Analysis and improvement of knowledge management processes in organizations using the Business Process Model Notation

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Abstract. Successful knowledge management is one of the main challenges for any kind of organization. This paper aims to enhance knowledge management processes within companies and institutions, by analyzing different processes that are part of common stages along all knowledge management lifecycles described in the literature. The processes have been modeled using the Business Process Model and Notation with a high abstraction level, in order to cover a wide range of organizations. The paper also presents a possible evolution and enhancement of knowledge management processes using the Business Process Model and Notation diagrams, including the use of superior and better performing technological solutions to support knowledge management processes. As a result, we propose a set of improvements that can be extrapolated to other knowledge management-related business processes.

Keywords: business processes, knowledge management, information systems, business process modeling

1   Introduction

The importance of knowledge generation and preservation has been present since the Ancient World through different formats—e.g. paper [1]. Nowadays, technological evolution provides new tools to improve knowledge management processes within any kind of organization, from small and medium enterprises (SMEs) to the biggest corporations, and from training centers to universities.

Knowledge management can be defined as the planning, organizing, motivating, and controlling of people, processes and systems in the organization, oriented to ensure that its knowledge-related assets are improved and effectively employed. In an

organization, knowledge consists not only of electronic or printed documents: the knowledge in employee's mind and the knowledge embedded in the organization's processes are also part of the knowledge-related assets [2]. Uit Beijerse [3] defines knowledge management as the achievement of the organization's goals by making the knowledge factor productive; the knowledge factor includes all the systems used to manage the information within an organization. According to Jelenic [4], knowledge management is not only associated to managing knowledge as a resource, but also to managing business processes that use that resource.

Currently, knowledge management is one of the biggest challenges for any kind of organization. Regarding knowledge management in SMEs, Nunes, Annansingh, Eaglestone and Wakefield [5] conclude that SMEs cannot afford the investment needed to achieve a credible business value from knowledge management. Wickert and Herschel [6] highlight that small and medium-sized companies often experience erosion of knowledge due to the leaving of a key employee, whether via retirement or because he or she leaves the company to work for a competitor. Desouza and Awazu [7] show that SMEs do not manage knowledge in similar ways as larger organizations, given their understandable resource constraints, and hence they have to be creative and find smart workarounds to circumvent these limitations.

In larger organizations, it can be difficult to find who is an expert on a certain subject. Therefore, in large companies knowledge has to be systematically collected, stored in a corporate memory, and shared across the organization [8]. In their study to understand how companies manage the knowledge, Davenport, De Long and Beers [9] list eight specific factors that are common to knowledge projects: (1) link to economic performance or industry value; (2) technical and organizational infrastructure; (3) standard, flexible knowledge structure; (4) knowledge-friendly culture; (5) clear purpose and language; (6) change in motivational practices; (7) multiple channels for knowledge transfer; and (8) senior management support. Furthermore, they highlight that knowledge management can be very expensive, and this statement is very often agreed on in organizations, mainly when it is somehow linked to economic benefit or competitive advantage.

Knowledge management has a lifecycle known as the knowledge management process. There is not just one unique knowledge management process, but several knowledge management process models. Davenport and Prusak [10] identify four knowledge processes: knowledge generation (knowledge creation and knowledge acquisition), knowledge codification (storing), knowledge transfer (sharing), and knowledge application. Birkinshaw, Sheehan and Team [11] present the knowledge lifecycle as an S-curve with four stages: creation, mobilization, diffusion and commoditization, as well as their strategic implications to help companies navigating through each stage of the knowledge life cycle. According to Staab, Studer, Schnurr and Sure [12], the knowledge process has four steps: creation, capture, retrieval and access, and use. Ward and Aurum [13] propose a seven-stage model: knowledge creation, knowledge acquisition, knowledge identification, knowledge adaptation, knowledge organization, knowledge distribution and knowledge application. Nonaka [14,15] develops the knowledge creation cycle, also known as SECI cycle, comprising four activities: internalization, externalization, combination, and socialization.

Regardless of the organization's size or the knowledge management lifecycle, knowledge management systems consist of tools to support the knowledge management process and facilitate knowledge access and reuse [16]. Nowadays, due to the rapid changes and advances in the development of technological solutions, knowledge management systems are strongly related to, and dependent on, the idea, definition and implementation of technological ecosystems. A technological ecosystem can be viewed as a set of different components connected through information flows in a physical environment that supports such flows, and where users are part of the ecosystem [17,18,19]. From this technological ecosystem perspective, the Business Process Model and Notation (BPMN) [20] offers a way to describe business processes similar to activity diagrams from Unified Modeling Language (UML) for description of software modeling, and may help understanding and improving knowledge management processes.

Therefore, the main objective of this paper is to analyze different knowledge management processes within any kind of organization, using the BPMN, in order to improve those processes from a methodological and technological point of view. The paper has the following structure: Section 2 analyzes different knowledge management processes in real contexts through the use of BPMN. Section 3 proposes changes and adjustments to the BPMN to enhance knowledge management processes. Finally, section 4 summarizes the main conclusions from this study.

2   Knowledge management processes

Knowledge management processes can be very complex because they generally involve human, methodological and technological elements. Furthermore, knowledge management processes may differ greatly depending on the knowledge management lifecycle of each organization. BPMN diagrams allow describing these processes with a high abstraction level, and therefore they are useful to describe a wide range of organizations. BPMN is quite simple and it has a very high power of expression to model business processes [21].

A comparison of the different knowledge management process models described in the reviewed literature reveals that there are two common stages in all the models: knowledge creation and knowledge sharing or distribution [10-15].

The knowledge management processes presented in this section describe business processes that are part of common stages in all knowledge management life cycles. Moreover, the processes modeled are based on real experiences working with different kind of organizations—universities, Public Administration, companies, etc. In a first step, we shall cover an example of a knowledge management process that takes place within a department, and then we will describe a knowledge management process that takes place across internal and external boundaries of an organization.

Companies and institutions follow different organizational structures, depending on their objectives. Typically, the organizational structure allocates responsibilities, processes and resources, both human and material, to different entities such as departments or areas. Business processes, in particular those related to knowledge management, may involve one or several departments—intradepartmental and interdepart-

mental business processes, respectively. Regarding knowledge management, sometimes the departments are like black boxes: they do not share any knowledge about their internal business processes, and they only share its inputs and outputs. In this context, the departments create knowledge following one of the four modes of knowledge creation described by Nonaka [14]—socialization, internalization, externalization and combination—but they do not share that knowledge or transfer it to other departments, even though sharing that knowledge, by means of reciprocity, might also improve their processes through the acquisition of knowledge generated by other departments. If we extrapolate this case to an institution with offices in different places with similar departments in each office, the problem would only increase in magnitude.

The knowledge embedded in the organization's processes is one of the main components of knowledge management [2,4]. When a group of employees manages a business process, it is possible that they end up improving that process. The knowledge created from this experience is known as best practices, and it can be transferred to other employees. Best practices usually remain confined to the boundaries of the department or the office where they have been created, following the black box concept described above. If the enhanced process is common to other departments, they will not be able to access to the best practices related to this process because knowledge sharing or transfer between departments does not exist. Fig. 1 describes this scenario, where department A improves process N and the best practices generated are not accessible to department B, where process N is applied, too.
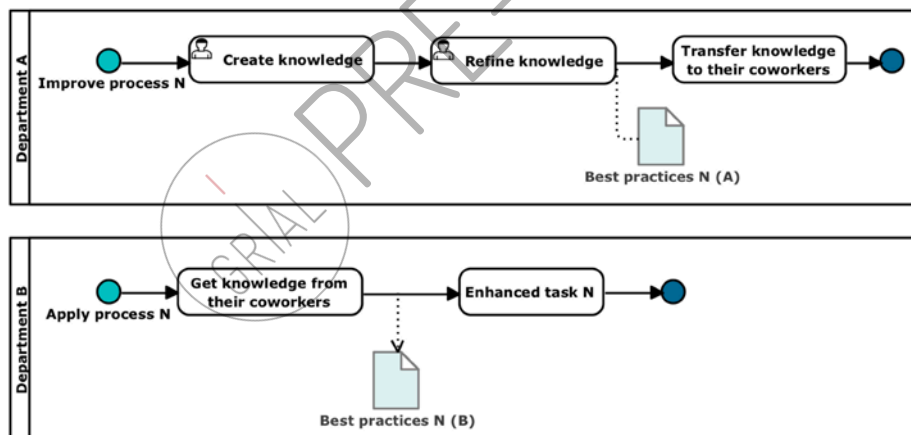

Fig. 1. BPMN diagram describing knowledge creation within a black box department

In order to have wide organizational impact, knowledge must be transferred or shared [2]. Davenport and Prusak [10] highlight that sharing knowledge between people and groups in an organization may be the most daunting task in knowledge management, and they distinguish between formal and informal knowledge transfer [22]. The TRAILER project proposes a methodology supported by a technological ecosystem to facilitate informal knowledge management within any kind of organization through tagging, recognition and acknowledgement of informal learning activities [23-

28]. Conde, García Peñalvo, Fernández-Llamas and García-Holgado [21] define the methodology stages through several BPMN, in order to describe all the possible scenarios. Kalpič and Bernus [29] believe that BPMN is an important tool for knowledge management that allows the transformation of informal knowledge into formal knowledge, and that facilitates its externalization—in the form of knowledge artifacts––, sharing and subsequent internalization.

Fig. 2 describes a business process that gives visibility to the knowledge beyond organizational boundaries. The employee or employees with a webmaster role receive the knowledge generated by other employees in the form of a document. The webmaster would then publish the document in the organization's repository and give it public dissemination through the organization's website in case the new knowledge generated is suitable to be accessed outside the organization.
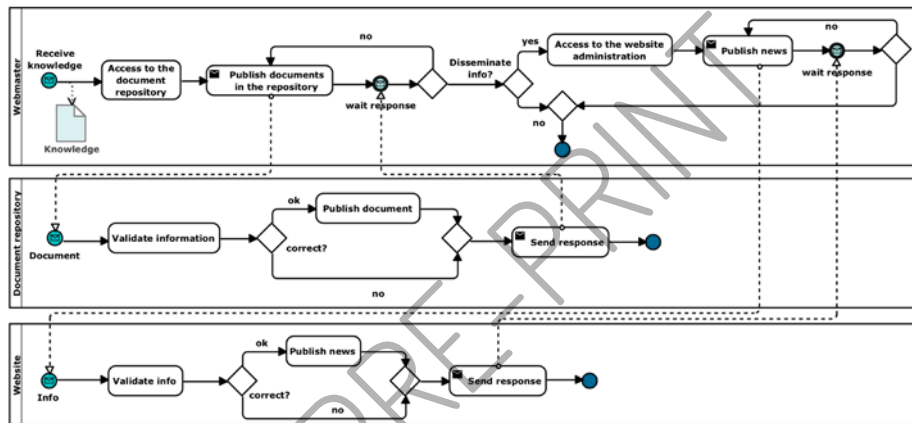

Fig. 2. BPMN diagram describing knowledge diffusion outside of the organization

3 Improvement of knowledge management processes based on BPMN diagrams

The BPMN diagrams in the Fig. 1 and Fig. 2 show some of the knowledge management problems that commonly appear in organizations. The analysis of these specific processes provides means to enhance knowledge management processes in order to improve the methodology and the technological solutions that support them. According to García-Holgado and García-Peñalvo [19], knowledge management within an institution or organization depends on a large number of factors, both internal (employees' profile, workflows, etc.) and external (cultural contexts, market, etc.), that have a direct influence on the definition and evolution of the technological ecosystem that supports such knowledge management.

Technological solutions are an important element for the improvement of knowledge management within both companies and institutions [9, 30], and methodology plays an important part in the definition of the technological solutions and the business processes. Therefore, both technology and methodology solutions have to be

taken into account for enhancement of knowledge management processes when using BPMN.

The problem represented earlier in Fig. 1 may be easily resolved by defining new business processes oriented to establishing workflows between departments or offices, and supported by adequate technology. Although this problem can be considered a trivial issue, there are examples of large institutions that are in similar situations; for instance, the Spanish Public Administration [18].

Fig. 3 shows a possible solution to the problem. The department where the best practice is generated should share it with other departments in the form of document through a repository that supports the storage of both public and confidential documents. Later on, the best practice can be retrieved from the repository and applied in other departments. Note that, from a BPMN perspective, this solution is achieved simply by adding a new component—a new process—that ultimately relies on the inclusion of a new technology to support knowledge sharing processes.
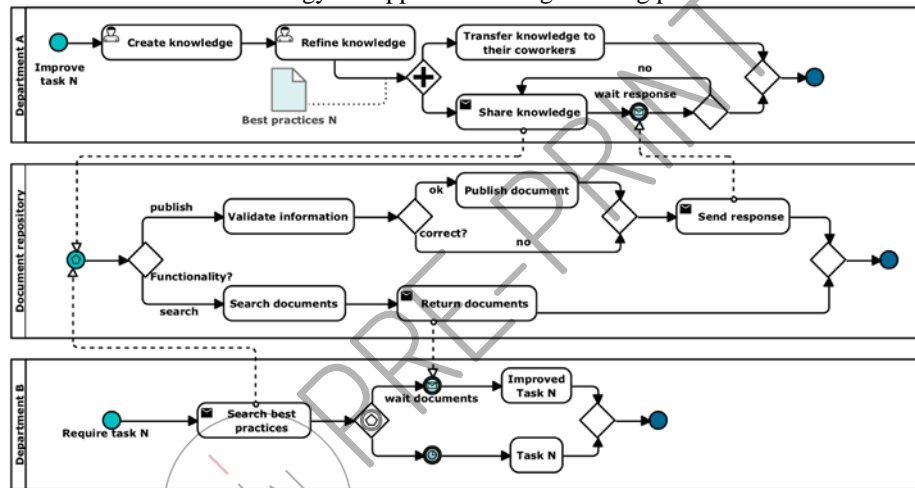

Fig. 3. BPMN diagram describing improved knowledge creation and transfer between departments

Finally, the problem detected in the Fig. 2 is not a technological problem because the tools supporting the knowledge sharing process are already available. Therefore, it is a methodological problem that requires a redefinition of the business process in order to change the role of the employee that should be responsible of sharing the knowledge to the public. Any kind of organization generates a huge amount of knowledge, and part of this knowledge is suitable to be shared publicly. If this task is assigned to just one person, or a very few people, the process will be prone to suffer a bottleneck. However, if knowledge sharing is transformed into an automated task, the bottleneck disappears (Fig. 4). In the proposed business process, a student, employee, public servant or any person inside the organization who generates knowledge, shares it on the repository and the tool is in charge of publishing the information on the website if it is marked as public.
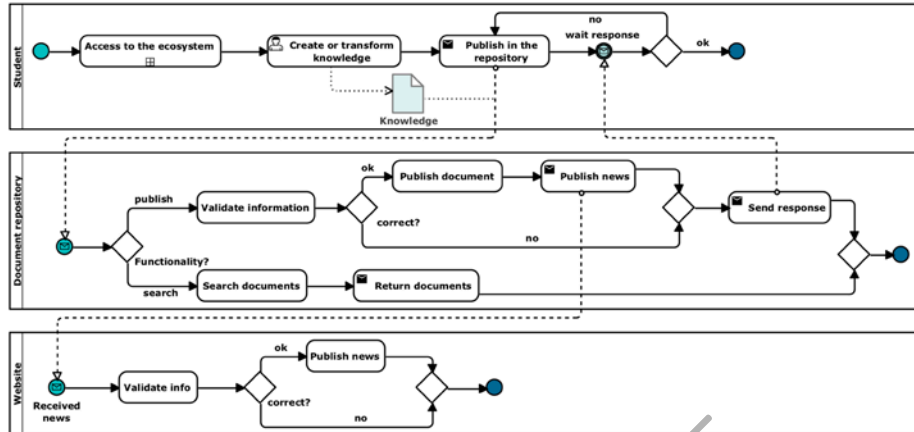
Fig. 4. BPMN diagram describing improvements in knowledge sharing or diffusion

4   Conclusion

At the present time, knowledge management is one of the most critical elements of success for all kind of organizations, from SMEs to large corporations or public institutions. Knowledge encompasses not only documents, both printed and electronic, but also people, processes and supporting technologies. BPMN diagrams provide visual analysis to facilitate description of business processes involving people instead of describing processes as relations between technological systems.

This paper shows how the use of BPMN for analysis of different scenarios involving knowledge management within and across organizations may help detecting problems in knowledge management processes, and how the information from the BPMN may be used to solve these problems and improve knowledge management processes.

5   Acknowledgements

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