding/reporting of flight data and aircraft ground handling process introduced, process metrics and key performance indicators such as process time, delays and reasons for the delay in ground handling operations and customer experience scores used.

The advantage of Software AG (previously ARIS, IDS Scheer) was in its modularity, thereby enabling Organization C to purchase those functionalities that were relevant for its specific BPM initiative goals. The appropriate BPMS functionalities and excellent support of the external consultants were recognized as the main success factors of the BPM initiatives. BPMS functionalities and BPMS maintenance fully met the requirements.

According to the characteristics of the organizational dimension, Organization C falls into the fifth stage of BPMS adoption: (1) presence of employee buy-in; (2) a common mind share of BPM and strong support at all management levels positively affected the adoption success; (3) BPM goals were derived from strategic goals of organization; (4) links were established

between business process outcomes, KPIs and the strategic goals of the organization; (5) establishment of the BPM Centre of Excellence responsible for BPM-related activities and a process-oriented organizational structure.

The external environment triggered BPM initiatives (Organization C intended to become and stay competitive) but did not affect adoption success. During the 15-year period, several BPMS adoption initiatives were conducted smoothly and successfully, without major issues or obstacles. Presently, a new BPM goal has been identified, i.e. the organization is aiming to invest efforts in the field of social BPM and customer experience.

BPMS ADOPTION SUCCESS FACTORS: A RECAPITULATION

According to the results presented in Figures 1 and 2, it can be concluded that for some technological factors of BPMS adoption, all practitioners shared the same opinion. For most of these factors, all practitioners assigned the highest level of importance both prior to BPMS implementation and after BPMS adoption. Those factors are supported by the functionalities and features of BPMSs that can be considered as core, such as those related to:

- (CAP-1) Process modelling, analysis and design;
- (CAP-2) Business rules modelling;
- (CAP-7) Enactable models and process engine;
- (CAP-10) Security and reliability;
- (COMPA-1) Existence of compatibility;
- (COMPA-2) Simplicity of integration;
- (REP-2) Presence on the local market;
- (REP-3) BPMS documentation;
- (REP-4) BPMS installation and maintenance.

These functionalities of BPMS should definitely be considered when selecting the BPMS for specific implementation, regardless of the business type, size of organization, vendor maturity, and other organizational and environmental factors of BPMS adoption. The fact that almost half of the 20 established technology factors were considered by all practitioners to be "absolutely essential", indicates that we have succeeded in identifying the important technological features of BPMSs.

It is also apparent that the study participants had differing attitudes about certain categories. Discrepancies were most evident in the issues on social BPM (CAP-4), low-code development (CAP-6), mobile & tablet functionalities (CAP-8), web platform, cloud capabilities (CAP-9), simplicity of BPMS use (COMPL-2), vendor maturity (REP-1) and BPMS implementation costs related to budget (COST-1). Some reasons that can justify these divergences are differences stemming from: (1) organizational and environmental factors, (2) stages of BPM adoption in the organization, (3) types of processes implemented, (4) final phases of implementation for particular process, and (5) the quality of the relationship between the organization and consultants and vendors.

These observations suggest that the framework formally presented in the section *Development of Research Model*, and then evaluated using the developed research instrument in three organizations, could be valuable to practitioners as guidelines in selecting BPMS. Organizations whose management is planning to adopt a BPMS need to investigate the organizational and environmental factors that may influence their future BPMS initiative, in any way. According to this multiple-case study, it is necessary to identify the organization-specific and mission-related requirements to keep the focus on supporting selected processes related to strategic goals. Our research has shown that complexity, costs and certain capability options related to emerging technologies vary in their influence on BPMS

adoption, mostly due to the organization's specific BPM goals, its technological maturity and BPM project scope. Clearly stated technological requirements regarding other capability options and compatibility, as well as thoroughly investigated and mapped features provided by reputable vendors, enhance the success of BPMS adoption.

CONCLUSIONS

This study investigated the contextual and technological aspects of BPMS adoption and related CSFs. A theoretical framework with identified fundamental dimensions of CSF for the BPMS adoption is presented. Each dimension is defined on a vast scientific literature review. A considerable amount of literature was focused on systematization and analysis of the contextual, i.e. organizational and environmental, dimension. In contrast, the number of publications exploring the technological dimension is considerably smaller, and even smaller is the number of publications in which CSFs have been empirically explored from the perspective of all three dimensions: organizational, environmental and technological. We believe that we have made substantial progress in that direction.

Furthermore, we have established a set of BPMS selection guidelines in relation to organizational, environmental and technological CSFs of BPMS adoption. The proposed framework and BPMS selection guidelines were tested using a case study approach. The study comprises three BPMS adoption initiatives that differ in relation to organisation ownership, size, type of business and process characteristics. Their BPM initiatives have different scopes, objectives and goals and belong to different BPMS adaptation stages. The differences between the organizations and their BPM initiatives are not considered a limitation of this study, since the intention is not to compare the findings, but to reveal the relationship between the contextual, environmental and technological characteristics of BPMS adoption initiatives and its success for three different organizations.

Qualitative and quantitative data collected in this study were analysed and discussed. We believe that the quantitative analysis of numerically evaluated components of the technological dimension and guidelines given thereto serve as a sound basis for BPMS selection. To further our research, we plan to analyse the quantitative data gathered here using recognized methods [51] for quantitative data analysis, e.g. AHP.

This study has several clear limitations. The first limitation is the number of case studies involved. Given the small number of case studies, caution must be taken when making general conclusions. In future research, we should answer the question: "Would the research results be different if the number of organizations involved is much higher?". Despite this, this study can serve as a foundation for future studies. Next, this study comprises the perspective of business practitioners concerning BPMS adoption, though to obtain a bigger picture of the field, the attitudes of BPM experts and BPM vendors should also be explored.

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