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"Old" theories, "New" technologies: Understanding knowledge sharing and learning in Brazilian software development companies

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ABSTRACT

Context: New technologies such as social networks, wikis, blogs and other social software enable collaborative work and are important facilitators of the learning process. They provide a simple mechanism for people to communicate and collaborate and thus support the creation of knowledge. In software-development companies they are used to creating an environment in which communication and collaboration between workers take place more effectively.
Objective: This paper identifies the main tools and technologies used by software-development companies in Brazil to manage knowledge and attempts to determine how these tools and technologies relate to important knowledge-sharing and learning theories and how they support the concepts described by these theories.
Method: A survey was conducted in a group of Brazilian software development companies with high levels of process software maturity to see how they implement the Brazilian Software Processes Improvement model (MPS.Br) and use new tools and technologies. The survey used a qualitative analysis to identify which tools are used most and how frequently employees use them. The results of the analysis were compared with data from the literature on three knowledge-sharing and learning theories to understand how the use of these tools relates to the concepts proposed in these theories.
Results: The results show that some of the tools used by the companies do not apply the concepts described in the theories as they do not help promote organizational learning. Furthermore, although the companies have adopted the tools, these are not often used, mainly because they are felt not to organize information efficiently.
Conclusion: The use of certain tools can help promote several concepts described in the theories considered. Moreover, the use of these tools can help reduce the impact of, some common organizational problems. However, companies need to improve existing organizational policies that encourage employees to use these tools more regularly.

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1. Introduction

Knowledge is an essential property for companies in contemporary economies, especially knowledge-intensive ones such as software-development companies. Such companies must not only explore current knowledge but also invest continuously in the search for new knowledge to provide strategic options for future decisions and develop a competitive edge [1]. Hence, it is extremely important that companies acquire, store and reuse knowledge systematically. To achieve this goal, new technologies such as social software can help promote the sharing and reuse of acquired knowledge. Social software is a term for software systems that support human communication, collaboration and interaction in large communities [2]. Normally, social software is associated with Internet communities but may also be used in learning contexts [3]. Many new technologies, which are also known as Web 2.0 technologies, constitute social software. They facilitate distributed collaboration, foster the free reuse of information and experience and help knowledge workers to deal with immense information overload by simplifying the organization, integration and reuse of information scattered across diverse content sources [4].

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In recent years, many knowledge-intensive companies such as those involved with software-development have used these new technologies as substitutes for intranets, creating an environment in which communication and collaboration between workers take place more effectively and organizational learning (OL) is possible [5]. However, despite the growing number of companies using these new technologies as a way of promoting the codification, sharing and reuse of knowledge, in many cases the companies do not know how these technologies can aid the OL process. Therefore, it is important to map how each technology can facilitate the different steps of the OL process in order to maximize the use of these tools. This is particularly important for developing countries such as Brazil, which have a large domestic software market and aim to compete in international markets. In Brazil, efforts are being made by both the government and industry to improve software processes.

This study seeks to understand how knowledge-sharing and learning theories relate to new technologies. Three well-established knowledge-sharing and learning theories were used: the single- and double-loop learning theory of Argyris and Schön [6], Wenger's communities of practice theory [7] and Nonaka and Takeuchi's SECI knowledge-creation theory [8]. These were chosen because the models proposed in the theories describe processes at the individual and organizational levels and the concepts described are closely related to the concepts that these new tools implement. In addition, since each tool applies a concept described by a theory, it can be claimed that the use of the tool can help improve the OL process related to that concept.

To identify the main tools and technologies used by companies and to understand what perception companies have of these tools and technologies, a survey was conducted in a group of Brazilian software-development companies. The revenue of the Brazilian software and services sector reached U.S. $27.1 billion in 2012 and has grown faster than the world average in recent years. The sector is now responsible for almost 50% of IT investments in Latin America. The present study, which focused on consolidated software development companies in Brazil with a medium to high maturity level, showed which tools these companies use to manage knowledge and how they view these tools. The data from the survey allowed us to identify which of the new technologies available are used to store knowledge generated during the software-development process.

This paper presents the results of a survey applied in thirteen out of twenty Brazilian software-development companies that implement the Brazilian Software Processes Improvement model (MPS.Br) at level A, B or C and use some type of new technology or social tool as a knowledge repository. The paper investigates the main new technologies used by these companies and compares the survey findings with data from the literature. It maps how the tools and technologies used relate to three knowledge-sharing and learning theories. More specifically, it aims to answer the following questions:

1. Which tools or technologies do the software-development companies studied here use as knowledge repositories?
2. Which theories of OL do the new technologies or tools cover?
3. To which new technologies or tools is each theory related?
4. Which new technologies or tools help promote OL in software-development companies more efficiently?
5. What organizational improvements do the tools or technologies make possible in the companies?

The remainder of the paper is organized into six more sections. Section 2 presents a brief overview of knowledge management (KM) and the three knowledge-sharing and learning theories. Section 3 describes the survey methodology, while Section 4 presents the survey results. Section 5 contains an analysis of the results and compares the survey data with the theories. Section 6 discusses the tools and theories presented. Final considerations are presented in Section 7.

2. Knowledge management

In recent years, organizations have placed increasing importance on their employees' experience and know-how, i.e., their knowledge [9]. This underlying knowledge is applied in many ways by companies, e.g., in routines, production practices and relationships. As a result, companies are faced with the challenges of creating and implanting processes that generate, store, organize, disseminate and apply knowledge produced and used in a company in a systematic, explicit and reliable way so that it is accessible to the community that makes up the organization.

The concept of KM can help organizations to minimize these challenges. KM is the process of creating, capturing and using knowledge so that it can be transferred significantly to another person [10], or, according to Landoli and Zollo [11], so that organizational performance can be improved. The primary objective of KM in a business context, according to Tiwana [12], is to facilitate the opportune application of fragmented knowledge by means of integration. KM refers to the practice and techniques used by an organization to identify, represent and distribute knowledge, know-how, expertise, intellectual capital and other forms of knowledge to leverage, reuse and share knowledge and learning throughout the organization [11].

KM is an especially relevant field for research into information systems (IS) as the functionalities of information technologies play a crucial role in organizational definition and in efforts to create, acquire, integrate, evaluate and use knowledge.

The focus of KM system implementation in companies has been the development of accessible document repositories to support the digital capture, storage, recovery and distribution of the explicit knowledge documents of a company. KM systems also encompass other technological initiatives, such as the training of database specialists, the development of support systems for decision-making and systems specialists and the development of networks to provide access to distributed resources [13].

KM systems thus help achieve the goals of OL by assisting the capture, storage, sharing and use of knowledge. According to Senge et al. [14] and Ali, Pascoe and Warner [15], OL can be defined as the continuous testing of experience and its transformation into knowledge that is accessible to the whole organization and relevant to its basic purposes. Another definition is given by Nevis, Di Bella and Gould [16], according to whom OL is the capacity or the processes within the organization that are designed to maintain or improve performance based on experience.

However, it is often difficult to identify OL and to differentiate it from KM, as they are intrinsically connected. Distinguishing between these two concepts is important because the subtle nature of the boundary between KM and OL means that some authors may see a conflict between the two areas.

Levitt and March [17] differentiate between OL and KM, arguing that the former is supplementary to the latter and that, at first glance, OL is seen as the codification of historical inferences in routines that guide behavior. Another differentiation is given by Easterby-Smith and Lyles [18], who consider that OL is centered on process, whereas KM is centered on the knowledge content that an organization acquires, creates, processes and occasionally uses. Yet another way of conceptualizing the intersection between both areas is to view OL as an objective of KM [19]. By motivating the creation, dissemination and application of knowledge, KM initiatives help organizations to achieve their objectives. OL can help organizations put knowledge to use.