IDEA GROUP PUBLISHING

701 E. Chocolate Avenue, Suite 200, Hershey PA 17033, USA
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ITP4642

Three Types of Data for Extended Company's Employees: A Knowledge Management Viewpoint

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ABSTRACT

This paper introduces a reflection on the types of data to accessed by be extended company's employees from the Knowledge Management viewpoint. This leads us to distinguish between three types of data: main-stream-data, shared-data, *and* source-of-knowledge-data. *In that way, as distinguishing crucial knowledge is a key factor, we propose to use a specific approach so-called* GAMETH framework, *the aim of which is to identify and locate crucial knowledge for the Company.*

1. INTRODUCTION

The concept of information system covers two notions: on the one hand, the reality of the organization that evolves and undertakes, communicates and records information; and on the other hand, the digital information system, the artificial object conceived by humans to help them acquire, process, store, transmit and restore the information that allows them to carry out their activities within the context of the organization [Reix, 95]. We will refer afterwards to the digital information system.

In the first part of this paper, we draw up a brief description of the Extended Company's digital information system and we introduce a reflection on the evolution of the employee's role within the Extended Company. This leads us to make an attempt at positioning Knowledge Management. Next, taking into account the new role of employees, we analyze the new employee's information needs when placed at his computerized desktop. And finally, we introduce the GAMETH framework.

2. THE EXTENDED COMPANY

Under the influence of globalization and the impact of Information and Communication Technologies (ICT) that modify radically our relationship with space and time, the company increasingly develops its activities in a planetary space with three dimensions: a global space covering the set of the organization that are the geographic places of implantation, a local space corresponding to the subset of the organization situated in a given geographic zone, and a space of influence that covers the field of interaction of the company with the other organizations. The hierarchical company locked up on its local borders is transformed into an Extended Company, without borders, opened and adaptable. Furthermore, this Extended Company is placed under the ascendancy of the unforeseeable environment that leads towards uncertainty and doubt .

The Extended Company meets fundamental problems of information exchange and knowledge sharing among, on the one hand, its formal entities distributed in the world (offices, core competencies, business units, projects), and on the other hand, the company's employees (nomadic or sedentary), bearers of diversified values and cultures according to the places of implantation.

Two networks of information overlap:

- An internal and external formal information network between the entities in which circulate data and explicit knowledge. Theses networks are implemented under intranet and extranet technologies.
- An informal information network between members, nomadic or sedentary employees, that privileges information exchange and tacit knowledge sharing. These networks are implemented through Communication Technologies.

3. THE EVOLUTION OF THE EMPLOYEES ROLE WITHIN THE EXTENDED COMPANY

« *What makes knowledge valuable to organizations is ultimately to make better the decisions and actions taken on the basis of knowledge* [Davenport & Prusak, 98]. » In the Extended Company which is taking place, initiatives and responsibilities are increasing, whatever the individuals hierarchical levels and roles are. Employees are placed in situations in which they need to take decisions. They become decision-makers who use and produce more and more knowledge as a basis for their efficiency. Their knowledge is the crucial factor enabling them to enhance their competencies, and thus improve their decision-making processes. To answer their missions, these individuals, commonly pointed out as « Knowledge-Workers», have to access knowledges and know-how widely distributed in the global and influence spaces of their organization. They must rely on the formal and the informal information networks of the company through their sedentary or mobile computerized workstation. The computerized workstation becomes a window opened on the company's planetary space of activities. Thus, the essential role of the digital information system is to provide relevant information to each employee at all levels of the hierarchy, so that he can control, make decisions and undertake actions.

Beyond the technical infrastructures that are implemented, the digital information system has to bring, to each individual, useful information. Moreover the digital information system has to supply means to share the knowledge with distant colleagues, and to enable access to essential knowledge in order to solve problems out of routine. Knowledge Management offers a way to answer these problems, may the employee be nomadic or sedentary, and whatever his geographic location and his mode of connection to the network (computerized workstation, laptop, personal assistants) are.

4. THE KNOWLEDGE MANAGEMENT

Today, the expression *Knowledge Management* has become a current expression that covers many different meanings according to the own perspective of the person who uses it. We make an attempt at clarifying the positioning of *Knowledge Management* as one facet of the general problem of capitalizing on company's knowledge assets.

4.1. The Multifacets Problem-Solving Approach to Capitalizing on Company's Knowledge Assets

When capitalizing on company's knowledge assets, many problems appear. We group them into a five facets model described as follows (see figure 1):

The first facet of the problem deals with **the location of crucial knowledge**, that is knowledge (explicit knowledge) and know-how (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: it is necessary to identify them, to localize them, to characterize them, to make cartographies of them, to estimate their economic value and to organize them into a hierarchy.

The second facet of the problem deals with **the preservation of knowledge and know-how**: it is necessary to acquire them with the bearers of knowledge, to model them, to formalize them and to conserve them.

The third facet of the problem deals with **the added-value of knowledge and know-how**: it is necessary to enhance their value, to put them at the service of the development and of the expansion of the company, that is to make them accessible according to certain rules of confidentiality and safety, to disseminate them, to share them, to use them more effectively, to combine them and to create new knowledge. Here is the link with innovation processes.

The fourth facet of the problem deals with **the actualization of knowledge and know-how**: it is necessary to appraise them, to update them, to standardize them and to enrich them according to the returns of experiments, the creation of new knowledge and the contribution of external knowledge. Here is the link with business intelligence processes.

The fifth facet of the problem deals with the interactions between the various problems mentioned previously. It is there that **the management of activities and processes, allowing the mastery of knowledge in organizations to be insured**, takes place. It is often called *Knowledge Management* in numerous publications. In fact, the expression *Knowledge Management* covers all the managerial actions aiming at answering the problem of capitalization of knowledge in general. It is necessary to align the knowledge management on the strategic orientations of the organization; to make people sensitive; to form, to encourage, to motivate and to rally people's interest; to organize and to pilot activities and specific processes leading towards more mastery of knowledge; to arouse the implementation of favorable conditions to the cooperative work and to encourage the sharing of knowledge; to elaborate indicators allowing the follow-up and the coordination of launched actions to be insured, to measure results and to determine the relevance and the impacts of these actions.

In this way, we can define Knowledge Management as: « *The management of activities and processes that enhance creation and use of knowledge within an organization, aim at two strongly linked goals: a patrimony goal and a sustainable innovation goal with economic, human, socio-cultural and technological underlying dimensions* ».

We will refer to KM abbreviation afterwards.

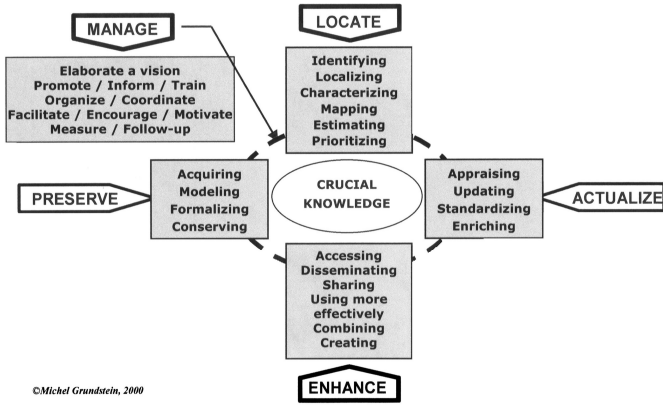
4.2. The KM Prism Analysis Model

The above definition generates the need for a Knowledge Management Framework "*which can act as a meaningful and practical guide to the context of KM initiatives – economic, technical, structural, socio-cultural – within the enterprise, and the interplay between these elements.*" [CEN/ISSS, 02]. This partially refers to the Knowledge Management Prism Analysis Model that is described hereafter.

The KM Prism Analysis Model is aimed at describing the different aspects that have to be taken in consideration when studying Knowledge Management activities and processes with enhancing the company efficiency as the final goal. Activities and processes must be analyzed under economical, organizational, socio-cultural and technological viewpoints, and on how they interact. So that we have to consider:

- Socio-organizational interactions, that is legal status, leadership, power distribution, management style, incentive and rewards, professional culture, ethic and values;
- Socio-technical interactions, that is digital information system linked to individuals (needs, self autonomy, and competence);
- Technico-organizational interactions, that is digital information system linked to organization (missions, structure, processes, relationship network).

Figure 1: The Multifacets Problem-Solving Approach



These two last points of view are central in order to conceive relevant computerized knowledge-worker desktops needed by Extended Company. The digital information system, centered on the knowledge-worker, requires a human centric design approach to place the knowledge-worker into the heart of the design process [Rosenthal-Sabroux, 96] [Kettani *et al*., 98]. The design must not dissociate the knowledge-worker, stakeholder of different functional and organizational groups and lines of business or projects, from the professional processes in which he is engaged, the actions he performs, the decisions he makes, the relations he has with his company environment (persons and artifacts).

Furthermore, beyond the conventional information system, the digital information system must bring to each computerized workstation three natures of information put in light by our research works on Information System, Knowledge Management and Decision Aid.

5. THE KNOWLEDGE-WORKER AT HIS COMPUTERIZED DESKTOP

Our researches focused on knowledge management and the knowledge-worker at his computerized desktop have led us to distinguish three general categories of data to be processed by the digital information systems: the *main-stream data*, the *source-of knowledge data*, the *shared-data* [Grundstein & Rosenthal-Sabroux, 01].

5.1. The Three General Categories of Data

When considering the notion of *Knowledge Portal* that has emerged as a key tool for supporting knowledge work [Mack *et al*., 01], we observe that the analysis has been done from a specific point of view, that is "*a fundamental aspect of knowledge management is capturing knowledge and expertise created by Knowledge-Workers as they go about their work and making it available to a larger community of colleagues.*" Our research are more focused on the problematic that is set down above. Therefore we have been led to distinguish three general categories of data as described below.

The Main-Stream-Data

The *main-stream-data* makes up the flow of information that informs us on the state of a company's business process or working information needed by each individual to act. If the digital system information is itself a company's production system (for example, a bank's digital information system), the *main-stream-data* informs us on the state of the information-related material to be transformed, and on the state of the digital information system that carries out this transformation. If the company's production system involves physical materials, *the main-stream-data* will provide information on the state of that material before and after the transformation, and will give information on the whole environment that makes this transformation possible.

The Source-of-Knowledge-Data

The *source-of-knowledge-data* is the result of a knowledge-engineering approach that offers techniques and tools for acquiring and representing knowledge. This knowledge, encapsulated in computer programs capable of reconstructing it as information immediately understandable to human beings, thus becomes accessible and manipulable. This leads us to integrate into the digital information system specific modules called *source-of-knowledge-data* systems, that both in their conception and in the techniques used to implement them influence the results produced through new orientations in knowledge engineering research [Charlet *et al.*, 00].

The Shared-Data

Moreover, the information and communication technologies have caused a rupture with older technologies, a rupture linked to the relationship of human beings to space, to time and to the capacity to be ubiquitous which take us from the real world to a virtual one, from the manipulation of concrete objects to abstract ones. The instantaneous transfer of digitalized multimedia documents that include texts, images and sounds, the possibility of asynchrony of information exchanges that transforms our relationship with time and space, electronic conferences that allow us to be in different places at the same time, engender a transformation in our behavior at work. They accelerate the publication and dissemination of documents, they facilitate working in groups, they modify our means of communication, and above all, they speed up the transmission and sharing of tacit knowledge that, until now, operated from person to person on a master-apprentice basis. In short, they generate processes of information exchange that were unbelievable with previous technologies. Information processed by these technologies is called "*shared-data*".

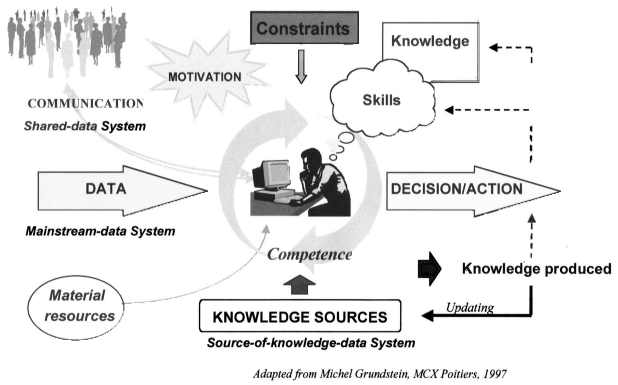
5.2. The Knowledge-Worker Desktop

Within the Extended Company, Knowledge-Workers find themselves confronted to situations that go beyond daily routine, situations in which they must evaluate all possible choices in terms of criteria relevant to a given set of goals. Taking into consideration all available information (*main-stream-data*, *shared-data*, *source-of-knowledge-data*), their own intentions, any restrictions that influence their decisions and their knowledge and know-how, they must analyze and process information in order to make these choices. We have materialized this vision under an empirical model form described below (see figure 2).

The Knowledge-Worker engaged in business or project lines processes is subjected to constraints inherent to these processes (available financial and human resources, cost, delays, quality, security, specific objectives to achieve). He uses physical resources (working environment, tools). He possesses knowledge and skills. Through the "*Main-Stream-Data System*", he receives and gets "current data", *i. e*., data relative to the tasks he has to execute (data on the status of the work he is achieving, data on evolving events to take in charge, management and technical data). Through the "*Shared-Data System*", he communicates in real time with the other actors, he exchanges information and shares tacit knowledge. To make a decision and act, he activates a cognitive process that shows his capability to put together his knowledge, his skills, his ethical attitude, under constraining conditions of his task situation. Here, we refer to his competence.

His knowledge and skills can prove to be insufficient to solve the out-of-routine problem he is confronted with. In that case, and according to his intention that depends on his freedom of action, he needs to get additional data stored in the "*Source-of-Knowledge-Data System*". This data, by interaction with his cognitive system, becomes new knowledge, enabling him to solve the problem, make decision and act. During this process, there is production of new knowledge. This new knowledge, on the condition of being acquired and formalized, can update and complete the "*Source-of-Knowledge-Data System"* [Grundstein & Rosenthal-Sabroux, 01].

Figure 2: The Knowledge-Worker as a Decision-Maker



Adapted from Michel Grundstein, MCX Poitiers, 1997

What is essential in this vision of things is the creative relation, between the knowledge-worker and his activity, taking into account his "intention", the end purpose of his action, and the orientation of knowledge towards an operational objective [Grundstein, 00].

Consequently, when considering the multifacets problem-solving approach to capitalizing on company's knowledge assets, we can envisage the digital information system as an essential instrument to provide Knowledge-Workers with crucial knowledge that is required to accelerate and improve the reliability and the quality of their decisions. The problem consists of being aware of what is known and what is crucial for Knowledge-Workers in order to achieve their tasks and respond to the functional, organizational, business lines and project lines overall goals aligned on the company's strategic orientations. This is the aim of the GAMETH framework that is briefly described in the following section.

6. THE GAMETH FRAMEWORK

As pointed out by Richard Collin [Collin, 01],

today, the knowledge management mainly amounts to store, to organize, to extract, to analyze and to spread information in the company. The role of the actors is underestimated and the knowledge management is mostly oriented towards "contents": information stock is privileged with regard to the dynamics of knowledge sharing. People looking for information are lost, while they are the source of the value: loss of orientation facing a vast and heterogeneous stock of information; loss of energy caused by the necessity of repeating requests to find the reliable solution; loss of sense bound to the absence of visibility concerning the operational utility of the information. The holder of information is not really mobilized: one asks him to give his knowledge without being paid for that. Information is little shared, little updated, badly exploited.

In fact, while since 1991 Thomas A. Stewart has made us sensitive to the necessity of considering the knowledge of the company as the essential resource and has announced a new challenge « *The challenge is to find out what you have - and use it* » [Stewart, 91], in his last work the same author notices the fatal effect of "contents" oriented processes that were not subjected to advisability studies: *« Companies waste billions on knowledge management because they fail to figure out what knowledge they need, or how to manage it* » [Stewart, 02].

Beyond the incentive organizational ways, methods and indispensable tools, the implementation of Knowledge Management points out a real need: the need to locate crucial knowledge for the company. This last point is developed below.

6.1. A Brief History of the GAMETH Framework

The GAMETH framework is one of the results of the CORPUS project initiated and led from 1991 to 1995 into the Framatome Group[1]. 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, 96]. As an example, for a quotation improvement project, this approach leads to highlighting a problem that we had decided to call "*knowledge traceability*", that is a generic problem based on the following needs: the need to refer to earlier facts, the need to refer to analogous cases, the need to ask questions about earlier choices, and the need to rely on experience feedback. Beyond a system that helps to prepare quotations, the solution implemented the functionality necessary for *"knowledge traceability"*. This functionality responded to the problematic of capitalizing on company's knowledge assets defined above.

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.

6.2. General Description of GAMETH framework

The GAMETH framework is described below. The GAMETH framework consists of looking more directly at the production processes. The GAMETH framework relies on three postulates, suggests three guiding prin-

ciples, induces an approach that has three specific characteristics and consists of three main stages. A detailed description has been given in [Grundstein *et al*., 02].

The postulates

The approach is based on the following postulates:

1) Knowledge is not an object, knowledge exists in the interaction between a person and data.
2) Knowledge is linked to the action.
3) Company's knowledge includes two main categories of knowledge: explicit knowledge – the specific know-how that characterizes the company's capability to design, produce, sell and support its products and services - and the individual and collective skills that characterize its capability to act and to evolve.

The guiding principles and the characteristics

The approach is characterized by three main characteristics:

1) 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.
2) 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.
3) It is a constructivist approach that 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 stages

The approach is aligned on the company's strategic orientation, and the deliverable is an Advisability Analysis Report that notably includes:

- A repertory of the crucial explicit knowledge, associated with a document presenting a description and a classification of these knowledges.
- A repertory of agents, the bearers of crucial tacit knowledge, associated with a document presenting a description and a classification of these knowledges.
- An index of the agents possessing knowledge elicitable, associated with a descriptive card of their competences, the persons who might solicitate them and the events that determine this solicitation.
- A document defining the tacit elicitable knowledges that should be shared, completed with a grid establishing the formal and informal relations between the agents, bearers of these knowledges, and the agents who might use them.
- Recommendations concerning the acquisition and the formalization of tacit elicitable knowledges.

In short, the GAMETH Framework Approach consists of the following steps:

- inventorying the goods and services for which a knowledge capitalization initiative is envisaged;
- modeling the units (functions, organs, and communication links) that supply these goods and services;
- delimiting the production processes concerned and specifying the phases and steps of the production cycles corresponding to these processes;
- analyzing the role of the poles of expertise in the satisfactory operation of each phase and each step of the production cycles;
- analyzing the risks and determining the critical activities;
- identifying the constraints and dysfunctions that weigh on these activities;
- distinguishing the determining problems;
- locating and characterizing the knowledge necessary to solve these problems;
- measuring the value of this knowledge and determining the crucial knowledge;
- drawing up a map of the knowledge to be capitalized, based on the inventory of the actors;
- cross-checking with the crucial knowledge, for each phase of the production cycles concerned.

In this way, the fields of knowledge, their locations, their characteristics and their influence on the operations of the company and its strategic orientations are detailed. At the end of the advisability analysis, the elements enabling the justification of a knowledge capitalization exercise will have been gathered, making it possible to decide upon and undertake the feasibility study.

7. RESEARCH PROSPECTS

Our research has two prospects in view.

1) When practicing the GAMETH framework approach, we are led to consider capitalizing on company's knowledge assets as a part of the digital information system project specification. Thus, customer's requirements are studied in depth during the advisability phase. The study emphasizes the required needs for knowledge that allow the resolution of well-posed problems. People are involved in the construction of the solution. As such, when considering integrating into a digital information system project, functionalities that will support knowledge management, the GAMETH framework approach can be useful. In particular we think about the establishment of a link with the inception phase of the development cycle as defined in the Rational Unified Process (RUP) [Kruchten, 99].
2) When speaking of crucial knowledge, the problem of finding good criteria arises. We are working in this way with a large automotive company which wants to justify investment in knowledge management initiatives.

The GAMETH framework has been implemented into a methodology developed by Alexandre Pachulski during his doctoral studies [Pachulski, 01]. The GAMETH framework partially underlies the KDE project[2] [Esprit project, 01]. It is the basis for another doctoral study specially focused on knowledge qualification [Saad *et al.*, 02]. At this point, this methodology is not completely validated as it has not been tested in a scientific protocol way.

ENDNOTES

1 French Nuclear Power Plant Company, first transformed into Framatome ANP, then integrated into AREVA Group in September 2001.

2 Esprit-IV Project 28678. Participants are Bureau Veritas, Eutech, Intrasoft, Salustro-Reydel Management, TXT and the University of Amsterdam.

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