A Global Vision of Information Management

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Abstract. The definition of Information System do not consider individual as a component of the Information System. In this paper we present our postulates, and our definition of Knowledge Management and Knowledge Management Systems. We describe the Model for Global Knowledge Management within the Enterprise (MGKME) that has been conceived in order to serve as a referential for Knowledge Management Systems in enterprise. Then we suggest a transposition of this model to Information System. This transposition leads to highlight two axis of research: (i) How to consolidate the concept of Information System considering individuals as users and components of the system; and (ii) How to use Information System as one of the factors enabling organizational learning processes.

Keywords: Model for Global Knowledge Management within the Enterprise (MGKME), Knowledge Management (KM), Knowledge Management System (KMS), Model for Global Information Management within the Enterprise (MGIME), Information System (IS), Information Management (IM), Information Management System (IMS).

1 Introduction

Many authors have already defined the concept of Information System, for example let's quote the following definitions: "An Information System is an organized set of resources: material, software, employees, data, procedures, in order to acquire, to process, to store, to disseminate information (data, documents, image, sound, etc.) in organization" [1]. "An Information System is the set of all elements that contribute to the process and the circulation of informations in an organization (data base, software, procedures, documents) including Information Technology" [2].
"Technically, we can define an Information System as a set of elements interconnected which collect (or recover), process, store and disseminate information in order to support decision and process control in organization" [3].
Technological vision of the Information System underlies these definitions. They do not take into account the actors of the enterprise as an integral part of Information System, that means as media and processors of information. Moreover, our research on Knowledge Management (KM) leads us to conceive a model that can serve as a referential in order to positioning Knowledge Management researches and Knowledge Management initiatives in enterprise. This model called "Model for Global Knowledge Management within the Enterprise" (MGKME) highlights the necessity to

consider actors as, at the same time, users and components of a Knowledge Management System.
In this paper we present our postulates and our vision of Knowledge Management, and. we describe the Model for Global Knowledge Management within the Enterprise (MGKME). Then we highlight the concept of Knowledge Management Systems (KMS), and we show how it can be transposed to Information Management System. This leads us to suggest two axis of research: (i) How to consolidate the concept of Information System considering individuals as users and components of the system; and (ii) How to use Information System as one of the factors enabling organizational learning processes.

2. Our Vision of Knowledge Management

KM is often looked at from a technological viewpoint, which leads to consider the knowledge as an object and disregard the importance of the people. To avoid this drift, in 2001, the CCRC ECRIN Working Group defines KM as follows:
"KM is the management of the activities and the processes that enhance the utilization and the creation of knowledge within an organization, according to two strongly interlinked goals, and their underlying economic and strategic dimensions, organizational dimensions, socio-cultural dimensions, and technological dimensions: (i) a patrimony goal, and (ii) a sustainable innovation goal."
This definition implies three postulates: (i) Company's knowledge includes two main categories of knowledge; (ii) Knowledge is not an object; and (iii) Knowledge is linked to the action. These postulates are defined below.
(i) Company's knowledge includes two main categories of knowledge
Within a company, knowledge consists in explicit knowledge on the one hand, composed of all tangible elements (we call it "know-how"), and on the other hand tacit knowledge [4], which includes intangible knowledge (we call it "skills"). The tangible elements are formalized in a physical form (databases, procedures, plans, models, algorithms, analysis and synthesis documents) and/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 [5] or as personal knowledge (skills, crafts, "job secrets", historical and contextual knowledge, environmental knowledge – clients, competitors, technologies, socio-economic factors).
(ii) Knowledge is not an object
Knowledge lies 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 [6], who deals with the construction of tacit individual knowledge. According to his research, the tacit knowledge, which lies within one's brain, is the result of the meaning one allocates – through one's interpretative schemes – to the data that one perceives as part of all the information received. This individual knowledge is tacit and it may or may not be expressed. It becomes collective knowledge as soon as it is shared by other

individuals, whose interpretative schemes are "commensurable", i.e. schemes that enable a minimal common level of interpretation, which is shared by all members of the organization.

(iii) Knowledge is linked to the action

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

3. MGKME Description

The MGKME supports our full meaning of KM as defined above. It should be seen as an empirical model. It consists of two main categories of elements (see fig.1): (I) the Underlying elements, and (II) the Operating elements.

3.1 The Underlying elements (I)

The core knowledge is embodied in people heads and their abilities to utilize them, and to generate new knowledge at the same time. The Information Technologies and the tangible technical resources enhance their competence, while Value-Added Processes, and Organizational Infrastructures are structuring their activities. Nevertheless, their social interactions [7] are essential factors, which leverage their potentialities, and that actually enable them to achieve effective results. Therefore, from our perspective, Sociotechnical Environment, and Value-Added Processes are fundamental elements that constitute the underlying elements of the MGKME.

The Sociotechnical Environment❶

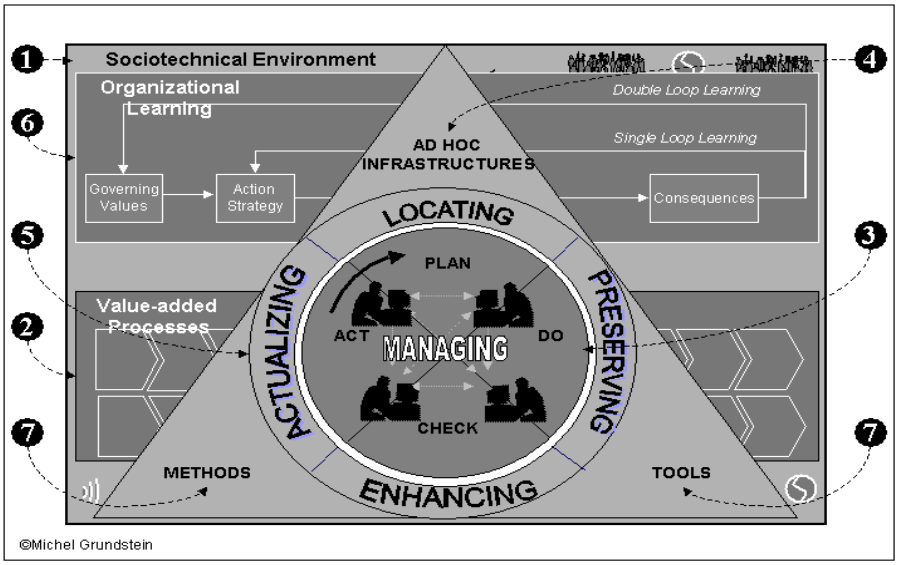
The Sociotechnical Environment constitutes the social fabric where autonomous individuals supported by ICT and tangible resources interact and are conversing through physical or virtual places (coffee machines, collaborative work spaces, weblogs, wikis, CoPs). Interacting is not enough. Thus, [8] observed what happens when there is interacting without conversing: "Stories are not told and associated sense of adventure is lost; knowing is not shared because questioning is not fostered; people become isolated, angry, resentful and do what they do with no real joy; while a business may be profitable it is likely that it is not operating at anywhere near its potential".

The Value-Added Processes❷

Value-Added Processes represent the organizational context for which knowledge is the essential factor of performance. It is in this context that is implanted a KM initiative. As pointed out by [9] "Process Management, with the concepts of internal customers and process ownership, is becoming one of the most important competitive weapons for firms and can determine a strategic change in the way business is carried out". These authors specify that: "Process Management consists in the rationalization of processes, the quest for efficiency/effectiveness, a sort of

simplification/clarification brought about by common-sense engineering". As Process Management engenders structural changes, when doing Business Process Reengineering we should consider KM activities in order to identify knowledge, which is the essential factor to enable Value-Added Processes to achieve their goals efficiently.

***Fig. 1**. Model for Global Knowledge Management within the Enterprise (MGKME)*



3.2 The Operating elements (II)

The operating elements of the MGKME focus on the underlying elements. They consist of managerial guiding principles, relevant infrastructures, generic KM processes, organizational learning processes, and methods and supporting tools.

The Managerial Guiding Principles❸

The Managerial Guiding Principles should bring a vision aligned with the enterprise's strategic orientations, and should suggest a KM Governance principles by analogy with Control Objectives for Information and related Technology [10] that was initially published by the Information Systems Audit and Control Foundation, Inc. in 1996. The IT Governance Institute issued the third edition, which incorporates all-new material on IT Governance and Management Guidelines, in 2000. COBIT® presents an international and generally accepted IT control framework enabling organizations to implement an IT Governance structure throughout the enterprise [11]. In particular, KM indicators must be established. Numerous publications and books relates to that subject [11], [12], [13], [14] and [15]. From our viewpoint, two main categories of indicators should be constructed in order to monitor a KM initiative: (i) a category of indicators that focus on the impacts of the initiative favoring enhancement of intellectual capital; (ii) a category of indicators that insure monitoring and

coordination of KM activities, measuring the results, and insuring the relevance of the initiative.

In addition, we should find a way to get a good articulation between the Deming's cycle and the Organizational learning. Firstly, we refer to the PDCA cycle of activities – plan, do, check, and act [16]. This cycle, first advocated by Deming [17] is well known as the Deming's Cycle by Quality Management practitioners. The PDCA cycle has inspired [18] Quality Standards in order to get a continuous process improvement of the Quality Management System. Secondly, we refer to the Single-Loop Learning and Double-Loop Learning defined in the Argyris & Schön's organizational learning theory [19]. Thus, we point out the key contribution of Knowledge Management to Change 2 defined by Watzlawick [20].

The Relevant Infrastructures ❹

The Relevant Infrastructures are adapted sets of devices and means for action. Beyond a network that favors cooperative work, it is important to implement the conditions that will allow sharing and creating knowledge. An ad hoc infrastructure must be set up according to the specific situation of each company, and the context of the envisaged KM initiative. This infrastructure could be inspired by the Japanese concept of Ba that "can be thought as a shared space for emerging relationships" [20].

The Generic KM Processes ❺

The generic KM processes answer the problem of capitalizing on company's knowledge defined in the following way: "Capitalizing on company's knowledge means considering certain knowledge used and produced by the company as a storehouse of riches and drawing from these riches interest that contributes to increasing the company's capital" [21]. Several problems co-exist. They are recurring problems with which the company was always confronted. These problems constitute a general problematic that has been organized in five categories [22]. Each of these categories contains sub-processes that are aimed to contribute a solution to the set of overall problems. Thus, we have identified four Generic KM Processes corresponding to the resolution of these categories of problems. These processes are described below.

The Locating Process deals with the location of Crucial Knowledge: it is necessary to identify it, to locate it, to characterize it, to make cartographies of it, to estimate its economic value, and to classify it. One can mention an approach named GAMETH® [22] and [23] specifically aimed to support this process.

The Preserving Process deals with the preservation of know-how and skills: when knowledge can be put into words, it is necessary to acquire it with the bearers of knowledge, to represent it, to formalize it, and to conserve it. This leads to Knowledge Engineering activities that are notably described in [24]. When knowledge cannot be put into words, then interactions through communities of practice or other types of networks must be encouraged.

The Enhancing Process deals with the added-value of know-how and skills: it is necessary 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 Actualizing process deals with the actualization of know-how and skills: 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 Organizational Learning Processes ❻

The Organizational learning processes underlay the whole Generic KM processes. The aim of the organizational learning process is to increase individual knowledge, to reinforce competencies, and to convert them into a collective knowledge through interactions, dialogue, discussions, exchange of experience, and observation. The main objective consists in fighting against the defensive routines that make barriers to training and change. So, it is a question of helping the members of the organization to change their way of thinking by facilitating an apprenticeship of a constructive way of reasoning instead of a defensive one.

The Methods and Supporting Tools for KM ❼

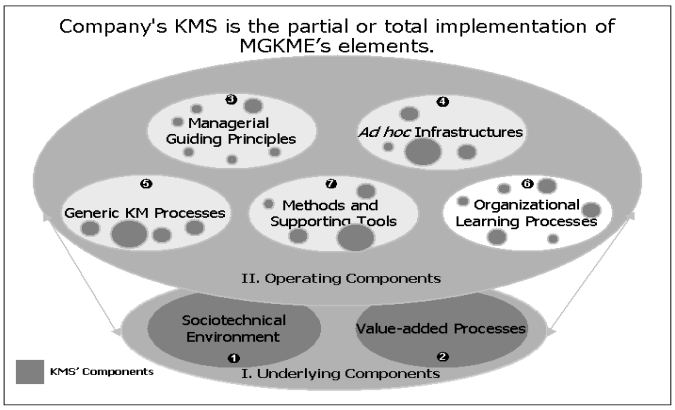
The methods and supporting tools relevant for KM can be determined only when considering the enterprise context and the envisaged KM initiative. One can find the descriptions and the characteristics of technologies, methods and supporting tools relevant for KM in many publications such as, for example[25], [26], [27] and [28], Actually, as mentioned by [29]: "(Employees) become decision-makers who use and produce more and more knowledge as a basis for their efficiency… Commonly pointed out as « Knowledge-Workers», (they) have to access know-how and skills widely distributed in the global and influence spaces of their organization… The computerized workstation becomes a window opened on the company's planetary space of activities". As a result, the information and application portals have become essential for the knowledge workers who have to share with colleagues disseminated all around the world. Thus, portals must be seen as collaborative Information Systems, as mentioned by [30] in their study on Collaborative Knowledge Management System (CKMS) defined as follows: "A Collaborative Knowledge Management System (CKMS) is an integrated systems tool that enables collaboration between its users and its components". They emphasize that "one of the most important components of CKMS is the knowledge workers, which are also the users of the system, and the workspaces they are associated with". Moreover, analyzing ISO/IEC 9126 Quality Standard and [30] point out that, "existing interpretations of ISO 9116 account for their role as users however not for their role as systems components". We insist on the importance to integrate the individual as a component of the system. In fact, relying on the professor Tsuchiya's works [6], we argue that knowledge is dependent of the individual's mental model and the context of his action. Consequently, knowledge resides primarily in the heads of individuals, and in the social interactions of these individuals. It cannot be consider as an object such as data are in digital information systems. Likewise, information can be misunderstood as it makes sense for an individual through his interpretative framework. As mental models and interpretative frameworks are directly forged by cultural factors, it induces to stress the role of cultural factors when social interactions and sharing information and knowledge are essential to enable efficiency in the global economy. Therefore, the project manager should consider the individual (knowledge worker and decision-maker) both at once as a user, and a component of the Knowledge Management System. Consequently, the conception of the digital Information System has to take into account the nature of the information that the individual, as a decision-maker, must be able to access. Three natures of information must be

distinguished: the *Mainstream-Data*, the *Source-of-Knowledge-Data*, and the *Shared-Data* [29] and [31]. Among the tools, the information and applications Portal, that supplies a global access to the information, can meet the needs of KM. In that case, the functional software and the tools answering the aim of KM is integrated into the digital Information System.

4 Knowledge Management System

KM becomes a reality in the implementation of a system, which is, paraphrasing [32] "A set of components in dynamic interaction organized according to a purpose." The purpose of this system is to amplify the utilization and the creation of knowledge so as to improve the enterprise's effectiveness. This system is often called Knowledge Management System (KMS) although this term "does not seem to have a consensus definition" [33]. So we have to distinguish between a model for a KM initiative and a KMS which is its implementation in the real world. MGKME suggests a sociotechnical approach defined as "the study of the relationships and interrelationships between the social and technical parts of any system [34]. So, the KMS that materializes MGKME is composed of organizational, human, and technical components. Thus, taking MGKME as a model of reference, avoids limiting the notion of KMS to the notion of Information Technology (IT) based system that reduces a KMS to a data processing system. This is often the case as shown, for example, by [35]. These authors, when speaking about KMS, refer to the works of [36], and [37]. In this way, KMS is "developed to support and enhance the organizational knowledge processes of knowledge creation, storage, retrieval, transfer and application" [36]. Furthermore, "knowledge management systems are divided into several major categories, as follows: groupware, including e-mail, e-log, and wikis; decision support systems; expert systems; document management systems; semantic networks; relational and object oriented databases; simulation tools; and artificial intelligence" [37]. The fig.2 shows an instantiation of MGKME into a KMS. Identifying the KMS components included into the MGKME elements enable to measure the maturity of the knowledge management initiative within the enterprise.

Fig. 2. *Instantiation of the MGKME*



5 Transposing the global vision of knowledge management to a global vision of information management

The concept of Information Management within the enterprise covers two notions: (i) the reality of the enterprise that evolves and undertakes, disseminates and records information, (ii) the digital Information System, the artificial object conceived by humans to support employees to collect, store, process and disseminate the information, in order to carry out their activities within the context of the organization. When considering the instantiation of MGKME into a Knowledge Management System as shown on fig.2, we can make a transposition to Information Management System (IMS). According to this hypothesis, the components of the IMS should be as follows (see fig. 3).

5.1 Underlying components

The Sociotechnical Environment and the Value-Added Processes give a concrete expression to the first notion of Information Management, which is the reality of the enterprise that evolves and undertakes, disseminates and records information.

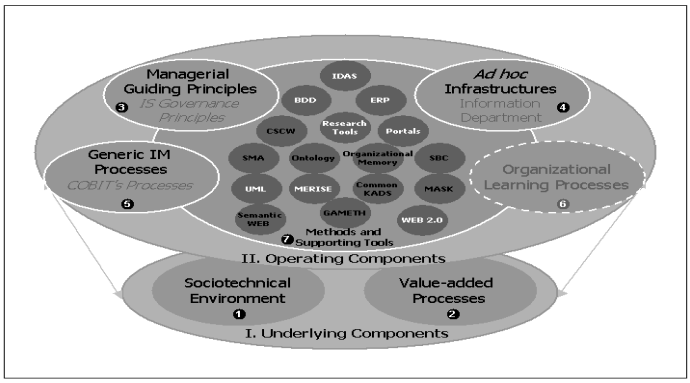
5.2 Operating components

The operating components represent the second notion that is the digital Information System, the artificial object conceived by humans to support employees to collect, store, process and disseminate the information, in order to carry out their activities within the context of the organization.

Thus, the Managerial Guiding principles and Generic IM Processes (that are the transposition of Generic KM processes) are directly issued from IT Governance Principle, and Processes described in the COBIT®; the Ad hoc infrastructures are implemented as Information Management System Department; Methods and Supporting Tools (such as Data Management, ERP, IDAS, Portals, Research Tools, Web 2.0, UML, MERISE) issue from IS. They complement one another with KM

Methods and Tools (such as CSCW, MAS, KBS, Semantic Web, Ontology, Organizational Memory, Common KADS, MASK, GAMETH®).
The only component that does not exist is the Organizational Learning Component.

***Fig.3**. Transposing Knowledge Management System to Information Management System*

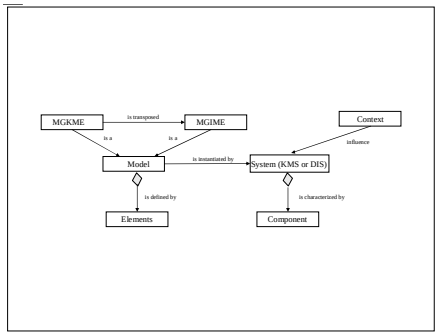


6 Essential points

The essential points highlighted by the transposition are as follow:
We distinguish the concept of model from the concept of system, which is its instantiation in the actual world. The model is defined by its elements and the system is characterized by its components. This is represented in the macro-architecture of the transposition from the Knowledge Management model, MGKME, to the MGIME for Information Management model, in fig.4.
Digital information system enables only flows of data and information. Therefore, distinguishing three types of information, as recommended in MGKME, leads to conceive Digital Information System taking into account the Source-of-Knowledge-Data, and the Shared-Data. For example we will use knowledge engineering and Web 2.0 methods and technologies.
In MGKME, considering tacit knowledge embedded by individuals, we have to considerer individuals as integral part of Knowledge Management System (KMS), that means as a component of the system, which is a processor of knowledge. As a metaphor we think about virtual reality applications or second life applications.
In the transposition to MGIME, beyond the vision of individuals as users, we integrate the vision of individuals as a processor of information in the context and the situation of their activities. This is an innovation, when we considerer the ISO/IEC 9126, which take into account the role of individuals as users and not their role as system's components. A part of MGKME model as been validated with a system for Operational Performance Management (OPM) implemented in an Entertainment Company based in France [38]. It highlights the importance of the "Intention" (associated to the enterprise culture and the personal skill, and the importance of "Shared" data system. This analysis leads to highlight the formalization of the

different data flows, the impact of the system on the organization, and to confirm the importance of individual as a processor. Furthermore, it opens new perspectives about the role of the Digital Information System in the organizational learning process to insure the Business Continuity Plan.
The context is inherent with underlying components as sociotechnical environment and value-added processes.

Fig.4. *The macro-architecture of the transposition of MGKME to MGIME*



7 Conclusions and Perspectives

Many authors have already defined the concept of Information System. These definitions are underlined by a technological vision of the Information System. They do not take into account the actors of the enterprise as an integral part of Information System that means as media and processors of information. We expect that the MGKME will serve as a pattern of reference for establishing a Model for Global Information Management within the Enterprise (MGIME). Thus, the Information Management System components described in this paper should be the partial or total implementation of the MGIME elements. In this case it appears that, on the one hand, some methods and tools coming from KM can be integrated into the Information Management System, and on the other hand that Information Management System does not integrates organizational learning.
We hope to succeed in elaborating the MGIME that should become an open framework as a basis to launch two axis of research: (i) How to consolidate the concept of Information System considering individuals as users and components of the system; and (ii) How to use Information System as one of the factors enabling organizational learning processes. In the future, we should complete and validate the MGIME, by developing our researches in that sense.

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