Diagnosis and Prognosis of Knowledge Management based on k-Workflow, on Conversion and Knowledge Flow

The Case of the National Land Transport Agency in Brazil

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Abstract: This paper presents the main contributions of the Iterative Model for Knowledge Management proposed by Universidade Federal Fluminense (UFF) in cooperation with the Brazilian Agency for Land Transport Regulation (ANTT). The method's great innovation is to combine to the KM diagnosis and prognosis, the concepts of conversion and knowledge flow, with the application of the 5W1H method and Enterprise Architect (EA) software to integrate the models built, also allowing its graphical representation. The models and products obtained have allowed: to understand the culture of the Agency's current KM; view existing gaps and needs in their knowledge flow construction and in the process of converting knowledge; propose a set of KM practices and tools appropriate to their reality and predict future actions of improvement that impact on the efficiency of the regulatory process.

1 INTRODUCTION

Currently, organizations have several computerized systems to support the implementation of its processes and activities without a structured information and knowledge model. In this scenario, some problems were identified: the absence of an information critical analysis culture; low level of information integration between sectors; absence of a formal structuring information process to facilitate/enable the fulfillment of the institutional mission; dispersed knowledge and with difficult access, requiring transformation of tacit knowledge into explicit and provision /sharing explicit knowledge to decision making process.

ANTT, National Land Transport Agency in Brazil, is an entity linked to the Ministry of Transportation and the regulation Agency of the exploitation of federal railway and highway infrastructure activity and land transportation provision activity in Brazil.

In order to fulfill its mission, the Agency needs to have its information and knowledge identified, mapped, integrated and available to those who may need it effectively building an Information and Knowledge Management Model (MGIC).

In order to develop a MGIC for an organization there are some necessary preliminary steps which are essential: information assets identification, information and knowledge flows and knowledge and skills mapping.

The major difference of MGIC is that it uses, in an innovative way, a specific methodology that brings together several theories, methods and tools embodied in the information and knowledge management.

This paper is a step of the building process of a MGIC and the result of the academic and scientific research; with the application of a case study conducted in the Brazilian land transportation Agency (Bastos et al., 2011).

Based on these products and aimed at creating a fertile environment for new ideas and problem

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solving, another goal is to make proposals and suggestions for improvements in knowledge management in ANTT.

The phases presented in this work are specifically modeling, analysis and representation of knowledge management in one Organizational Unit of the ANTT, providing details on methodology and method.

This paper is organized as follow. The next section presents the Knowledge Models Development Phases; the section 3 the Analysis of the Models and Generated Products, the fourth section shows Diagnosis of the current status of Knowledge Management, finally the fifth section shows the conclusion of the work in progress.

2 KNOWLEDGE MODELS DEVELOPMENT PHASES

For developing of an Information and Knowledge Management Model (MGIC), the first phase is the knowledge and skills mapping using a specific method, which enables to build a knowledge tree, knowledge and skills topography and a unified knowledge database, which enable a descriptive and analytical approach to knowledge management in the organization.

For building a MGIC, there have been specifically adopted the following integrated methodologies and scientifically proven in the literature: Zarifian (2005) and Fleury and Fleury (2004) with the concept of mobilization of knowledge and skills; Rezende (2007) with the Iterative Method for Mapping and Analysis of knowledge and Skills; Nonaka and Takeuchi (1995, 2009) with the SECI Model explaining the processes of knowledge conversion and the knowledge spiral; Michael Authier and Pierre Lévy (1992) with the concept of the knowledge tree for knowledge dynamic structuring .

It is worth mentioning that the initial part that composes the MGIC: Information Asset identification and modeling, Information Flow and Ontology model, as well as the final phase of construction of the architecture and implementation of knowledge management in the organization, are described in a more complete methodology for the construction of MGIC (Bastos et al., 2011).

The relevance of the method lies in the fact that, while it maps knowledge/skills/professionals, it also analyzes the flow and the processes of knowledge conversion in the organization, supporting the construction of architecture and a tool proposition for knowledge management.

The method application allows the organization to identify the relevant sources of information and knowledge and set the strategy for its collection and methods for its analysis; to implement a culture of research, collection, recording and analysis of knowledge within an organizational context; to know what types of knowledge exist and where they are located, to manage them, integrate them and organize them, in order to make the most of their extraction for decision-making; support to the organization through knowledge sharing and integration among employees, enabling the transformation of tacit knowledge into explicit; improve the localization and exploitation process of new knowledge that, despite having it, the organization is not able to identify, thus enriching creativity and generating competitive intelligence; to identify experts (inside professionals) to give technical support for analysis; to support the construction of communication forms, conversation, learning, training community work, structuring individual and teams experiences, facilitating access to ideas and solutions.

In the phases of knowledge and skills identification and collection, initially, there were mapped the procedures for carrying out the information flows activities and related to explicit and tacit knowledge, as well as the skills of the professionals involved. In this process we created a Knowledge Workflow (k-workflow), an innovation in modeling process and knowledge management created especially for the MGIC.

For knowledge and skills mapping and representation and k-workflow building, there were used a methodology based on research developed by Rezende (2011), the methodology 5W1H (Ikeda et al., 1997) and the software Enterprise Architect (EA) for the models integration and reports generation.

For visualization in a hierarchical form of shared and specialized knowledge, the Treebolic (2007) software was used for the construction the knowledge tree (Authier and Lévy, 1992).

From the construction of knowledge and skills topographies and an integrated database, it was possible to generate descriptive graphs that enable statistical analysis.

An important level of analysis is the identification of gaps in knowledge flow (Figure 1) and the process of knowledge conversion (SECI Model), proposed by Nonaka and Takeuchi (1995; 2009), which allows to have a vision of KM as a process.

From the knowledge gaps identification during the analysis phase there were suggested techniques, practices and tools that allow the organization to capture, mobilize and innovate knowledge as an input for the development of intellectual capital and social capital through effective services.

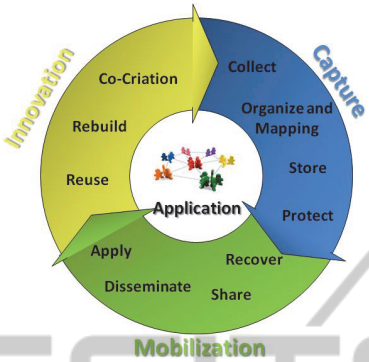

Figure 1: Knowledge flow.

The models developed, Iterative Method for Knowledge Mapping and Management in Enterprise Environments, indicating the different steps performed: 1) information collection; 2) knowledge and skills survey; 3) classification; 4) representation and 5) analyzing, during which several products are generated.

The first stage of information collection was conducted through open interviews with managers and employees, chosen by the nature of their functions and specializations potentially useful to participate in the collective knowledge development process.

This step has two well featured phases, the first phase is inputs consolidation at the information level and needed knowledge to start modeling, where it was taking into consideration: a) all documents provided to assist the agency understanding, b) existing systems at the agency, c) the list of information assets and d) the actors/workers identified at the generated models in the previous stages of MGIC construction.

From the consolidation phase of the inputs, the professionals list to be interviewed was identified. A script was prepared for interviews considering all the knowledge previously gathered in information flows.

The interviews, which were carried out openly and transcribed manually searched to identify the existing explicit and tacit knowledge and skills needed to perform the activities.

The method generates a table that shows a sketch with the demographic data of the interviewed employees that can allow to analyze the expertise level and realize their correspondence to operational skills at the Organizational Unit (OU).

The workflow, was made based on 5W1H method (Ikeda, Okumura and Muraki, 1997), led to the breakdown of activities to be undertaken for the management of an information asset. The method also generates an outline of working groups identified in the information assets.

Thus, the collection stage enabled the construction of the k-workflow containing procedures for implementation of information asset and their knowledge, their skills and their related working groups, the information asset matrix x interviewed x working group and the listing of demographics data of the interviewed professionals (Figure 2).

The second stage was to survey, which allowed the mobilized knowledge definition and the skills needed to perform the activities of an information asset by working group. Consequently it was possible to generate knowledge and skills lists.

After information collecting phase the knowledge and skills of an information asset were identified. The materials collected in the interviews, documents provided and the existing systems applied were used to define the knowledge and skills.

In this phase it was performed the knowledge Topography composed of the following steps: identification, description and classification (nature, relevance and level).

By analyzing the knowledge topography, it was identified that the majority of processes are well structured for employees.

All identified knowledge was of explicit nature, with well-defined location, but without a systematic storage, retrieval, update, dissemination and recreation.

In this phase it was performed the skills topography, consisting of the following steps: identification, description, relevance and skills representation (Rezende, Lobão, Burmann, Castro Júnior, Merino, Rocha and Bastos, 2012).

The third stage, the classification, aims to construct the knowledge and skills topographies. The knowledge topography consists in classification in nature terms (tacit or explicit), relevance (irrelevant, little irrelevant, relevant and very relevant), knowledge level (basic, intermediate and advanced) and its location. Based on these ratings the relationships map was constructed from information assets x activities x working groups.

From knowledge and skills topographies and the relationship matrix it was prepared the basis for

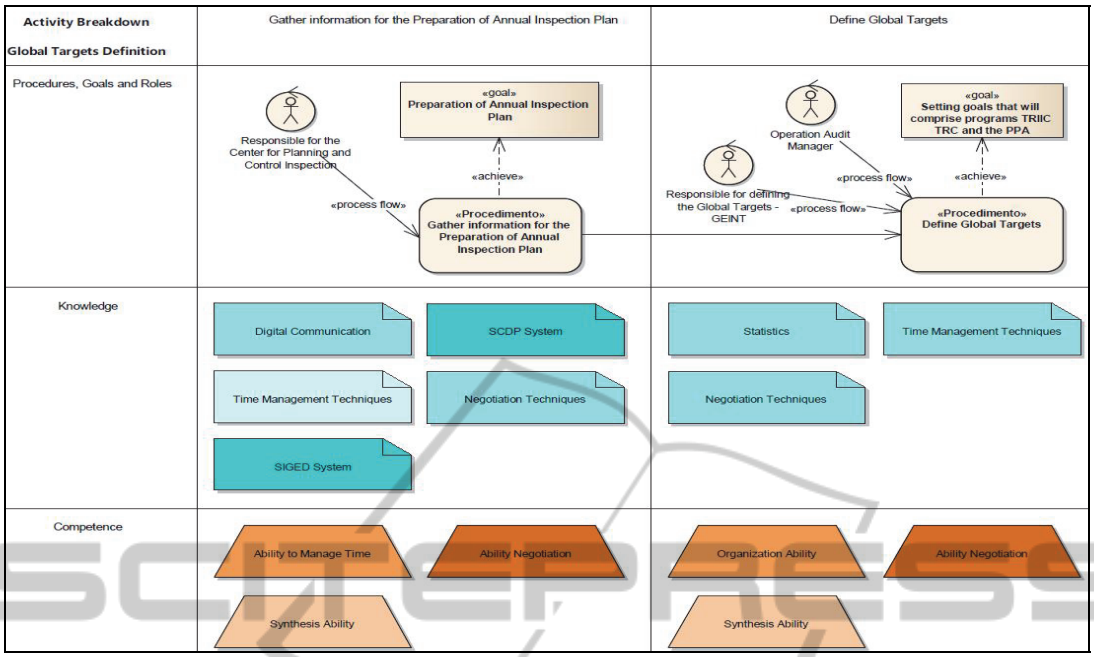

Figure 2: Knowledge workflow and map of knowledge/skills/work groups.

construction of knowledge /skills / professionals map.

The fourth step was the representation, which consisted of the knowledge/ skills/professionals map (through the use of EA software) and the knowledge tree (using the Treebolic software).

To view in a hierarchical way the knowledge gathered the knowledge tree was used as graphic representation. This visual instrument to represent knowledge is easy to handle and allows any user to explore a whole information structure without feeling lost in its hierarchy.

The organization can use the knowledge tree as a support tool to help: the elaboration of a training plan and capacity building; locating expertise; sharing information; indicating knowledge gaps.

In the final stage of model analysis there were constructed descriptive charts, showing the different possible groupings of the information and knowledge gathered, classified, represented and mapped. Gaps were identified in relation to the knowledge flow (Figure 1) and the SECI Model (Nonaka and Takeuchi, 1995, 2009).

Yet it was possible to investigate the correlations between skills and knowledge that indicate new relationships associated with information assets, activities and working groups.

The following section presents outlines of models and generated products at each stage of the method and its application.

3 ANALYSIS OF THE MODELS AND GENERATED PRODUCTS

Several analyses can be performed from the models and generated products. With the knowledge basis built it is possible to identify: the existing working groups in the organization, the working groups associated with an information asset, the working groups associated with different information assets activities; the technical knowledge ordered by the relevance; correlations between activities / knowledge /skills; specializations by working groups and vice versa; specialized and shared knowledge and data intersections of interest to the organization.

The analysis of the technical knowledge of an information asset by relevance may influence the profile definition of knowledge that an employee must have to perform his activities efficiently. Another application may be the use of these analyses as an additional tool for the process of evaluating the employee performance.

The analyzes of the activities numbers of the working groups in the implementation process of an information asset within the Organizational Unit may help in assessing the OU assessing the number of activities performed by a particular working group.

It should be noted that other possible analysis may be performed from the knowledge basis such

as: a) working groups in ANTT by area; b) information asset associated to working groups; d) technical expertise ordered by relevance; e) correlations between activities/ knowledge/skills; f) expertise by working group and vice versa; g) specialized and shared knowledge. Therefore, the Agency has a strong management tool to define projects teams, employees recruitment process, development of training courses for the different working groups, monitoring and evaluation of performance of its employees, among others.

4 DIAGNOSIS OF THE CURRENT STATUS OF KNOWLEDGE MANAGEMENT

Throughout the processes of data collection, mapping and modeling, information and knowledge inputs were consolidated provided by the Agency to understand the business processes, ANTT's mission and how their activities contribute to achieving the Agency's goals.

Based on these inputs a diagnosis of Knowledge Management was built in the following categories: People; Knowledge Management; Organization/ Procedures.

Regarding the People category, we evaluate the experience and the educational of the Agency staff.

As far as the Organization and Procedures for Knowledge Management category is concerned, we evaluate the knowledge required for the execution of information assets, if it is formalized in documents and is integrated by systems. We are also interested if the Agency promotes knowledge sharing and if it includes dissemination activities for training new employees. The K-workflow procedures for carrying out the necessary activities for implementing their information assets helped us to understand its operation and identify its working groups. It is noteworthy that the most of employees interviewed, participate in more than one working group. We are particularly interested to know if the environment is adequate for the implementation of methods and techniques of knowledge management.

Knowledge management has the function to strengthen the individual and organizational knowledge basis. In the category related to Knowledge Management, we evaluate if the stages of knowledge flow are properly covered, associated to the steps of knowledge capture, mobilization and consequently to innovation steps.

We evaluate if documents and reports standardization support the implementation of information assets and if storage and documents protection are done in an unique way.

Regarding the mobilization stage, we evaluate if overall and specific goals from previous years are used as inputs for the creation of the new documents and information assets. It is also verified if the Agency promotes sharing and dissemination among stakeholders.

We also evaluate if there are some gaps in the steps of knowledge capture and mobilization that can compromise the innovation stage.

We also evaluate if the four models of knowledge conversion: socialization, externalization, combination and internalization are performed systematically in stages of knowledge flow for implementing identified information assets.

The socialization process is regarding individual and collective experiences sharing to create new tacit knowledge. In the organizational, it occurs through training, customer interactions, informal sessions, brainstorms. So, we are interested in identify the need to intensify the integration among actors involved and to socialize knowledge and successful practices.

The externalization process consists of knowledge creation through new and explicit models from tacit knowledge. We are interested to check if tacit knowledge is been explicit and registered and if knowledge is mapped and organized to be used.

In the combination process, which occurs through the exchange and combination of different sets of explicit knowledge, and that in the Organization is acquired especially by means of documents, meetings or computer network, it has been found that the absence of a knowledge database centralized, integrated and consolidated causes avoidance of explicit knowledge thus making it hard the activities related to analysis, reporting and consultation documents. In order to have quality and efficiency in the activities performance, it is necessary to ensure that the skills are available for the application, reuse and creation.

The internalization process occurs in conversion of explicit knowledge into tacit, by "learning by doing". So we are interested to check if information from prior years is used as support for the development of new reports and documents and if knowledge is internalized and therefore used for the construction of new explicit knowledge.

In order to accomplish the prognosis of methods, techniques and tools for Knowledge Management, each category used in KM diagnosis is then analyzed and some improvements recommendations are

proposed in order to eliminate the gaps identified in knowledge flow and knowledge conversion processes.

5 CONCLUSIONS

The Iterative Method proved to be effective in its application, allowing to identify, collect, map, analyze and represent tacit and explicit knowledge, skills and professionals mobilized and involved in the construction of information assets, besides analyzing the knowledge flow in all stages.

Mapping will facilitate the activity of allocation, reallocation and professional training according to the activity to be performed, besides facilitating the location of key people, those that have the most relevant knowledge on a particular subject.

Critical success factors identified and their enablers in KM may assist managers in their decision making process in different situations, such as: process improvement using techniques and tools of knowledge management; identification of knowledge gaps in professional activities; perception of opportunities for new training courses and competences building; identification of gaps between individual's professional knowledge and skills needed to perform activities.

The method developed can be applied to other domains of different areas, constituting a knowledge basis for Knowledge Management.

KM models developed for the Agency based on its information assets are implementable in the short or medium term, through the use of best practices and tools (intermediate results) or from the application of KM architecture still under construction (final results).

From knowledge basis constructed throughout modeling process it is possible to make more descriptive analysis such as: working groups associated with one or several information assets and vice versa; working groups associated with different activities of an information asset, correlations among activities/skills/abilities of one or more working groups and vice versa. The managers have at their disposal an incremental basis of knowledge, unique to the Agency, which enable different analysis depending on the need and the decision to be made.

With mapping and modeling built it will be possible to structure the KM architecture of the Agency and define proper methods, techniques, technologies and tools for their effective knowledge management, allowing it to fulfill its mission more effectively.

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