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rca.cse@contato.ufsc.br

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de Souza Bermejo, Paulo Henrique; Olímpio Tonelli, Adriano; Zambalde, André Luiz; Leomar
Todesco, José
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TOWARDS AN UNDERSTANDING OF INFORMATION TECHNOLOGY STRATEGY DEVELOPMENT BASED ON KNOWLEDGE MANAGEMENT

*Uma Visão do Desenvolvimento de Estratégias de TI Utilizando
a Gestão do Conhecimento*

Paulo Henrique de Souza Bermejo

Pesquisador. Departamento de Ciência da Computação. Universidade Federal de Lavras. Lavras, MG. Brasil.

E-mail: bermejo@dcc.ufla.br

Adriano Olímpio Tonelli

Professor. Instituto Federal de Educação, Ciência e Tecnologia de Minas Gerais – Campus Formiga. Formiga, MG. Brasil.

E-mail: adriano.tonelli@ifmg.edu.br

André Luiz Zambalde

Pesquisador. Departamento de Ciência da Computação. Universidade Federal de Lavras. Lavras, MG. Brasil. E-mail: zamba@dcc.ufla.br

José Leomar Todesco

Pesquisador. Engenharia e Gestão do conhecimento. Universidade Federal de Santa Catarina. Florianópolis, SC. Brasil.

E-mail: jose.todesco@ufsc.br

Abstract

The formulation of IT strategies is increasingly seen as a collaborative process, where knowledge management (KM) and learning become central to building a shared view of how information technology (IT) can support and extend business strategies. This article presents three interrelated components that support the application of KM to IT strategy development (actors and types of knowledge, knowledge conversion modes, and technological tools and artifacts). Through a longitudinal, qualitative case study, we illustrate strategies for applying these components. Faced with the importance of knowledge and collaboration to IT strategies, the results provide recommendations so that organizations can apply concepts and practices of KM processes in formulating IT strategies.

Palavras-chave: Information Technology. Knowledge Management. Strategic Alignment. Knowledge Creation.

Resumo

Cada vez mais a formulação de estratégias de TI é vista como um processo colaborativo, em que a gestão do conhecimento (GC) e o aprendizado se tornam centrais na construção de uma visão compartilhada de como a tecnologia da informação (TI) pode suportar e estender estratégias de negócio. Este artigo apresenta três componentes inter-relacionados – atores e tipos de conhecimento, modos de conversão do conhecimento e ferramentas – que descrevem a aplicação da GC no desenvolvimento de estratégias de TI. Por meio de um estudo longitudinal baseado em dados qualitativos e estudo de caso, o artigo ilustra estratégias para operacionalização desses três componentes propostos. Juntamente com os componentes, as estratégias propostas fornecem subsídios para que organizações possam aplicar conceitos e práticas de GC para formulação de estratégias de TI.

Keywords: Tecnologia da Informação. Gestão do Conhecimento. Criação do Conhecimento. Alinhamento Estratégico.

1 INTRODUCTION

Coined by Davenport and Prusak in the mid-1990s, the term knowledge management (KM) encompasses a set of processes and resources aiming to: (1) make knowledge applicable to organizational practice; (2) develop a culture conducive to the sharing, creation and application of knowledge; (3) create networks that enable people to share knowledge. (DAVENPORT; PRUSAK, 1998).

Contemporary views of organizations recognize knowledge as strategic (LIAO; WU, 2010; JIMÉNEZ-JIMÉNEZ; SANZ-VALLE, 2011). Such views emphasize people and knowledge as the most important strategic resources of organizations (GRANT, 1996) and people, technical capabilities, practical knowledge and organizational routines as the main sources of competitive advantage. (GRANT, 1997; NONAKA; TAKEUCHI, 1997; DAVENPORT; PRUSAK, 1998; ALAVI; LEIDNER, 2001)

Knowledge management can be implemented through approaches, processes and tools contributing to better use of knowledge and to enhancement of a wide range of creative and intellectual organizational practices. (NONAKA; TAKEUCHI, 1997; DAVENPORT; PRUSAK, 1998; ALAVI; LEIDNER, 2001; BUTLER; MURPHY, 2007; AURUM; WARD, 2008; NEWELL *et al.* 2009)

IT strategy development processes can be viewed as organizational practices for the construction of an IT vision providing innovative applications of information technology and alignment with business demands, practices in which creativity and knowledge play a central role. (LEE; BAI, 2003; KEARNS; SABHERWAL, 2007; LEE *et al.* 2008; YEH *et al.* 2011)

Strategic alignment between IT and business as well as the innovative application of IT resources are central organizational performance issues (LAI *et al.* 2007; BULCHAND-GIDUMAL; MELIÁN-GONZÁLEZ, 2011; LEIDNER *et al.*, 2011). And today's literature supports the thesis that alignment of IT strategies with business demands has a positive correlation with agility (Tallon and Pinsonneault 2011), value chain performance (TALLON, 2011), financial performance (LAI; ZHAO *et al.*, 2007) and operational performance. (LEIDNER *et al.* 2011)

However, the construction of IT strategies aligned with business demands is a complex, multifaceted task which has evolved in the literature, both in form and in terms of development approaches (GALLIERS, 1991; EARL, 2003; LEE; BAI, 2003; CHEN *et al.*, 2010). Regarding form, IT strategies have, over time, evolved from a single view to a shared view of the role that IT should play within the organization (CHEN *et al.*, 2010). Regarding process, approaches have, over time, evolved from methodological approaches, with rigid planning processes tracing the development of IT strategies, to iterative and creative processes, where knowledge, relationships and collaboration among different stakeholders are central to an ongoing IT-business alignment. (GALLIERS, 1991; EARL, 2003; LEE; BAI, 2003)

The importance of knowledge to the formulation of IT strategies has been supported by a range of studies showing correlations between effectiveness in the development and implementation of IT strategies and factors such as people's behavior in sharing knowledge and learning (PAI, 2006; YEH *et al.*, 2011), intergroup relationships for sharing knowledge (LEE; BAI, 2003) and knowledge and involvement of top management (KEARNS; SABHERWAL, 2007). Such results emphasize the importance of managing knowledge in processes of development and of implementation of IT strategies. (KEARNS; SABHERWAL, 2007)

Facing this background, we argue that knowledge management resources and processes can be useful to explaining how firms develop IT strategies in alignment with business demands. Although currently available works have made important contributions to understanding new approaches based on knowledge in IT strategy, the operationalization of such contributions remains a great challenge for practitioners. Questions related to how to incorporate knowledge management frameworks and tools remain unanswered for many organizations and practitioners.

In this paper, we present, based on a literature review, three interrelated components describing the role of knowledge management in IT strategy development. Then, we illustrate, through a case study of a medium-sized Brazilian organization, some practical strategies for using knowledge management in the development of IT. Finally, we present recommendations based on the literature review and the case study results,



recommendations for introducing KM mechanisms to IT strategy development processes.

2 LITERATURE REVIEW

In essence, knowledge pertains to information held in the minds of human beings and is related to facts, procedures, concepts, ideas, observations and judgments. (NONAKA; TAKEUCHI, 1997; DAVENPORT; PRUSAK, 1998; ALAVI; LEIDNER 2001)

Knowledge and people are increasingly recognized as strategic to organizations, being analytical focuses relevant to understanding the process of strategy formulation. IT strategy formulation can be viewed as a learning process (Mintzberg et al. 1998) permeated by knowledge (NONAKA; TAKEUCHI 1997; LEE; BAI, 2003), by behavioral aspects of those involved (LEE; BAI, 2003; PAI, 2006) and by interpersonal relationships. (LEE et al. 2008; VALORINTA, 2011)

Different features of the knowledge management literature can be viewed as relevant to the support and understanding of the process of developing information technology strategies. In the following, we identify three interrelated components describing KM contributions to IT strategy development. Below we describe these components for KM implementation in the process of IT strategic development. Finally, through a case study, we demonstrate how a conceptual model can, through a set of strategies, be applied.

2.1 Component 1: characterization and analysis of knowledge types and actors involved in it strategy development

The interactions among different actors and the composition of teams are identified as central components in the IT strategy formulation process. In essence, the interaction of actors from different parts of the organization is a mechanism for expanding the process of IT strategic management beyond the boundaries of organizations' IT function. (EARL, 2003; LEE; BAI, 2003; HUANG; HU, 2007)

IT is in fact pervasive. All organizational units are affected by IT services supporting and extending business processes. In this sense, the involvement of

actors from different organizational units aims to: (1) promote synergy of knowledge about demands and offerings of IT; and (2) create shared views of how IT should support and extend business opportunities and processes. (LEE; BAI, 2003; LEE et al. 2008; CHEN, et al., 2010; VALORINTA, 2011)

Earl (2003) highlights the importance of considering the knowledge and experiences accumulated by middle managers. Other works (LEE; BAI, 2003; PAI, 2006; ŠTEMBERGER et al., 2011) emphasize the support and involvement of top management. In a broader approach, Lee and Bai (2003) emphasize the involvement of different stakeholder groups – managers, IT leaders and IT users, where each group has different types of knowledge and backgrounds.

Working in different parts of the organization, different groups accumulate different types of knowledge, skills and experiences. Following this premise, the identification of relevant actors in the formulation of IT strategies is, in the literature, closely linked to the types of knowledge that these stakeholders and actors accumulate. Table 1 illustrates the different types of actors involved in the development and implementation of IT strategies and their knowledge.

Table 1: Actors and knowledge types involved in the process of IT strategy formulation

ACTOR	KNOWLEDGE TYPE	REFERENCE
Top management	Business Knowledge Strategic vision of business Market conditions	(LEE; BAI 2003; PAI 2006; ŠTEMBERGER, MANFREDA et al., 2011)
Middle-managers and IT users	Localized demands for IT in the organization Business processes	(EARL, 2003; LEE; BAI, 2003)
IT staff	IT knowledge: IT architectures, IT solutions, technical feasibility	(LEE; BAI 2003; YEY et al. 2011)

Source: Authors of this article

From Table 1, we can see the process of developing IT strategies through the interactions between different actors: (1) members of senior management who provide knowledge about the business, including strategy, marketing and financial health (LEE; BAI, 2003; PAI, 2006; ŠTEMBERGER et al., 2011); (2) members of middle-management and IT users who

provide specific knowledge about the organization, including business processes and local demands on IT services (Earl 2003; Lee and Bai 2003) and (3) IT staff who provide IT knowledge on architectures, solutions, the technical feasibility of strategies (LEE; BAI, 2003; YEH *et al.* 2011)

The identification of actors and knowledge types raises two fundamental questions. How do interactions occur between the different actors? And how is knowledge generated and shared in order to create IT strategies that are part of a shared vision among different stakeholders?

To answer these questions, the following section describes KM approaches that can support the involvement of different actors and knowledge types and the implementation of a knowledge-based view in IT strategic formulation.

2.2 Component 2: Use of knowledge conversion modes

One of the most fundamental typologies adopted in the KM literature is based on the work of Michael Polanyi. It divides knowledge into tacit (undocumented and based on personal experiences, values, beliefs and judgments) and explicit (codified in documents, formal processes and other material or digital artifacts) (Nonaka and Takeuchi 1997).

In IT strategic management literature, this typology was adopted by Lee and Bai (2003) to highlight that knowledge being used for development of IT strategies can: (1) be encoded through documents, routines and digital media (explicit knowledge); or (2) reside in the minds of different actors-directors, IT leaders, users and middle management-as the result of the accumulation of experience and practice of these actors (tacit knowledge).

We can extend this approach by inserting Nonaka's knowledge creation theory. (NONAKA; TAKEUCHI, 1997; NONAKA; KONNO, 1998)

Insofar as it highlights the dynamics of knowledge creation through the interaction between tacit and explicit knowledge, this theory can provide an important tool for understanding the dynamics of creating a shared view on how IT can support the business stra-

tegically. According to Nonaka and Takeuchi (1997), organizational knowledge can be created through four knowledge conversion modes: 1) socialization, or the sharing of tacit knowledge between individuals; 2) externalization, or the transformation of tacit knowledge into explicit knowledge; 3) the combination of different explicit knowledges into a new and better elaborated explicit knowledge; and 4) internalization, or the transformation of explicit knowledge into tacit knowledge.

The theory of knowledge creation may serve, in the process of IT strategy formulation, as a framework for describing the dynamics in which different types of knowledge and actors can be used to create knowledge of how information technology can strategically support the business. In this sense, the process of IT strategy development can be viewed as a knowledge creation process supported by several tools and artifacts.

2.3 Component 3 – Tools and artifacts for knowledge management

Several tools have been identified for implementing knowledge management approaches (DAVENPORT; PRUSAK, 1998; ALAVI; LEIDNER, 2001; AURUM; WARD, 2008). These KM tools can be used to create environments in which different knowledge types (business knowledge, IT knowledge and both tacit and explicit specific knowledge) are socialized, externalized, combined and internalized. (NONAKA; KONNO, 1998)

In essence, based on works that highlight the use of KM tools (DAVENPORT; PRUSAK, 1998; ALAVI; LEIDNER, 2001; LEE; BAI, 2003; AURUM; WARD, 2008), we can propose a classification based on three interrelated categories for such tools: organizational structures, procedures and artifacts and technologies (Table 2).

Organizational structures encompass tools that formalize actors' responsibilities and tasks (and their knowledge). This formalization can occur through the creation of strategic committees (LEE; BAI, 2003) and communities of practice (AURUM; WARD, 2008). These committees and communities bring together different actors dedicated to a wide range of activities of IT strategic formulation and implementation.

Table 2: Categories of and tools for support of knowledge management

CATEGORY	TOOLS
Organizational structures	Committees (LEE; BAI, 2003), Communities of practice (AURUM; WARD, 2008).
Procedures	Situational participative analysis (HUERTAS, 1996), survey of lessons learned, focus groups, training (AURUM; WARD, 2008), workshops, in-depth interviews. (PAI, 2006)
Artifacts and technologies	Corporate portals (DAVENPORT; PRUSAK, 1998), templates to encode information social media (ALAVI; LEIDNER, 2001; AURUM; WARD, 2008), groupware (AURUM; WARD, 2008), support decision systems (GOUL et al. 1986), expert systems (AURUM; WARD, 2008), intranet, data mining. (ALAVI; LEIDNER, 2001)

Source: Authors of this article

Procedures encompass activities that systematize the interactions among actors and knowledge conversion modes. In this category, we included situational participative analyses (HUERTAS, 1996), surveys of lessons learned, focus groups, training (AURUM; WARD, 2008), workshops and in-depth interviews. (PAI 2006)

Technologies and artifacts provide the means by which to: (1) implement procedures (e. g. survey of lessons learned); (2) register and retrieve explicit knowledge; (3) provide explicit knowledge supporting decision-making; and (4) enhance communication between actors involved in the process of strategy formulation. Artifacts and technologies include corporate portals (Davenport and Prusak 1998), templates, social media (ALAVI; LEIDNER, 2001; AURUM; WARD, 2008), groupware (AURUM; WARD, 2008), decision support systems (GOUL *et al.*, 1986), expert systems (AURUM; WARD, 2008), intranets and data mining. (ALAVI; LEIDNER, 2001)

3 METHODOLOGY

To develop this research, we conducted an exploratory study, based on a literature review and case study. The literature review was conducted using scientific repositories such as Science Direct, EBSCO, Google Scholar, ProQuest and JSTOR. In these repositories, searches for related works were performed using terms

associated with “information technology strategy” and “information systems strategy”, both associated with the “knowledge management” term. Using a Google Scholar tool, we also verified new publications citing the papers found in the repositories. And so, with these procedures, we identified one set of papers addressing knowledge management issues relevant to information technology strategy and another set containing the key concepts and practices of knowledge management relevant to IT strategic planning. This review allowed for the identification of three interrelated components for strategic planning based on knowledge management issues.

These components were verified through a longitudinal case study of a Brazilian organization. The organization, with annual revenue of around R\$ 20million, was medium-sized according to criteria developed by the Brazilian Development Bank (BNDES) defining medium-sized as organizations having annual revenue between R\$ 16 milion and R\$ 90 milion. (MORAES 2010)

In this work, we identify, for the sake of confidentiality, the subject of the case study as Organization A. The study was conducted between 2007 and 2009, during the structuring and implementation of the IT strategic planning in Organization A.

Qualitative data were collected through in-depth interviews with actors involved in the process of IT strategy formulation. We conducted 33 interviews: 10 with members of senior management (Executive Director, Sales Director, Project Directors and Chief Financial Officer) and 14 with members of middle management (Administrative Management, Project and Services Management, Process Management). Documental analysis included strategic planning and organizational processes documentation. Also, participant observation was conducted by the authors of this paper.

Data were analyzed in an iterative mode based on the concept of controlled opportunism (EISENHARDT, 1989). Thus, data analysis was performed periodically, considering interviews performed, documents analyzed and participant observation diaries developed by researchers.

In order to identify strategies adopted by Organization A to aggregate KM in the process of IT strategy development, data collected were interpreted through pattern matching between qualitative data and cate-

gories described in the three components proposed (BARDIN, 2007). Based on Bardin (2007), Component 1 (actors and knowledge types) was verified through the identification of people involved in the process, as well as the information and background these people provided during the process.

Component 2 (knowledge conversion modes) was verified through the concepts of tacit and explicit knowledge provided by Michael Polanyi and modes of knowledge conversion provided by Nonaka and Takeuchi (1997). Based on the data obtained, explicit knowledge was defined as documents containing information relevant to the process of strategic and IT management. Tacit knowledge was identified as the absence or lack of documents or material artifacts with recorded information (explicit knowledge) and from the need for direct involvement of people to provide the insights and information necessary for the process of developing IT strategies. Finally, Component 3 (tools and artifacts) was identified by matching the tools and devices observed in the process with options found in the literature.

4 CASE STUDY

This section is formed by a presentation of the organization where it was realized the case study and its process for strategic planning of IT.

4.1 The Organization

Organization A is a medium-sized organization operating in the segment of automation of mobile assets for the mining and construction industries.

Created in 1999, Organization A is among the leaders in Brazil, providing systems for managing mobile assets. Currently, the main objective of the organization is the international expansion of its operations.

The organization has achieved annual growth rates of around 100%. These rates have largely been driven by a large number of new customers. Both in its original country and in others, the majority of potential customers have no solution similar to that developed by Organization A. The estimated share of companies using its solution is 28% in Brazil and 20% world-wide. However, top management in Organization A is increasingly worried about the organization's capacity for continued growth and internationalization of operations.

There is almost a consensus among directors that existing processes and structures cannot support a strategy of expansion and exploitation of market opportunities.

4.2 The Process of Strategic Planning of IT in Organization A

The process defined by Organization A to develop IT strategies has four phases (Figure 1).

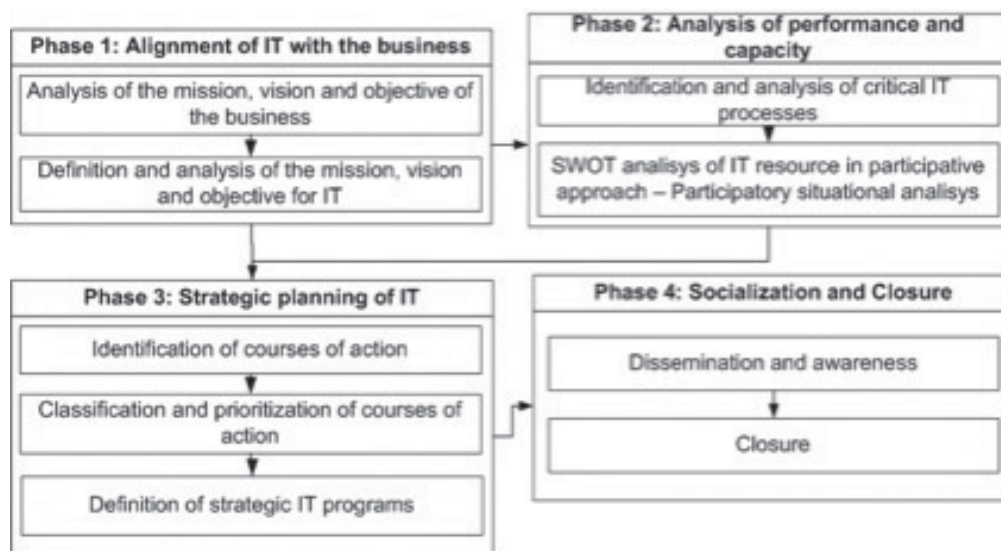


Figure 1: IT strategic planning (ITSP) method implemented in Organization A

Source: Authors of this article



Throughout, IT objectives, in alignment with business objectives, are defined (Phase 1). Performance and capacity of IT processes and resources are evaluated in order to identify the gap between the future desired (IT objectives) and the present (Phase 2). Strategies and performance indicators are defined to provide IT objectives achievement, and action plans (tactical plans) are formulated in order to operationalize strategies (Phase 3). Finally, results are disseminated throughout the organization (Phase 4).

4.3 IT Strategic Committee Formation

A strategic committee is in charge of Organization A's strategic planning process, a committee headed by the CEO and the process manager. The former is responsible for providing strategic vision and coordinating senior management activities, including IT strategy analysis and prioritization as well as process results validation. The latter is responsible for managing, along with members of senior management, the data collection process. The other members are responsible for: (1) analyzing information about their organizational units, to be used during Phase 2 of the PETI process and (2) developing strategic projects and actions during Phase 3 of the process. Similar to the aims outlined by Aurum and Ward (2008) and Lee and Bai (2003), the committee aims to formalize responsibilities of different actors in the process.

In Organization A, the committee (Table 3) is formed by employees from different organizational units. This is in alignment with recommendations found in the literature which urge the involvement of heterogeneous actors in the IT strategic management process. (EARL, 2003; LEE; BAI, 2003; ŠTEMBERGER *et al.*, 2011; VALORINTA, 2011; YEH *et al.*, 2011)

Table 3: Composition of the Committee on Organization A

POSITION	FUNCTION IN ORGANIZATION A	EXPERIENCE IN ORGANIZATION A
CEO	Strategic management	Founder of the Organization
Product manager	Software product quality control Software product evolutions	51 months

POSITION	FUNCTION IN ORGANIZATION A	EXPERIENCE IN ORGANIZATION A
Project Manager	Management of projects for software product customization	45 months
System analyst	Design and coding of software products	25 months
Process manager	Monitoring and control of processes Information management	16 months
Sales manager	Marketing research Sales management After-sales management	10 months
Administrative manager	Accounting and financial management Management of contracts with customers and suppliers	8 months
IT Service manager	Customer support service management	7 month

Source: Authors of this article

4.4 Phase 1: alignment of IT with business demands

The results for this first phase were organized in the following two subsections, which contemplate perceptions and expectations of top management and business and IT objectives for the studied company.

4.4.1 Perceptions and expectations of top management

The main expectations and perceptions of senior management regarding their organization and the strategic role of IT in their business initiatives were identified through in-depth interviews with senior management.

According to Organization A's CEO, IT must provide an accurate and complete view of the organization. So, an information structure must be developed to provide performance measurement and adequate support for strategic decision-making. And, according to their CFO, IT must provide easy access to information on sales, revenues and assets, allowing for increased product delivery agility and quicker profitability.

For the Chief Sales Officer (CSO), the main role of IT is to support closer relationships with customers

and markets. In this sense, IT must synchronize a huge volume of information about sales, customers and market demands.

Finally, for the Project Management Officer (PMO), the critical points are the interfaces between project teams, the sales force and the hardware production staff. Additionally, the PMO cited lack of process standards as a major impediment to increased scalability. Table 5 illustrates the synthesis of perceptions and expectations of top management.

4.5 Business and IT Objectives

Organization A's strategic plan established two fundamental objectives-first, the expansion and inter-

nationalization of business and, second, the increase of profit and revenue. To achieve these goals, the following strategies were formulated: (1) increasing product quality in order to compete in global markets; (2) increasing scalability to enhance the capacity to absorb demand fluctuations; (3) acquiring a firm to develop complementary products and (4) creating new overseas offices.

Based on this strategic plan and stakeholders' perceptions and expectations about IT, Organization A was able to develop its main IT objectives (Figure 2).

In order to enable business strategies, IT objectives described a global information structure capable of supporting the four international expansion strategies mentioned above.

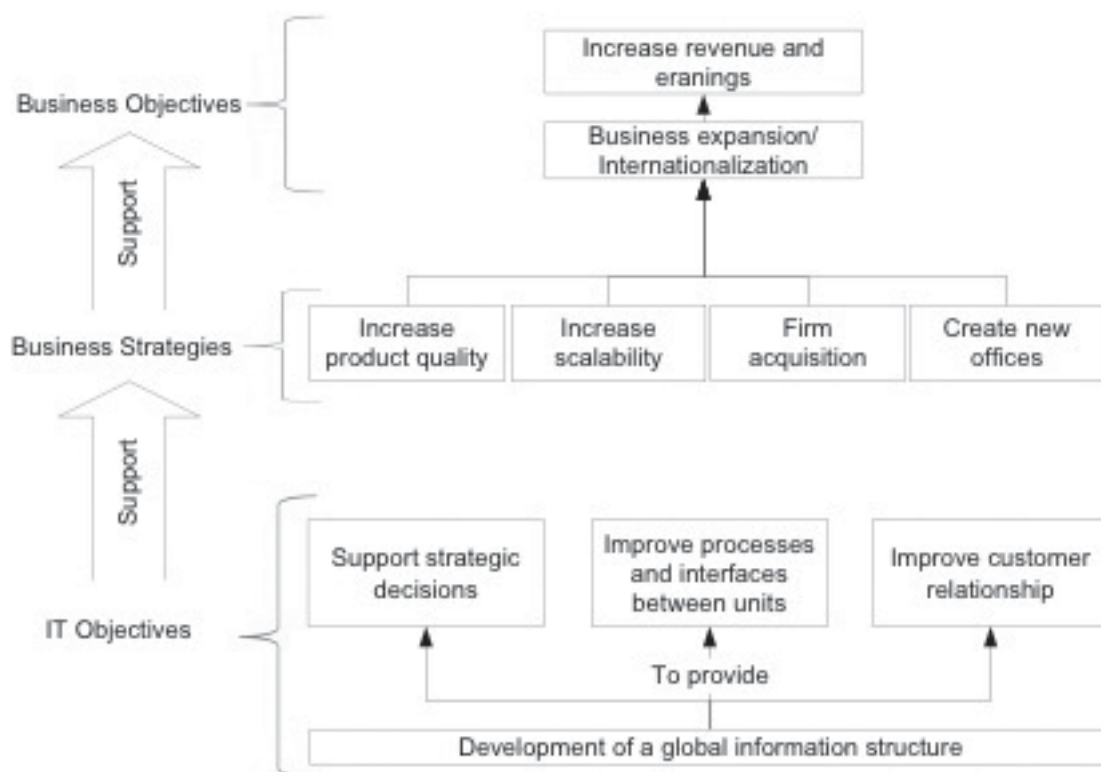


Figure 2: Business and IT objectives of Organization A
Source: Authors of this article

In essence, IT objectives defined in Organization A highlight the development of a global information structure that provides: (1) IT services and information supporting fast decision-making by top management; (2) enhanced organizational processes and organizational unit interfaces; and (3) improved electronic channels and processes for enhancing customer relationships.

4.6 Phase 2: analysis of IT performance and capacity

Phase 2 was performed by the strategic committee and was based on an assessment of strengths, weaknesses, opportunities and threats related to the use of IT. For the execution of Phase 2, three groups were formed from members of the strategic committee (Table 4).

Table 4: Groups formed from the committee members throughout the ITSP execution

GROUP	COMPOSITION	AREA
Group 1	Product manager, Support manager	Customer support, Software development units
Group 2	Project manager, Administrative manager	Financial and administrative unit, Hardware production and embedded software unit,
Group 3	System analyst, Process manager, Sales manager	Sales unit, IT internal support

Source: from authors

Each group collected information relevant to the areas under their responsibility (Table 4). Issues regarding strengths, weaknesses, opportunities and threats related to IT objectives were raised and discussed in depth throughout Phase 2 (Table 5).

Table 5: Synthesis of the main strengths, weaknesses, threats and opportunities raised in Phase 2

SWOT	ITEM	IMPACT	SOURCE
Strengths	The main product of Organization A	Our main product provides conditions to support the company's growth	All units
	High competence of employees	Our staff can support the growth of the company and the creation of new solutions to the mining sector	Sales unit, Software development unit
Weakness	Difficulty in communicating with implementation teams	Delay in release of safety equipment for employees at customers' sites. Delays in implementation of projects and services.	Financial and administrative unit
	Difficulty of access to information outside the organization	Delay in submitting proposals to customers. Difficulty in monitoring customer demands and market.	Sales unit

SWOT	ITEM	IMPACT	SOURCE
Weakness	Overload in the production of hardware	Late delivery of equipment. Delivery of faulty hardware. Low scalability.	Hardware and embedded software production. Software development unit.
	Poor communication between software development units	High rate of defects and rework in products delivered. Low scalability.	Software development unit
Opportunities	Growth in the mining sector Few mines have solution for mobile asset management	Potential for growth of the Organization	All units
Threats	Disorderly growth of the company	Collapse of the Organization	Financial and administrative unit, Hardware and embedded software production

Source: Authors of this article

As Table 5 suggests, the main weaknesses were related to communication between units and information access. Such weaknesses are viewed as barriers to be overcome so the organization can: (1) mitigate threats associated with disorderly growth; (2) leverage strengths associated with their main product and the competence of their employees; (3) leverage opportunities in the mining sector and, then (4) achieve IT objectives defined in Phase 1.

4.7 Phase 3: strategic planning of IT

Although Organization A has achieved expansion, growth, and internationalization as its main objectives, it can be observed, from the results of Phase 2, that internal capacity deficiencies must be mitigated if a viable information infrastructure is to be provided on a global scale.

IT strategies were developed through the committee groups formed during Phase 2.

Once developed, the IT strategies were analyzed, improved and prioritized by top management in order to generate strategic programs.

As illustrated by Figure 3, a strategic map was developed based on three interrelated perspectives: people, technology and processes. Within this map, cause-and-effect relationships, as proposed by Kaplan and Norton (1997), were established between technology and process and between people and process. According to the strategic map, the development of IT resources and the training of people sustained the adequate development of processes.

Training (people perspective) and infrastructure (technology perspective) were key IT strategies for the development of a global structure for Organization A. Training programs included the creation of competencies needed to properly use IT tools and processes.

Infrastructure programs included the development of a technological infrastructure supporting a better interface between organizational units and improved information access.

Regarding the processes perspective, strategic actions included restructuring projects and units, both financial and administrative. Additionally, the process perspective contemplated the creation of a CEO Office. This office would aim to create a function supporting performance monitoring and providing strategic information to the CEO.

In order to monitor ITSP achievements, performance indicators were defined and linked to each program.

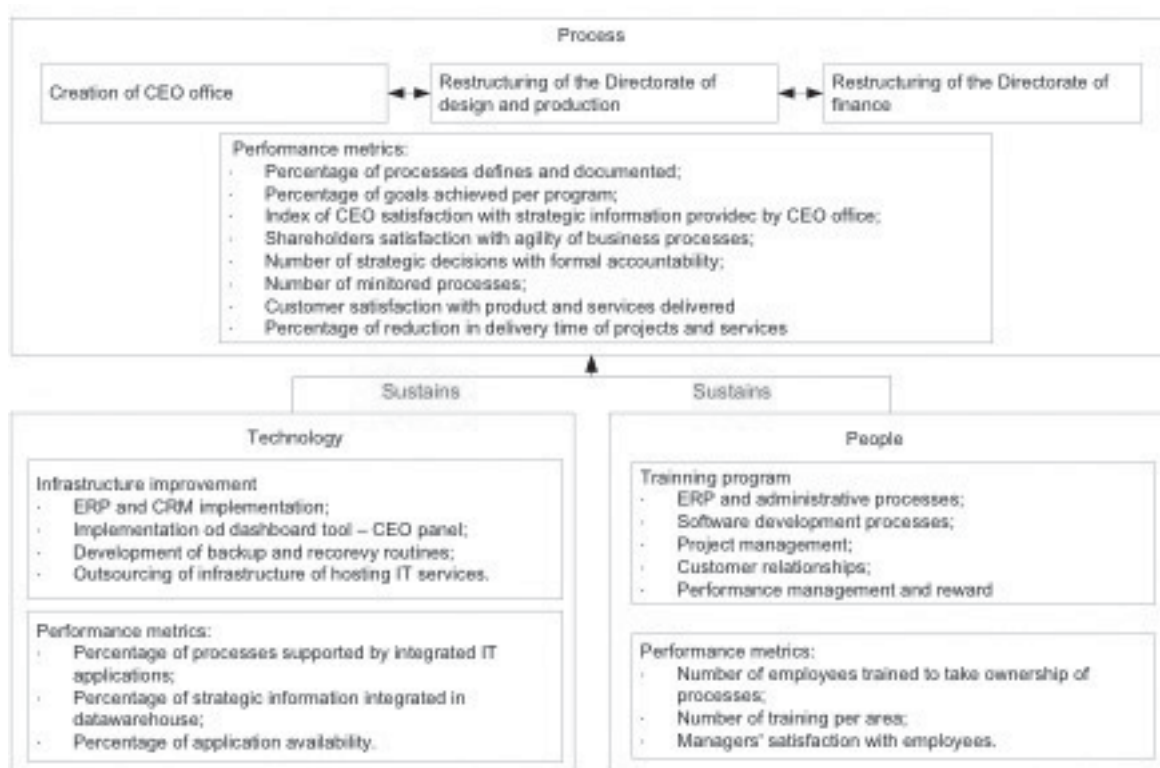


Figure 3: Synthesis of the IT strategic map developed in Organization A
Source: Authors of this article

4.8 Phase 5: socialization and closure

In Phase 5, meetings were held between the committee, the execution team and senior management to validate the results obtained in ITSP. In addition, workshops, talks and seminars were held to communicate results throughout the organization.

Regarding commitment to continuity, the strategic committee was given the responsibility of presenting accounts of projects underway and discussing new strategic needs. Meetings were held with the members of senior management and with the support committee for the presentation and final validation of the results.



5 KNOWLEDGE MANAGEMENT COMPONENTS IN IT STRATEGIC DEVELOPMENT IN ORGANIZATION A

In this section, we discuss the strategies observed in Organization A for implementing the three components (actors and knowledge types, knowledge conversion modes and KM tools and artifacts).

5.1 Types of Knowledge, Organizational Actors and Knowledge Conversion Modes

Through the process of IT strategy formulation, we observed the involvement of different actors from different parts of the organization. This was consistent with works emphasizing plurality of actors and knowledge in the process of strategy formulation (LEE; BAI, 2003; PAI, 2006; YEH *et al.*, 2011). In Organization A, through the involvement of different parts, could be incorporated knowledge sources, scenarios and viewpoints relevant to IT strategy development but dispersed throughout the organization.

With respect to modes of knowledge conversion, we wish to highlight eight stages (Figure 4). Essentially, these stages occur when there are: (1) cycles of knowledge conversion; (2) a combination of knowledge generated within committee and/or top management; (3) internalization, from top management or committee, of combined knowledge. In Organization A, Figure 4 describes the modes of knowledge conversion in Organization A.

In Phase 1, members of senior management socialized, externalized and combined knowledge about the market, business strategies and strategic demands for IT (stage 1). In this phase, business knowledge refers to organizational objectives and strategies. And IT knowledge refers to objectives that IT must achieve in order to provide alignment between organizational objectives and strategies and stakeholder perception (Figure 2). Once combined, IT knowledge (IT objectives) was internalized by the committee (stage 2).

In Phase 2, specific knowledge about the organization was socialized, externalized and combined by three groups formed within the strategic committee (stage 3). Such knowledge was then combined (stage 4) in order to be internalized by the committee and

top management (stage 5). In this phase, specific knowledge about the organization refers to strengths, weaknesses, opportunities and threats on: (1) customer support and software process development (Group 1); (2) administrative and accounting processes and hardware development processes (Group 2); and (3) customer relationships and internal support of IT. This specific knowledge was then combined in order to generate a general vision of strengths, weaknesses, opportunities and threats in Organization A. Table 5 illustrates a sample of weaknesses raised in this phase.

In Phase 3, strategic actions (IT knowledge) were created by the three groups formed within the strategic committee. In each group, there was a cycle of knowledge creation (stage 6).

Once developed in each group, IT strategies were combined to then go to a new cycle of knowledge creation within top management (stage 7 and stage 8). Through this cycle of knowledge creation, actions were reviewed, refined and prioritized. As a result, the IT strategic map was developed, as illustrated in Figure 3.

Finally, in Phase 4, ITSP results were disseminated throughout Organization A by workshops.

5.2 Knowledge Management Artifacts and Processes in Organization A

In this section, we discuss the use of KM tools in the process of IT strategy development in Organization A.

During Organization A's ITSP development, the following KM tools and artifacts were: the portal, focus groups, templates, meetings and workshops. Such tools enabled the development of dynamics for knowledge creation in IT strategy development.

Figure 5 illustrates the use of KM tools through the phases of the process, with stages highlighted in order to illustrate the knowledge conversion modes.

In Phase 1, business and IT knowledge was generated through focus groups including top management and the process manager, who was the committee leader (stage 1). Such knowledge was transferred from top management to the committee to be internalized through meetings and the ITSP portal. Knowledge generated in Phase 1 was codified in the ITSP portal in order to be available to the committee during other ITSP activities (stage 2).

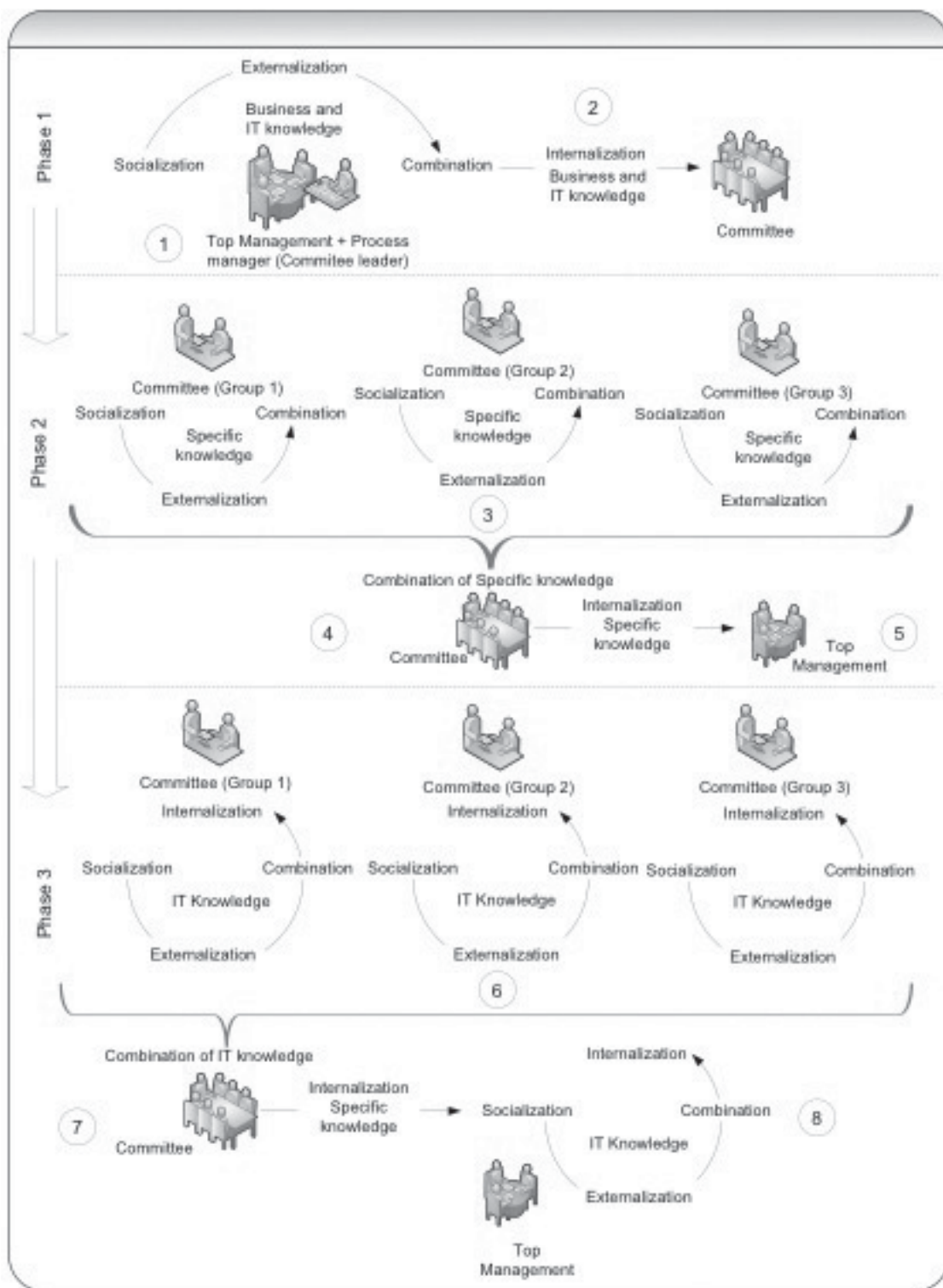


Figure 4: Knowledge types, organizational actors and knowledge conversion modes on ITSP in Organization A
Source: Authors of this article

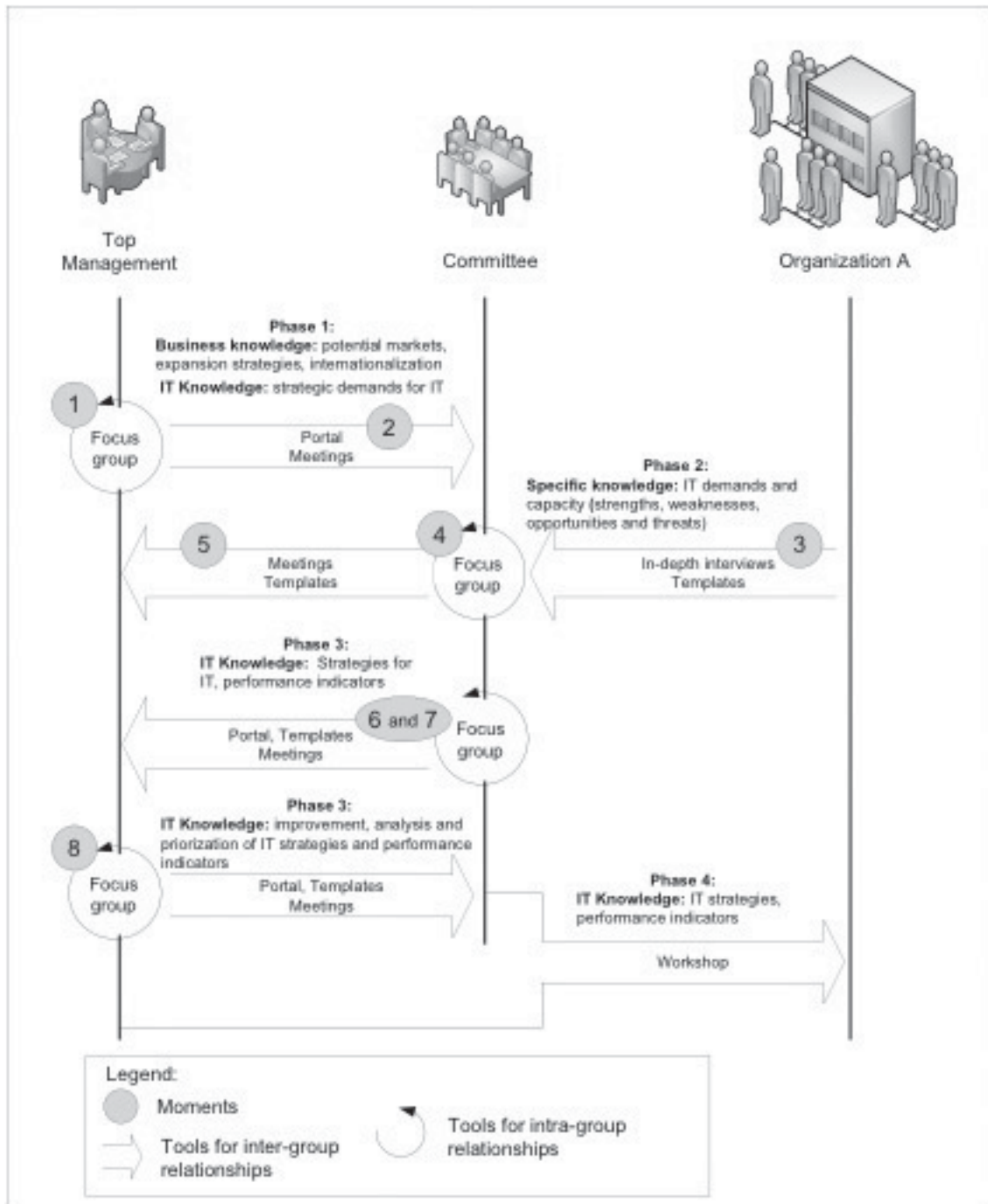


Figure 5: Knowledge transfer in Organization A's ITSP

Source: Authors of this article

In Phase 2, specific knowledge was codified, externalized and transferred from employees to the committee through in-depth interviews and templates (stage 3). Once analyzed and combined by the committee (stage 4), the results of Phase 2 were transferred through meetings to top management (stage 5).

In Phase 3, IT knowledge generated by the committee was codified and externalized through templates and the ITSP portal. This codified knowledge was then transferred (through meetings and the ITSP portal) to top management (stages 6 and 7). Once analyzed and prioritized, IT strategic actions and performance metrics were combined using templates and the ITSP portal, and then transferred to the committee (stage 8).

Finally, in Phase 4, knowledge related to IT strategic programs was transferred through workshops to the entire organization.

6 CONCLUSIONS

As emphasized by the literature, IT strategies are seen as shared views on how information technology should support the business (CHEN *et al.*, 2010), and are best developed through approaches fostering learning, organizational knowledge and collaboration. (EARL, 2003; LEE; BAI, 2003; PAI, 2006)

In this context, this paper presents a literature review regarding the practical application of knowledge management to the IT strategy formulation process. Through this review, we developed an approach based on three components – actors and knowledge types, knowledge conversion modes and KM artifacts and technologies. In essence, these components support a knowledge-based view of IT strategies to the extent that they contribute: (1) to the identification and involvement of different actors, knowledge, backgrounds and experiences (Component 1); (2) to the understanding of the development of IT strategies as dynamic knowledge creation (Component 2) and (3) to the identification of others technological tools and artifacts to support the involvement of actors and operationalize the dynamics of knowledge creation in the process of formulating IT strategies IT.

Through the case study of Organization A, it was possible to identify some strategies for the implementation of the three components. The experience of

Organization A shows that the involvement of multiple actors can occur through the formation of an interdisciplinary committee and involvement of top management. Furthermore, we observed that top management is responsible for: (1) providing a vision about business and IT and (2) assessing, prioritizing and approving the results produced by the committee.

Through the committee and top management, the creation of knowledge can occur in eight stages falling into roughly three categories (Figure 4): (1) generation of IT objectives (stages 1 and 2); (2) generation of knowledge about the current capabilities of IT (stages 3, 4 and 5); and (3) generation of IT strategies (stages 6, 7 and 8). In Organization A, this dynamic was supported by organizational structures (committee and top management), by the use of procedures to support interaction within groups (e.g. involvement of the committee and top management) and across these two groups. The interaction within groups was supported by templates and focus groups, introducing a dynamic by which knowledge was socialized, externalized, combined and internalized. The interaction across groups was supported by templates and the corporate portal in order to externalize, combine and internalize knowledge through the process of IT strategy development.

The results presented in this paper provide a conceptual picture of the application of knowledge management to IT strategy development. Additionally, the results of the case study illustrate possible strategies for implementing the proposed conceptual view.

By proposing the three interrelated components, as well as through the case study, this paper provides guidance on how to apply knowledge management to the formulation of IT strategies.

The literature reports evidence that knowledge, learning and the involvement of multiple stakeholders are essential to the alignment and efficiency of IT strategies (LEE; BAI, 2003; PAI, 2006; LEE *et al.* 2008; CHEN *et al.* 2010; ŠTEMBERGER *et al.* 2011; VALORINTA, 2011; YEY *et al.*, 2011). However, there is a lack of studies providing detailed guidance on how KM can be effectively applied to the development of IT strategies. Thus, we consider this work necessary and relevant.

We do not intend, however, to present, based on the results of this paper, a mechanistic or deterministic view of development strategies from the resources of



the KM. The process in question is highly contingent and complex (LEDERER; SALMELA, 1996; EARL, 2003; LEDERER; SETHI, 2003). So, approaches and interactions between different actors and the use of tools and technological artifacts by them can occur in different ways.

Thus, future studies might consider new strategies for implementing the three components proposed in this paper or even provide, from empirical data, adjustments and changes in explaining the use of knowledge management for IT strategy formulation.

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