

## A PROPOSAL FRAMEWORK FOR TECHNOLOGY-BASED ENTERPRISES

**Ana Lucia Ferraresi Schmitz, Dra.**

*Has a doctoral degree in Knowledge Management Engineering  
from the Federal University of Santa Catarina,  
Florianópolis, Santa Catarina, Brazil.  
E-mail: [analucia.schmitz@gmail.com](mailto:analucia.schmitz@gmail.com)*

**Édis Mafra Lapolli, Dra.**

*Has a doctoral degree in Production Engineering  
from the Federal University of Santa Catarina,  
Florianópolis, Santa Catarina, Brazil.  
E-mail: [edismafra@gmail.com](mailto:edismafra@gmail.com)*

**Universidade Federal de Santa Catarina**

*Programa de Pós Graduação em Engenharia e Gestão do Conhecimento  
Campus Universitário João David Ferreira Lima  
Trindade, Florianópolis 88000-000—Santa Catarina Brazil*

### ABSTRACT

*Technology-based companies located in business incubators detain flexible production processes to allow them a fluid standard of innovation and use knowledge as their main raw material. Part of their employees, highly qualified, start their own business. With this concern, this research presents a methodology for a Framework of Knowledge Management (KM) in technology-based companies, in the field of security, that are members of Associação Catarinense de Empresas Tecnológicas - ACATE, the association of technology companies located in the state of Santa Catarina. This tool will provide the framework for implementation of the best practices for company management. The intention is to support the implementation of KM through a model framework, functional and facilitator for the businesses participating in the investigation. The adopted method was supported by systematic review and by interview with business owners. The content analysis allowed the achievement of the results. The suggested framework prompted projection and orientation of the managers of these companies in the implementation of KM.*

**Keywords:** *Knowledge Management. Framework. Good Practice. Technology-based Enterprises*

### 1 INTRODUCTION

Knowledge Management may prove an efficient management tool for technology-based companies, given the need for new corporate vision, as competitive advantage in the human factor, especially in positions occupied by workers who hold expertise, such as engineers, designers, sales advisors, among other. The knowledge aggregated by each of these employees needs to be well managed, in order to appreciate its organizational importance and to return it to the clients, thereby increasing business competitiveness.

In this scenario, keeping track of how the activities of each current process are performed, evidencing, storing and reusing knowledge, is an essential factor to organizational growth. Managing people is as important as managing the knowledge generated by them when performing their functions and attributions, being that knowledge is inherent to human beings. And when the time comes when employees leave the company, the knowledge carried by these individuals may be stored and shared in the organization. For this, the quote from Santos (2014) is of fundamental importance, when he argues that "creating a 'place' where these ideas can be exchanged without hierarchy is a good start. This procedure means making public the private knowledge" (translated by the authors).

Thus, the project consisted in knowing how knowledge management undergoes in technology-based companies, in the field of security, that are members of Associação Catarinense de Empresas Tecnológicas - ACATE, the association of technology companies located in the state of Santa Catarina. It is suggested, through a methodology of framework, ways to explain, share and store the knowledge generated in the activities developed by the various companies that participated in the survey.

Towards that goal, the following **research question** was prepared: which framework adapts to the setting of technology-based companies for gathering, sharing and reuse of knowledge generated in the activities performed by employees and, also, by customers?

In order to reach the answer to this question, the general research objective was determined:

- To suggest a methodology for a Framework of KM that evidences, shares and stores the knowledge of technology-based companies of the security vertical of ACATE.

Setting the model of framework for implementation of KM will be possible starting from the diagnosis of the company, which was made possible by content analysis, as proposed in this research.

## 2 METHODOLOGICAL PROCEDURES

The research was conducted over a period of 9 months, in which the following activities were performed: a) literature surveys on the subject, in order to identify KM frameworks used in technology-based companies, ie, ones found in similar scenarios; b) getting acquainted with the businesses in this branch associated to ACATE; c) interviews with their managers; d) presenting of a framework for the introduction of corporate Knowledge Management that evidences the good practices for the implementation of KM in companies such as these.

It is a theoretical and empirical research, in which the fieldwork was conducted in six technology-based firms in the field of security of ACATE, who were willing to cooperate with the investigation. The data survey of the field research was conducted through semi-structured interview with the managers of the companies. Therefore, the research could be characterized as generic qualitative and case study. The semi-structured interviews supported the experience, in which the researcher granted the respondent broad opportunity to express the subject matter (Gil, 1999), in order to understand the business reality and to obtain substracts for the establishment of a framework consistent with the scenario.

An integrative systematic review was also conducted, which aimed to guide the researcher with scientific sources and contributions. In it, the focus was on the terms: technology-based companies, Knowledge Management and Framework, providing support and expertise on the topic.

Collective Discourse Analysis (CDA) was adopted for data analysis of the interviews, in order to enable the description of relevant characteristics of the content. It is a research technique that aims at grasping the multidimensional nature of the phenomenon in question, assisting in understanding the addressed context (Andre, 1983). The information was interpreted (Barros & Lehfeld, 1991; Delgado & Gutierrez, 1994) and compared, ie, the data from interviews, listed by CDA, were compared with the data of the integrative systematic review. This method design allowed presenting an adequate framework to the implementation of KM in the technology-based companies in the field of security of ACATE.

## 3 SYSTEMATIC REVIEW

In order to support and achieve the proposed objective, an integrative systematic review was held on the website of CAPES, on the SCOPUS Elsevier database, based on the procedures of the Cochrane Handbooks (2013). The integrative systematic review used the terms: Technology-based Companies and its variables; Knowledge Management and its variables; and Framework, in order to identify and analyze the knowledge management frameworks. This technique was applied in May, 2014.

The Elsevier Scopus database was used because it covers various areas of knowledge, enables greater number of articles, reviews and references from scientific literature and provides search in an indexed content. The procedure of the systematic review was performed by means of the steps established by the Cochrane Handbook (2013) and by Banningan, Droogan & Entwistle (1997).

Two surveys were conducted and three terms were applied. For each term, two searches were performed. The first search (B1) did not consider restrictive criteria. The second search (B2) took into consideration the following restrictive criteria: time: 2007-2014; no area restriction; type of documents: articles and reviews.

The terms used in the first research were the following:

Term 1 (T1) - "Technology based company" or "Based Technology Company"

Term 2 (T2) - "Knowledge Management" or "Managing knowledge" or "Management of knowledge"

Term 3 (T3) – Framework.

After applying the established steps, the search resulted in 11 titles, which suggested means of capture, storage, dissemination and reuse of knowledge and exposed methods and good practices for deployment in technology-based companies. The 11 titles are listed in Table 1.

## 4 RESULTS

### 4.1 Content of the selected articles

Of the 11 selected articles:

Verbano & Crema (2013) presented guidelines for evaluating the Intellectual Capital of the company in the accounting system, in order to facilitate an internal audit and to communicate effectively its value, as a means to support decisions in enterprise performance management.

Rubens, Still, Huhtamaki & Russel (2011) present social networks (WWW) as a useful tool to capture the knowledge of another company with which one maintains a business relationship.

Tzing, Hsin-Chiang & Wei (2007) deal with a hybrid model of generalized quantitative evaluation to assess learning and organizational growth using the Fuzzy method.

Cheong, Chatwin & Young (2010) propose a structure for the consolidation of laboratorial data, adopting Enterprise Service Bus as a Management System for Laboratory Data and Hospital Data, in order to plan the treatment of patients and monitor the diseases over time.

Velásquez, Zambrano & Vélez (2011) present a framework to contribute in the identification and classification of the necessary variables to measure and evaluate the ability of technological innovation in businesses.

Gusberti, Viegas & Echeveste (2013) develop a business model based on the process of product development, as well as technology management, with the aim of obtaining an effective and competitive organization.

Grace Lin & Tzing (2011) propose a process of network analysis (ANP) for effective selection of new hybrid technology for organizational decision-making (DEMATEL), providing support to top managers of technology-based companies in making decisions more objectively and effectively.

Four articles presented good practices for management of enterprise knowledge. Sánchez (2008) reinforced the idea that it is paramount for the management to spread and measure the intellectual capital, through three processes that must be recorded in corporate reports: a) the vision of the organization over its intangibles; b) a summary of intangible resources and activities; c) indicators system, monetary or non-monetary. The author also recommends systematic activities to make the information public on memos, accounts, annual reports, line information, even in web pages.

Suñea, Bravob, Mundeta & Herrerc (2012) presented a set of good practices for knowledge management that have been successful in developing new designs and products in technology-based company: a) Strategy of practical innovation, with the following good practices - promoting competitive content in interactive distribution channels, services, technologies and business models of these channels; - having a plan of innovation management with strategic goals; - explicit communication on the importance of innovation in public acts; - alliances with other organizations. b) Incentive to innovative culture in the organization, with the following good practices: - exploring if the knowledge reflected in the minds of the directors; - tolerating errors; - open communication; - customer orientation; - transformational leadership; - application of non-monetary incentive systems. C) Structuring the innovation process, through the following good practices: - managing creativity and ideas, encouraging a culture of knowledge transfer, oriented through its KM platform; - combining a functional structure and projects where all employees involved in a new product development venture remain with the project at least one year; - rotating staff between projects; - creation of multidisciplinary teams; - creation of an Innovation Committee; - usage of models for management excellence; - establishing a system with indicators of Innovation.

Vick, Nagano & Santos (2013) pointed contributions to acquisition, dissemination and use of information to create knowledge. They consider that the organization can create knowledge through interactions and conversations that enable explanation between the dimensions of tacit and explicit knowledge. Opinions and ideas need to be encouraged. The digital information system is not considered the most appropriate for the agility of services. The exchange of ideas and informal conversations should be encouraged daily. Employees improve their knowledge in courses and training. The new knowledge gained at meetings must be recorded. Higher level of informality in relation to information management. Digital information system for agility in services. Designation of an employee responsible for collecting information.

Lindlöf & Söderberg (2011) propose visual planning as a useful method for product development teams that need efficient means of communication and coordination of team work, in order to obtain the tacit and explicit

knowledges of the R&D employees. The activities and results are described and illustrated in a board of physical planning and discussed at regular meetings.

The authors Suñea, Bravob, Mundeta & Herrerac (2012), Vick, Nagano & Santos (2013), Lindlöf & Söderberg (2011) and Sánchez (2008) presented ways to identify, capture, store and disseminate human knowledge of the technology-based companies through the implementation of good practices, thereby enabling innovation and organizational competitiveness that are crucial to continuity and growth in the current scenario of global gamesmanship.

#### **4.2 Interview analysis**

Founded in 1986, ACATE is an association of technology-based companies that strives for the development of its own members, with businesses in the fields of health; textiles; security; energy; education; gaming; agribusiness; government; sustainability; and telecom. The vertical of security of ACATE today holds 11 technology-based companies that employ innovation in their products. Three of these companies are not very active in the vertical, which compromised the investigation. Of the eight companies participating in monthly meetings of the vertical, six granted interviews, thus enabling the completion of the investigation.

In order to analyze the interviews, the methodology of Collective Discourse Analysis (CDA) was applied, proposed by Lefevre and Lefevre (2005). This technique, based on collected testimonies, yields a quanti-qualitative product, ie, the qualities that derive from the quantitatives reported by respondents, where "the potential speech is in the meaning given by a group of people when responding to a particular topic" (Gondim & Fischer, 2009, p.16).

The interviews relied on open questions. However, in order to grasp the collective thinking, it is necessary to work individually with each subject of the proposed sample, so that each one freely expresses their internalized thinking, being that, according to Lefevre & Lefevre (2005, p. 13, translated by the authors), the collective complies with "[...] the idea of a set of individuals [...]".

The steps described by Lefevre & Lefevre (2005) were applied in the construction of the CDA, which were the grouping of individual discourses related to each question; extraction of Key Expressions (KE); extraction of the Central Ideas (CI) of each grouping of KE; and the use of Anchors (AC) reported in interviews and described in the systematic literature review of the research.

The methods proposed by Lefevre and Lefevre (2005) were applied, gathering the elements of KEs, CIs and ACs.

- Key Expressions (KE) are selected portions of the verbal content of the statements or interviews;
- Central Ideas (CI) are the expressions that exhibit homogeneous sense with which respondents define the sense in the responses;
- Anchors (AC) are expressions depicting the ideologies, values, and beliefs of the individuals involved and are present in voiced speech in the responses to interview questions.

The CDA technique allowed identification of repeated words or phrases, that, at the end of the analysis step, highlighted 19 expressions or key words, repeated 792 times, resulting in six central ideas, repeated 84 times, which are depicted in Table 2. On the same Table the anchors are described.

## **5 DISCUSSION**

The survey, which included the collective discourse analysis, allowed the understanding that companies still do not have initiatives for implementation of KM, but use information systems for storage of documents and information relevant to business management, either in the aspect of processes, products, services or persons. They are information systems, repositories or collaborative environments that store specific content and allow communication between users. Therefore it can be inferred that even without comprehension necessary to KM, there is use of tools that assist it.

Interviews with business owners revealed that there is little to no knowledge about how to deploy KM in the company. About this, Santos (2014) explains that in order to implement KM, many companies started with pilot projects. That happens because, as a new discipline and form of management, the real power of KM will manifest in the coming years.

As for the competitive advantage that can represent the knowledge of individuals, business owners demonstrated in their speech that they do not understand how KM can assist in this matter. Therefore, it is necessary to

introduce simple but clear forms of implementing KM in these companies. Therefore, not only the initial steps for implementation were designed, but also the good practices for KM.

The suggestions of good practices identified in the systematic review were analyzed. However, the reality of management, presented by the subject companies, showed that the most suitable and appropriate model to their reality refers to the good practices that suit the organizational processes, products and services, generating innovation and, mainly, considering the knowledge of the individuals in the organization.

### 5.1 Good Practices of KM

Companies need to develop strategies of support and expansion directed towards institutionalizing Knowledge Management in order to identify, store, share, apply and create knowledge. This methodology is an action plan that allows the company to develop practical guidance on what to do to succeed in institutionalizing Knowledge Management. Thus, a list of good practices for the implementation of KM, directed to this type of company, is presented below, since it is the intention of this paper to provide a simple model to supply the lack of KM that was evidenced throughout the interviews.

The implementation of the framework strategies combined with the good practices provides vision and approach in order to face problems such as the risk of losing knowledge data due to retirements and conflicts, generational differences in the workplace and technology updates. Thus, the following steps are presented as to implement KM in the surveyed companies, taking into account the cycle of knowledge that permeates the steps of identification, creation, dissemination and reuse of knowledge:

- a) Knowing the organizational processes – this step aids in the identification of corporate knowledge;
- b) Identifying the organizational sectors and actors – this step aids in the identification of corporate knowledge;
- c) Structuring a multidisciplinary team to work the organizational KM – Vick, Nagano & Santos (2012) share the understanding that there shouldn't be a specific department or person responsible for the collecting of information, therefore responsible for the Knowledge Management;
- d) Capacitating the actors that form the multidisciplinary team – this step provides spread of knowledge;
- e) Defining and spreading the good practices – this step not only triggers the spread of knowledge, but also contributes to the creation of knowledge;
- f) Establishing criteria for monitoring, evaluation and reuse of the implemented actions.

The framework suggests good practices that fit the organizational needs and that may be applied in the company. Listed below are suggestions of good practices that are in line with the interviewees, as well as with suggestions offered by the authors researched during the systematic review:

**Alliance with other organizations.** It should be a practice by companies wishing to remain competitive in the market. Thus, maintaining a relationship with ACATE becomes important for the development of actions necessary to organizational and individual growth, as well as allowing close relationship with companies in the same industry, as suggested by Suñea, Bravob, Mundeta & Herrera (2012).

**Capturing ideas** is essential in Knowledge Management. Often even the process of explicitly writing a new idea during a training. Use of notebooks, sharing by information technology through knowledge blogs, recorders for capturing speech, capturing via Intranet, blogging teams, facebook, audio conferencing, video conferencing etc (Schmitz et al, 2012). Still regarding this practice, Lindlöf & Söderberg (2011) propose a way to facilitate communication and retention of employee knowledge in technology-based companies, the visual planning. For the authors, it is a useful means to capture knowledge using or allowing teams to express themselves and write their ideas.

**Comments following learned lessons** is a technique to assess and capture lessons learned after the completion of a project. This technique allows to learn from successes or failures to improve future projects. For Sánchez (2008), corporate management can increase production and encourage innovation in the company.

**Communities of practice** are groups of people who share a concern or a passion for something they do. This practice enables sharing and creating common skills, knowledge and expertise among employees.

**Virtual collaboration tool** are devices that allow people to work together, share documents, opinions, ideas, collaborative editing and audio/video conferencing, among other information necessary for the company (Schmitz et al, 2012). The implementation of a digital information system is considered more appropriate for efficiency of services, according to Vick, Nagano & Santos (2013).

**Physical space for collaboration** allows human interactions to happen and can support sharing and creation of knowledge. It is necessary to create reasons for employees to engage *ad-hoc* interaction, which can be a designated area for coffee or snacks, for reading magazines or books, or even mailboxes and printers to pick up cards and copies (Schmitz et al, 2012). For Vick, Nagano & Santos (2013), a higher level of informality regarding information management was found in the incubated companies and, at the same time, greater



incentives for knowledge creation.

**Virtual space of knowledge** is an IT tool to connect people who need and people who have knowledge. A combination of IT and people that support finding and connecting other people (Schmitz et al, 2012). This digital information system is considered the most suitable for efficiency in services, but it is necessary to designate an employee responsible for gathering information, as pointed by Vick, Nagano & Santos (2013).

**Narrative** is a means of transferring tacit knowledge through exposure of a story. A person who has knowledge portrays the experience in front of individuals who seek the knowledge. It can spark the interest to find other people with common interests (Schmitz et al, 2012).

**Video and voice technology** are tools that offer ease in transmission of knowledge for calls to people anywhere in the world. It grants a rich form of communication, allowing to share presentations, e-learning, with high level of interaction (Schmitz et al, 2012).

Meetings for **storm of ideas**, taking into consideration the opinion and idea of everyone from lower to higher hierarchical levels. Brainstorming is a simple way to help a group of people in generating new and unusual ideas, aiding people to get involved in the problem solving process of the company (Schmitz et al, 2012). Vick, Nagano & Santos (2013) pointed contributions to acquisition, dissemination and use of information to create knowledge through human interaction, where information sharing and knowledge creation are vital to the success of organizations. With the technique of brainstorming the company can create knowledge through interactions and conversations that enable explanation between the dimensions of tacit and explicit knowledge.

**Technical visits** aim at knowing what's new in technology market, elements presented at national and international fairs, congresses, conferences and other events that bring updated knowledge. Vick, Nagano & Santos (2013) state that the new knowledge gathered at events or meetings must be recorded.

Image 1 was prepared for a better understanding of the application of the framework, presenting each stage for the achievement of the steps of this deployment.

The entire research was conducted under field information and literature review that present the paradigms that sustain knowledge management as a means to bolster the intangible assets, propped by integrative systematic review and collective discourse analysis, which aided in the understanding of the path to Knowledge Management, evidencing the methods applied to each step, presenting the parameters of a Framework that enables the deployment of KM via good practices method, with focus on people, as a preponderant factor to the innovative corporate management.

## 6 FINAL THOUGHTS

Thinking KM in company management is also thinking the new in management and ultimately creating value. Identifying the knowledge and the creative potential of people needs to rely on a place where ideas can be exchanged without hierarchy, as stated by Santos (2014), who still makes it clear that "this procedure means making public the private knowledge."

Therefore, in order for knowledge management to collaborate in organizational development it is not enough having a bonded creative team, but also that people have space to present this creativity. It is also important to bear in mind that the diversity of culture, knowledge and skills means different ways of perceiving the world and conceiving ideas. Also, the diversity of perception and the freedom of exposing thoughts are what generates innovative ideas and knowledge to businesses. The manager needs to focus on the identification of human knowledge in a liberal fashion, ie, less hierarchically, providing opportunities to exhibit the ideas of employees in the organization.

Based on the analyzed articles it is possible to see that knowledge management is present in various aspects of business management, innovating in products, services or in the improvement of processes. Methods and practices to enhance human knowledge and individual expertise in order to increase the competitiveness of the company were suggested by three articles that sought to demonstrate good practices of KM seeking to use more of what people know and do as a means to present useful things for the company.

The articles address several different themes from an interdisciplinary point of view that surrounds the conducted research. The selection made from the systematic review provided greater consistency of argumentation to the research, also clearing that the matter suggests approach to themes such as framework, technology-based companies and Knowledge Management.

The investigation also led to the understanding that people are a key part of the success of the company, since individuals hold the knowledge to the necessary innovation and creation for the maintenance of business competitiveness. For the successful implementation of KM there is need for differentiated conditions in the organizational environment, enabling the exchange of ideas without hierarchy, and for support from the business owners for the development of these ideas.

Finally, the best practices were listed and it was sought to strengthen the idea that KM is an innovative aspect to business management, being that it focuses precisely on innovation itself, and it becomes the path to success and achievement of results for any company that desires to grow, expand and stay in the market.

In the paradigm presented by this research and based on the literature, it is necessary to look at people in companies as a major factor on the deployment of a new management model. For an organization to be considered innovative, individuals need to be a differential factor and encourage innovation, after all they are the ones who hold the knowledge and make the company work. Organizational leaders must identify and strengthen their values and potential, positively impacting the KM.

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**TABLES AND FIGURES OF RESEARCH**

**Table 1: Relation of Titles Obtained**

<b>Título</b>	<b>Autor</b>	<b>Ano</b>
A Network Analysis of Investment Firms as Resource Routers in Chinese Innovation Ecosystem	Neil Rubens; Kaisa Still; Jukka Huhtamaki; Martha G. Russell	2011
Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL.	Gwo-Hshiung Tzing, Cheng Hsin-Chiang, Chung-Li Wei	2007
Buenas prácticas de innovación: un estudio exploratorio de empresas tecnológicas en el sector audiovisual español	Albert Suñea, Edna Bravob, Joan Mundeta y Liliana Herrerac	2012
Identifying the information management process and knowledge creation in technology-based companies: a Brazilian comparative case study	Thais Elaine Vick; Marcelo Seido Nagano and Fernando Cesar Almada Santos	2013
A Framework for Consolidating Laboratory Data Using Enterprise Service Bus	Chi Po Cheong; Chris Chatwin and Rupert Young	2010
Methodological Tool for Measurement and Assessment of Technological Innovation Capabilities	Jorge Robledo Velásquez, José Javier Aguilar Zambrano, and Juan David Pérez Vélez	2011
Pros and cons of lean visual planning: experiences from four product development organizations	Ludvig Lindlöf and Björn Söderberg	2011
Organizational Capability Deployment Analysis for Technology Conversion into Processes, Products and Services	Tomoe D. Hamanaka Gusberti; Claudia Viegas and Márcia E. S. Echeveste	2013
Combined DEMATEL techniques with novel MCDM for the organic light emitting diode technology selection	Yung-Chi; Grace T.R. Lin and Gwo-Hshiung Tzing.	2011
The role of the intangible assets and the intellectual resources or capital in the creation and the spreading of the knowledge in the organizations: the nowadays situation and he future challenges	M. Paloma Sánchez	2008
Profiling the intellectual capital of Italian manufacturing SMEs: An empirical analysis	Chiara Verbano; Maria Crema	2013

Source: Author, 2014.

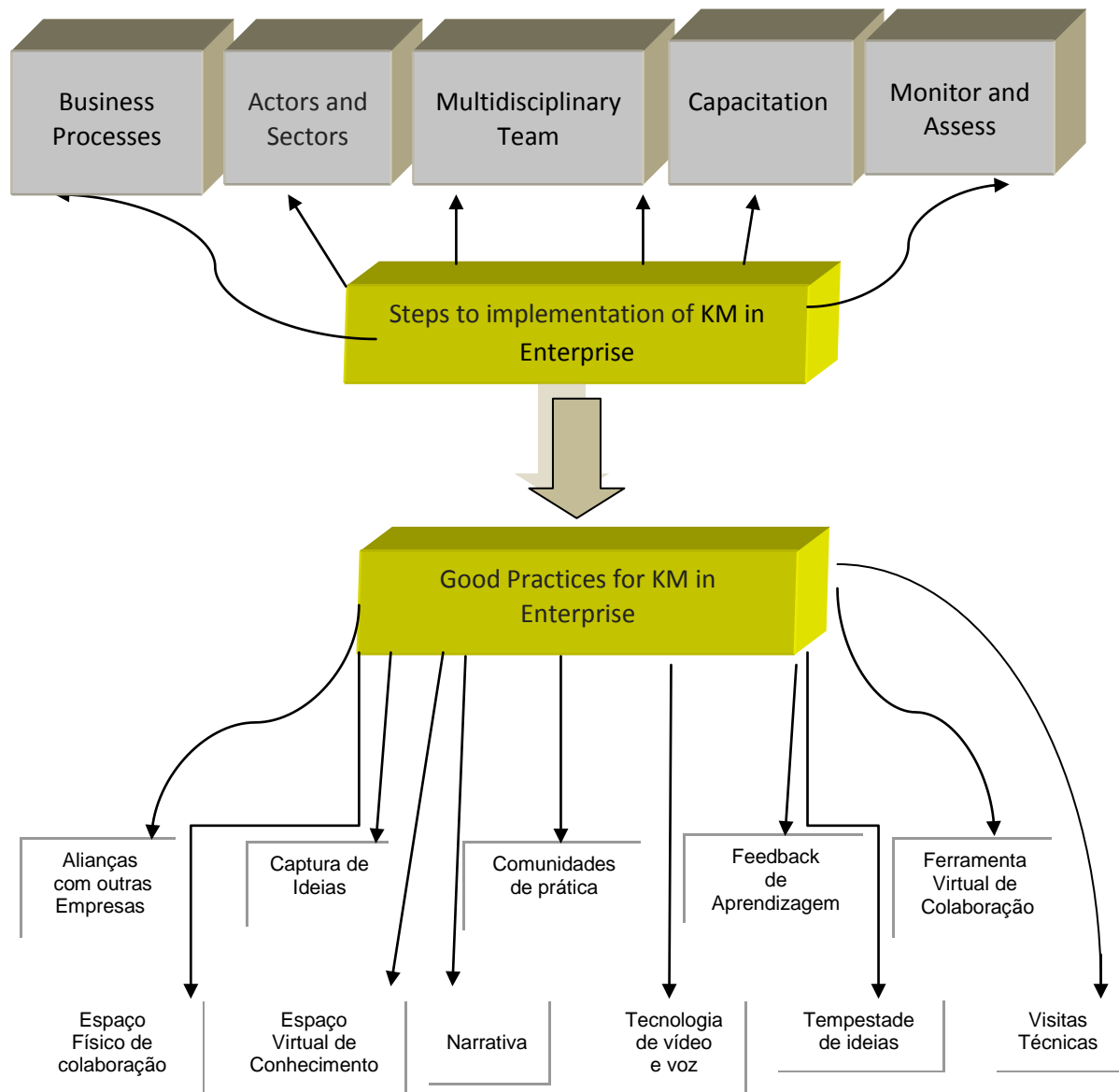
**Table 2 – Discourse Analysis Collective**

<b>Key Expressions (KE)</b>	<b>N°</b>	<b>Core ideas (CI)</b>	<b>N°</b>	<b>Anchoring (AC)</b>
Products	67			
Technology	49			Develops its
Innovation	36	Technology-based enterprise	08	products based on
Knowledge	85			tecnology and innovation
Development	38			
Meetings	10			
Informations	23			
Systems	46			Knowledge of the
Projects	26	Knowledge Management	12	processes and
Processes	57	Information System	35	through developing
Storage	21	Storing of data	11	of products
Activities	09			
Repositories	36			
Market	50			
Customers	43	Need of Customers	09	Get Innovative
Companies	163	Knowledge of Employees	09	Information
Employees	33			
<b>TOTAL</b>	<b>792</b>		<b>84</b>	

Source: Author, 2014



**Image 1: Steps to implement the Framework in their good practices**



Source: Author, 2014