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A Process Modeling Approach to Identify and Locate Potential Crucial Knowledge: The GAMETH® Framework

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ABSTRACT

In a knowledge management project, the key issue is to help the stakeholders to choose which parts of their knowledge, either tacit or explicit, will need to be specifically capitalized. This means finding an approach enabling them to identify and locate "potential crucial knowledge," that is a set of knowledge to be assessed in order to decide which is crucially important for the enterprise. To deal with this type of issue, a specific Framework named GAMETH® has been developed. In this article, we describe the postulates, the guiding principles, and the main phases of the approach proposed by GAMETH® emphasizing the process modeling method that is inherent to the second phase of the approach. This process modeling method, supports the effective capability to locate and identify "potential crucial knowledge". Further more we present lessons learned from three case studies.

INTRODUCTION

One of the main issues in a knowledge management project is to locate and identify essential knowledge to be capitalized. This issue was pointed out as early as 1991 by Thomas A. Stewart in a report published in Fortune: "Brain Power, how intellectual capital is becoming America's most valuable asset". In his article, Tom Stewart warned companies for the first time that "intellectual capital is becoming corporate America's most valuable asset and it can be its sharpest competitive weapon. The challenge is to find what you have – and use it."

The key issue is to help the stakeholders in a knowledge management project to locate the essential knowledge and to choose which parts of it will need to be specifically capitalized. This means developing an approach enabling the identification and localization of potential crucial knowledge. To deal with this type of issue, a specific approach named GAMETH® Global Analysis Methodology, has been developed, that is notably based on process modeling.

In this article, after having defined the concept of "potential crucial knowledge," we describe the GAMETH® Framework emphasizing the process modeling method that is used. Finally, we present lessons learned from three case studies.

CONCEPT OF "POTENTIAL CRUCIAL KNOWLEDGE"

The concept of "Potential crucial knowledge" has been introduced by Saad in her Ph.D. thesis (Saad, I., Grundstein, M., & Rosenthal-Sabroux, C., 2003) as an analogy with "Potential action" defined by Roy in the decision support research (Roy, 1985) (Roy & Bouyssou, 1993) (Roy, 2000).

Bernard Roy defines the concept of "Potential action" as "a generic term used to describe the object or the referent of a decision." In other words, the concept of potential action clarifies the nature of what constitutes the decisional problem and formalizes the object of the decision.

In our case, that is capitalizing on company's knowledge assets, the key issue is to help the stakeholders to choose which parts of their knowledge will need to be specifically capitalized.

Thus, The identification and assessment of the knowledge, which would justify an effort of capitalization, presume a decision-making process. In that case, by analogy to the concept of "potential action", the object of decision is named "potential crucial knowledge" that is a set of knowledge to be assessed in order to decide which is crucially important for the enterprise, and justify an effort of capitalization.

THE GAMETH® FRAMEWORK

Positioning the GAMETH® Framework

The GAMETH® Framework (Grundstein, 2000a) is one of the results of the project untilted CORPUS and initiated and led from 1991 to 1995 into the Framatome Group. The scope of CORPUS was to elaborate a set of concepts, methods and tools aimed at contributing to capitalizing on company's knowledge assets.

At the beginning, CORPUS deliverable was a complementary approach to manage the advisability phase of an information project with the aim of integrating knowledge capitalization functionalities into the specifications (Grundstein, 1996). Later on, we have considered that this approach could be generalized, and since 1997, it has been consolidated as a Global Analysis Methodology, the so-called GAMETH® Framework.

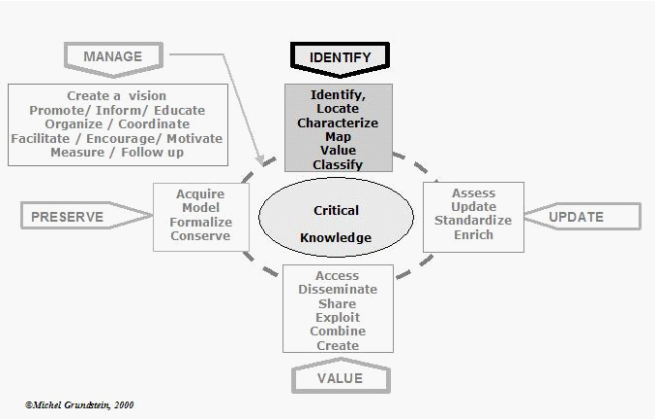
The knowledge capitalization issue within an organization comprises a set of recurrent problems to which the organization has always been confronted.

Several problems co-exist. They have been organized in five facets as described by (Grundstein, 2004). Each of these facets contains sub-processes, which are destined to contribute a solution to the set of overall problems. The GAMETH® Framework responds to the facet "Locate" of the problem (cf. Figure 1).

General Description of the GAMETH® Framework

The GAMETH® Framework (Grundstein, 2000) provides the elements that lead to the identification of the problems, the clarification of the needs for knowledge, the identification, localization, specification and value-based assessment of this knowledge and to the determination of "crucial knowledge", that is: Knowledge, that supplies essential resources to the conception of products and new services, that contributes

Figure 1. Positioning GAMETH®



to the added value and to the performances of the functional and operational processes of the firm, and that is the essential factor to maintain and improve its competitive position. That knowledge is vulnerable, i.e.: rare, specific and unique, imperfectly diffused, non-substitutable, difficult to pass down. The cost to develop or purchase that knowledge is very high and the period of time required getting it is long. The possible loss of that knowledge can cause an unacceptable risk for the strategy and life durability of the firm, by weakening its core competencies, endangering the performances of its business units and reducing its market share. Knowledge can be tacit (embodied within the head of a person or embedded in an artifact), or explicit (incorporated into a document).

The GAMETH® Framework relies on three postulates (p1, p2, p3), suggests three guiding principles (gp1, gp2, gp3), induces an approach that has three specific characteristics (c1, c2, c3) and consists of three main phases (ph1, ph2, ph3).

The Postulates

The approach is based on the following postulates:

p1: Company's knowledge includes **two** main categories of knowledge:

Within a company, knowledge consists of, on the one hand, explicit knowledge comprising all *tangible elements* (we call it "know-how") and, on the other hand, tacit knowledge (Polanyi, 1966), which comprises intangible knowledge (we call it "skills"). The tangible elements take the shape of formalized knowledge in a physical format (databases, procedures, plans, models, algorithms, analysis and synthesis documents) or are embedded in automated management systems, conception and production systems and in products. The intangible elements are inherent to the individuals who bear them, either as collective knowledge (the "routines" – non-written individual or collective action procedures (Nelson & Winter, 1982) or personal knowledge (skills, crafts, "job secrets", historical and contextual knowledge, environmental knowledge – clients, competitors, technologies, socio-economic factors).

p2: Knowledge is not an object: Knowledge exists in the interaction between an interpretative Framework (incorporated within the head of an individual, or embedded into an artifact), and data.

This postulate is based on the theories developed by Tsuchiya (Tsuchiya,1993), who deals with the construction of tacit individual knowledge. According to his research, the tacit knowledge which resides within our brain, is the result of the meaning we attribute – through our interpretative schemes – to the data that we perceive as part of the information that we receive. This individual knowledge is tacit and it can or cannot be expressed. It becomes collective knowledge as soon as it is shared by other individuals, whose interpretative schemes are "commensurable". That is, these schemes enable a minimal level of interpretation, which is shared by all members of the organization.

The idea that this knowledge cannot be made objective results from the paradox that, as soon as we deal with technical knowledge (descriptive knowledge, normative or prescriptive knowledge dealing with material or immaterial objects) or with scientific knowledge, having a universal nature and a truth-value, this knowledge is often confused with the media that enable their distribution. In reality, these media, i.e. material or dematerialized (electronic) documents, only contain the *informational sources of knowledge* (Grundstein, M., & Rosenthal-Sabroux, C. 2003) for people who are capable to interpret it, based on their profession, their domain of research or interest, their beliefs and their culture. The concept of "commensurability" enables to solve this paradox. For example, we can consider that, in the case that the commensurability of the interpretative schemes is important, the knowledge that is presented through documents and other media has been objectified, that is, being made independent of the individual.

p3: Knowledge is linked to the action

From a business perspective, knowledge is created through action. Knowledge is essential for the business's functioning and is finalized through its actions. Hence, one has to be interested in the activities of the actors – decision-makers, engaged in the process contained in the company's missions. This vantage point is included in the use of the concept of knowledge, which cannot be detached from the individual placed within the company, his/her actions, decisions and relations with the surrounding systems (people and artifacts).

The Guiding Principles

GAMETH® offers three main principles with respect to the modeling of the company, the knowledge analysis method and the process modeling approach.

gp1: The modeling of the company

The modeling is based on the concept of activity as having been defined by Lorino [Lorino, 1992). This leads to a modeling principle in which the company, as perceived from the point of view of knowledge that it uses and produces, can be represented as a set of activities that make up the processes that are part of the company's mission.

The activity model (Grundstein, 2000) has been inspired by the SADT method (Marca & McGowan, 1988). However, there are two differences: first, it distinguishes the transformed material from data which is based on this material; second, it includes the notions of produced knowledge and used knowledge.

gp2: The knowledge analysis method

The knowledge analysis process is founded on the so-called "sensitive processes". A sensitive process is a process, which represents the important issues which are collectively acknowledged: weaknesses in the process presenting a risk of not being able to meet the cost or time objectives, the required quality for the goods or services produced, obstacles that have to be passed, challenges that are difficult to reach, goods and services that are strategic assets of the company. The determination of sensitive processes is obtained through creativity sessions, building on the knowledge that is being held by the responsible persons within the intervention domain. The analysis method will be described hereafter.

The influential problems and constraints can weaken the activities and may even endanger the process to which they are supposed to contribute.

Therefore, the sensitive processes are submitted to a risk assessment. This assessment helps to determine the *"critical activities"*. The consensual identification of these critical activities can be done rapidly through a group exercise, which obtains its coherence through the adherence of the actors that contribute to the processes and to the process representation.

The problems related to these activities are called "determining problems". The relaxation of organizational constraints can lead to a rapid absorption of these problems. The identification of the remaining determining problems leads to the identification of the knowledge that is required for their resolution. This knowledge can be qualified as "crucial knowledge" depending on its actual value. The knowledge analysis method leads to the analysis of used and produced knowledge within the same process.

Thus, the GAMETH® Framework does not involve a strategic analysis of the business objectives. It rather suggests to focus on the analysis of the knowledge that is relevant for the activities that contribute to the well-functioning of the processes in concordance with the business missions.

gp3: The process modeling approach

Besides the advantages of process modeling (Kruchten, 1999), in the GAMETH® approach the process modeling approach suggested in the phase *ph2* of the approach follows a constructivist logic (see paragraph 5). In order to distinguish potential crucial knowledge, the GAMETH® approach builds on the observation that processes, formalized through numerous procedures that prescribe action rules and operational modes, often differ from how these processes are perceived in reality.

Additionally, we observe that actors are often well aware of their part of the process, but ignorant with respect to the overall process in which this part has to operate. The approach consists of the construction of a process representation following from the partial knowledge that actors have acquired through the activities that they are supposed to perform. Throughout the analysis, the problems encountered provide the possibilities for the identification of information and communication relations between actors, not recorded in documents, and the identification of the knowledge required for the resolution of these problems. The advantage of this constructivist approach is that it stimulates collective engagement, which is primordial for a successful outcome of a knowledge management initiative.

The modeling process comprises a formalization, with the stakeholders, of objectives relative to sensitive processes. These objectives are modeled with a tree network representation called "Mission Tree" (see Figure 2). The interest of this representation is double: i) It allows stakeholder to have a common representation of the objectives to reach; ii) It is a way to identify sub-processes.

Figure 2. The Mission Tree

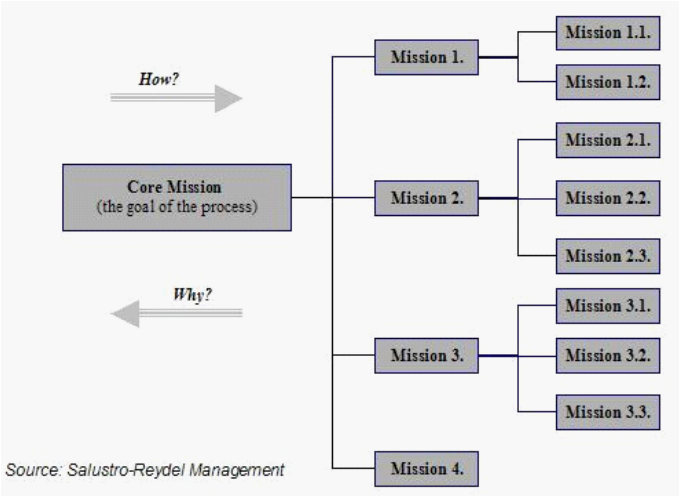
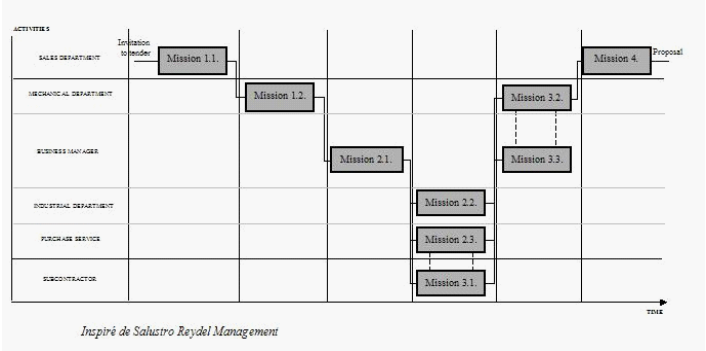


Figure 3. Actigram Representation



Processes that allows representing how different services cooperate through activities and exchange information all along the time are modeled with a flow diagram called "actigram" (see Figure 3). This "actigram" helps the cognitive engineer to pinpoint informal communication between actors. Moreover, this representation maps the interaction between individuals in terms of how they transfer their tacit and explicit knowledge in the sensitive process.

During the process modeling phase, we understand the structure and the dynamics of processes, we ensure that stakeholders have a common understanding of processes, we derive the needs of stakeholders to support processes, we identify problems and critical activities, and we put in light communication networks between the actors.

THE GAMETH® FRAMEWORK'S APPROACH

The approach is characterized by three characteristics and consists of three main phases.

The Characteristics

c1: It is a problem-oriented approach

The problems are located, the required needs for knowledge that allow their resolution are clarified, the knowledge is characterized, and then, the most adapted solutions to solve the problems are determined.

c2: It is a process-centered approach that connects knowledge to the action

The analysis is not based on a strategic analysis of the company's goals, but instead on the analysis of the knowledge needed by the value-added activities of functional, production, business and project processes.

c3: It is a constructivist approach

The approach allows collective commitment. The aim of this approach is to build from partial knowledge of the actors through their activities, the representation of the process. This representation allows to identify informal links between the actors that are not described in the documents.

The Main Phases

In short, the GAMETH® Framework Approach consists of three main phases gathering the following steps:

ph1: Project Framing.

The first phase, called "Project Framing" specifies the project context, defines the domain and the limits of the intervention and determines the process, which is to be subjected to an in-depth analysis. The phase includes four steps: (i) the definition of the domain and specification of the context of the undertaking; (ii) the framing of the operational processes, the production processes and the organizational entities (operational units, functional services, partners, clients) dealing with the production of goods and services; (iii) the modeling of the domain of intervention (functional and structural models of the organizational entities, communication network model); (iv) the determination of the sensitive processes.

ph2: Identification of the Potential Crucial Knowledge.

The second phase, called "Identification of the Potential Crucial Knowledge", aims at distinguishing the problems that weaken the critical activities, i.e. the activities that might endanger the sensitive processes. The phase includes five: (i) the modeling of the sensitive processes; (ii) the determination of the critical activities for these processes, and the assessment of the risks to which the sensitive processes are exposed due to these critical activities; (iii) the identification of the constraints and malfunctioning that weigh down on these activities; (iv) the distinguishing of the determining problems; (v) outline the potential crucial knowledge.

ph3: Determination of the Axes of a Knowledge Management Initiative.

The third phase, entitled "Determination of the Axes of a Knowledge Management Initiative", is intended to define, localize and characterize the knowledge to be capitalized. It aims at answering the question: Who utilizes which knowledge during what phase in the sensitive process cycle? The phase includes five steps: (i) the clarification of the knowledge requirements for the resolution of the determining problems; (ii) to localize and to characterize this knowledge; (iii) to assess the value of this knowledge and to determine the crucial knowledge; (iv) to outline a project for the improvement of the decision-making processes, and of the functioning and essential production of the company; (v) to determine the axes of a knowledge management initiative.

APPLICATIONS OF THE GAMETH® FRAMEWORK

The GAMETH® Framework has been applied in different contexts. Hereafter are some case studies and lessons learned.

Case Studies

The first example has been carried out within the French Institute of Petroleum (IFP). The second example has been carried out in PSA Peugeot Citroen, with the final goal to choose and justify necessary investment to elaborate corporate memory components. The third example has been carried out within the French National Center for Scientific Research (CNRS) Engineering Sciences Department (SPI).

The IFP has applied the GAMETH® Framework in order to set up a pragmatic approach to the capitalization of knowledge within the context of a research and development project. The initiative has been taken by the Quality Direction)and was carried out as part of a five-month internship within a M.Sc. program (Research Master) ending in June 2002. The objective of the research was to facilitate the identification of potential crucial knowledge through a selection of the documents, which would contain possibly valuable future assets as part of the final steps of a project.

Within PSA Peugeot Citroen the initiative was carried out as part of a thee years research undertook by a PhD student ending in march 2004 (Saad, I., Grundstein, M., & Rosenthal-Sabroux, C. 2003). The goal was to justify a situation for which capitalizing on knowledge is advisable and choose methods dedicated to the building of a corporate memory in order to transfer the know-how and skills created and used during the design project of a component A, toward a line of design projects in progress of new components alike component A.

Within the French National Center for Scientific Research (CNRS), the SPI department intended to launch a project in order to capitalize its internal information as well as the information produced by its attached research laboratories. The GAMETH® approach has been applied during a M.Sc research internship (Master research) ending in June 2003. The objective of the study was to facilitate the decision-making process through the identification of potential crucial knowledge (both tangible and tacit) required for the well-functioning of a sensitive process within the SPI: the recruitment of engineers and technical personnel (IT). The main objective was to identify the critical activities and knowledge to be capitalized within the process.

The Lessons learned

This application of GAMETH® has shown that the identification of sensitive processes and the implementation of a constructivist approach for the representation of these processes enable the identification of potential crucial knowledge within a short time-span and without the need for excessive resources.

The experiment at the IFP has shown the compatibility of the GAMETH® approach with the ISO 9004 (December 2000) recommendations. Furthermore, the alignment of the knowledge management discourse with the quality management discourse has turned out to be a key factor in the success of the project.

At a methodological level, the GAMETH® approach should be limited to one single process and involve at most 10 individual actors in order to be feasible within a six-month period.

The essential conditions for a successful implementation are: (i) include an initiation phase to familiarize the actors with the concepts of knowledge management; (ii) assure the involvement of (an important part of) the management, which is normal in any quality assessment approach; (iii) make sure that the GAMETH® approach is implemented by an individual familiar with the Enterprise.

The relevance of the approach is to be found in the fact that it tackles the selected process first with respect to the missions to be accomplished (independent of time), then through the responsibilities involved and finally through the interfaces that may exist between the activities.

The analysis of the results leads to a reasoned and shared vision of the sensitive process by the stakeholders of this process. This emphasizes also the impact of the process being studied at different levels of organizational action. Several problems result in fact from the interrelation of processes.

CONCLUSION

The GAMETH® Framework responds to the first facet of the problem of knowledge capitalization within a company that deals with the location of potential crucial knowledge, that is explicit knowledge and tacit knowledge, that are necessary for decision-making processes and for the progress of the essential processes that constitute the heart of the activities of the company.

The case studies have shown the relevance of the GAMETH® Framework leading to the construction of a "problem space", to the identification of stakeholders, and to the clarification of knowledge requirements.

As a result of the constructivist approach logic, the involved actors contribute to the clarification of the problem and the elaboration of the solution. The approach crystallizes a learning process marked by the engagement of the stakeholders to learn together to articulate the problems and to develop the solutions. In this way, the approach acts as a catalyst of change.

Thus, the GAMETH® Framework should be integrated in process reengineering and quality management as a complementary means to

those approaches in order to identify and locate potential crucial knowledge for business processes.

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