Chapter

Toward Management Based on Knowledge

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Abstract

In a world overwhelmed with pervasive digital technologies, the organization is transformed and becomes a socio-technical system which is constantly renewed. Organization needs specific skills, adapted to the values and to the cultures peculiar to each location. The cooperation and the mobility become a shape of inescapable work which rests on a permanent personal and collective learning. Beyond the information handled in the digital information systems, the role of the tacit knowledge, which is in each individual's head, cannot be ignored. A constructivist attitude replaces a determinist attitude strongly deep-rooted in our educational modes. The managers have to pass from a posture of authority and of control to a posture of incitation, of support, and of accompaniment. The notions that are introduced in this chapter result from a managerial and socio-technical vision of knowledge management. They arouse essential reflections to develop a mode of management adapted to the digital transformation of the organizations called management based on knowledge.

Keywords: management based on knowledge (MBK), cognitivist perspective, constructivist perspective, knowledge management (KM)

1. Introduction

In a world disrupted by the omnipresence of digital technologies,[1] the hierarchical organization closed on its local borders has evolved into an extended, borderless, open, and adaptive organization under the control of an unpredictable environment that creates uncertainty and doubt. Organization encounters fundamental problems of information exchange and knowledge sharing between: on the one hand, its formal entities spread throughout the world (functions, business units, projects), and, on the other hand, her members carry values and cultures diversified according to their local sites. Regardless of their roles and hierarchical positions, actors are faced with new situations that increase their scope for initiatives and responsibilities, and they become decision-makers.

This chapter presents basic concepts derived from our industrial experience and our university research. These concepts constitute the roots of our vision of managerial and socio-technical approach of knowledge management (KM) that we transpose to the concept of "management based on knowledge (MBK)," described

[1] The term "digital," used in this chapter, refers to digital information systems characterized by the contributions of Web 2.0, reinforced in particular by Big Data, analytics, machine learning and deep learning technologies, and physical tools such as smartphones and tablets, equipped with SIM cards giving access to 4D, which have become essential prostheses for the human being in his personal and professional life.

in this chapter. That supplies a set of elements which raise awareness of crucial problems linked to the digital transformation of the organizations and transcend traditional solutions.

In Section 2, the chapter describes the background theories and assumptions. We introduce a reflection on knowledge within organization considered from two perspectives: a cognitivist perspective and a constructivist perspective. We state three interlinked fundamental postulates that constitute the basis of our approach of knowledge management; we present our vision of KM that we call "managerial and socio-technical" approach to KM. In Section 3, the chapter provides a discussion about KM, and we identify two main approaches underlying KM: a technological approach and a managerial and sociological approach. Then, in Section 4, the chapter introduces the socio-technical approach to the organization and the concept of organization's information and knowledge system (OIKS/SICO). Finally, in Section 5, the chapter presents the management based on knowledge with regard to the problem of capitalization on knowledge within organizations. This vision is a transposition of our approach to knowledge management.

2. Background theories and assumptions

2.1 Research motivations, method, and objectives

In this chapter, the basic concepts presented are derived from our industrial experience and university researches. As an operational manager responsible for the deployment of innovative technologies (including computer-aided design and knowledge-based systems) in a large industrial company—at a time when these technologies had just been developed in universities and laboratories—we developed empirical models with a socio-technical vision of organizations. These models have been used as references to generate the organizational learning process that induced organizational members to appropriate and use these technologies.

Later on, we became associate researcher in the domain of knowledge management, and we highlighted the lack of KM models with a socio-technical perspective. As the project's manager, we practiced a constructivist approach underlying the creation and use of knowledge. The interactions of these dual trajectories are at the root of a useful reflection on the establishment of the concept of "management based on knowledge," transposed from our "managerial and socio-technical" approach of knowledge management.

In addition, this reflection is based on (1) few books posing the fundamentals of knowledge management [1–9], (2) the work of the European Committee for Standardization (CEN) KM working group [10], and (3) the thesis conducted at LAMSADE[2] [11–16].

We wish that this chapter should be useful for all stakeholders of the digital transformation processes within organizations.

2.2 Knowledge within organizations considered from two perspectives

Our research has led us to identify two major approaches to knowledge management in organizations: a technological approach and a managerial and sociological approach. These approaches are significant for the fundamental conceptual distinction of two world visions: the cognitive perspective and the constructivist

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perspective, highlighted by [4]. Thereafter, we agree with their analysis and paraphrase, in large part, what they say, which describes two ways of approaching the concept of knowledge in organizations.

2.2.1 Cognitivist perspective (representationism)

The cognitive perspective is the best established and best known. It began in the early 1950s with considerable advances in computer science, systems theory, psychology, and neuroscience. The cognitive sciences provided important insights into the physical structure of the brain and the functioning of cognitive processes. Formal models of the cognitive system as an information processing machine and logical reasoning were developed. Knowledge was envisaged as representations of the world consisting of a number of objects and events, and the key task of the brain (or any other cognitive system) was to represent or model them as accurately as possible. Knowledge was universal; two cognitive systems were to lead to the same representation of the same object or event. For cognitivists, knowledge was explicit, capable of being encoded and stored, and easily communicable to others.

Moreover [17], specified that from a cognitive perspective, two major hypotheses concerning knowledge can be identified:

- Knowledge is seen as a representation of a pre-defined world. This implies that reality, whether objects, events, or states, lies outside the subject of knowledge and is given objectively for everyone.

- Knowledge can be seen as information processing and rule-based symbol manipulation.

2.2.2 Constructivist perspective (anti-representationism)

Resting on new contributions of the neurobiology, the cognitive sciences, and the philosophy, the constructivist point of view envisages the cognition as an act of construction or creation rather than an act of representation [4]. The prospect anti-représentationniste of Von Krogh and Johan Roos leans in particular on the model "autopoïèse" created by [18], two Chilean biologists, who suggested that the cognition was a creative act of production of the world. Because knowledge lives in ourselves and is closely linked to our senses and our previous experiences, we are brought to create the unique world to ourselves. So, knowledge is not universal, and the constructivist carries only not much attention to comparisons between different models. The constructivist approach considers that the cognitive system works when knowledge allows effective actions. For certain constructivists knowledge is explicit, but others can be tacit, strongly personal, not easy to express, and consequently little easy to share with others [4].

These two perspectives influenced the theories and the practices of the management. However, the interest of the constructivist studies is that they consider as well the tacit aspects that the explicit aspects of knowledge. The main features of these two perspectives, enriched by [19], are summarized in **Table 1**.

2.3 Three fundamental postulates

Our observations and experiments within the industry led us to set forth three postulates about knowledge within organizations: (i) knowledge is not an object, (ii) knowledge is linked to the action, and (iii) organization's knowledge includes two main categories of knowledge. We define these postulates hereafter.

The cognitivist perspective of knowledge within organizations (representationism)	The constructivist perspective of knowledge within organizations (anti-representationism)
• Knowledge is seen as a representation of a pre-defined world. This implies that reality, whether objects, events, or states, lies outside the subject of knowledge and is given objectively for everyone • Knowledge is universal: two cognitive systems should lead to the same representation of the same object or event • Cognition (the ability to know) is seen as information processing and rule-based symbol manipulation • The cognitive approach considers that the key task of the brain (or any other cognitive system) is to represent or model reality as accurately as possible • For cognitivists, knowledge is explicit, can be encoded and stored, and is easily transmitted to others	• Knowledge resides in ourselves. It is closely linked to our senses and past experiences • Knowledge is not universal; we are driven to create the one world for ourselves • Cognition (the ability to know) is considered an act of construction or creation rather than an act of representation • The constructivist approach considers the cognitive system to work when knowledge enables effective actions • For constructivists some knowledge is explicit, but others may be tacit, highly personal, not easily expressed, and therefore difficult to share with others. Tacit knowledge involves talents, dexterity, and skills characterized by perception and intuition

Table 1.
Knowledge within organizations from two perspectives.

2.3.1 First postulate: knowledge is not an object

This postulate is based on the theories of [20] concerning organizational learning. Drawing on the concepts of "tacit knowledge" and "sense-giving" and "sense-reading" studied by [21, 22], he observed that "Although terms 'datum', 'information', and 'knowledge' are often used interchangeably, there exists a clear distinction among them. When datum is sense-given through interpretative framework, it becomes information, and when information is sense-read through interpretative framework, it becomes knowledge" (p. 88).

The sense-giving and sense-reading processes are defined by [22]: "Both the way we endow our own utterance with Meaning and our attribution of Meaning to the Utterances of others are acts of Tacit Knowing. They represent sense-giving and sense-reading within the structure of Tacit Knowing" (p. 301).

Tsuchiya added the concept of "interpretative framework," which from our perspective can be considered a mental model as defined by [23]: "Mental models are personal, internal representations of external reality that people use to Interact with the world around them. They are constructed by individuals based on their unique life experiences, perceptions, and understandings of world. Mental models are used to reason and make decisions and can be the basis of individual behaviors. They provide the mechanism through which new information is filtered and stored." In short, tacit knowledge that resides in our brain results from the sense given, through our interpretative frameworks, to data that we perceive among the information transmitted to us.

Tsuchiya [20] emphasizes how organizational knowledge is created through dialog and highlighted that "commensurability" of the interpretative frameworks of the organization's members is indispensable for an organization to create organizational knowledge for decision and action. Here, commensurability is the common space of the whole interpretative frameworks of each member. Let us quote Tsuchiya: "It is important to clearly distinguish between sharing information and sharing knowledge. Information becomes knowledge only when it is sense-read

through the interpretative framework of the receiver. Any information inconsistent with his interpretative framework is not perceived in most cases. Therefore, commensurability of interpretative frameworks of members is indispensable for individual knowledge to be shared" (p. 89).

Therefore, we postulate that knowledge is not an object processed independently of the person who has to act. This individual knowledge is tacit knowledge, self-explanatory or not, and can be later transformed into collective knowledge, as it is shared with other people. Tacit knowledge involves talents, dexterity, and capacities characterized by the perception and the intuition.

Consequently, formalized and codified knowledge that are independent from individual, are not more than information. We call it "information source of knowledge for someone." Furthermore, taking back [24], we must discern the knowledge of knower and the codification of that knowledge (p. 295).

The *conditions and limits under which knowledge can be thought of as an object* and therefore can be managed as information as follows: Knowledge is explicit, stable and well defined, recognized by a specific homogeneous population. Knowledge is "apparently" independent of people and situations. Knowledge is dissociated from action and can be thought of as an object.

Exception cases: Knowledge is highly complex and/or has a very high degree of specialization.

2.3.2 Second postulate: knowledge is linked to the action

Within organizations, activities contributing to value-added processes and support processes, defined by [25], use and create knowledge. So, the organizations' knowledge is depending of the context and the situation that allow using and creating this knowledge. Moreover, knowledge is partially characterized by the aim of these activities. In particular, the role of the stakeholder, involved with these activities, must be taken into account. Therefore, knowledge is linked to their decisions, their actions, and their relationships with the surrounding systems (people and artifacts).

2.3.3 Third postulate: knowledge used and created in organizations includes two main categories of knowledge

Within an organization, 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 defined by [21], which comprises intangible elements (we call it "skills"). The tangible elements take the shape of formalized knowledge in a physical format (databases, procedures, plans, models, algorithms, and 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, either as collective knowledge ("routines"—the logic of individual or collective actions defined by [26]) or as personal knowledge: skills, tricks, trade secrets, knowledge of history and decision-making contexts, and environmental knowledge (customers, competitors, technologies, socioeconomic influences) (see **Table 2**).

2.4 Our vision of knowledge management

Relying to the three postulates mentioned overhead, it appears that KM addresses activities, which utilize and create knowledge more than knowledge

Know-how *(Explicit knowledge)* **Tangible elements**	**Skills** *(Tacit knowledge embodied by individuals)* **Intangible elements**	
Collective knowledge *Knowledge that can be though as objects*	Collective knowledge *Routines*	Personal knowledge *Private knowledge*
Knowledge that is formalized within documents and/or codified into data bases	*Knowledge that is incorporated within models and regular and predictable behaviors*	*People's abilities* *Professional knack* *Knowledge of company history and decisional contexts* *Knowledge of the environment (customers, competitors, technologies) and socioeconomic factors*
Information source of knowledge for someone ©Michel Grundstein	Defensive routines *Knowledge that are obstacles to change* Constructive routines *Knowledge that favors innovation and change*	Specific knowledge belonging to each individual *Knowledge that is a volatile intangible resource, which depends on the continuity of the presence of employees in the company*

Table 2.
The two main categories of organization's knowledge.

itself. With regard to this question, since 2001, our group of research[3] has adopted a managerial and socio-technical approach to KM defined as follows [27]:

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 (p. 980).

The *patrimony goal* has to do with the preservation of knowledge, their reuse, and their actualization; it is a static goal. The *sustainable innovation goal* is more dynamic. It is concerned with organizational learning that is creation and integration of knowledge at the organizational level. This definition of KM, by focusing on managerial and organizational problems linked to socio-technical environment and organization's value-added processes, highlights the economic and strategic dimension of KM. It leads to integrate the whole dimensions that should be involved in the management based on knowledge within organizations. In doing so, it induces a well-balanced technological, organizational, and socio-technical management based on knowledge strategy that mutualizes and structures the various themes discussed in this chapter.

3. Distinguishing two main approaches underlying knowledge management

In this section we will refer to our research that leads to distinguishing two main approaches underlying KM: (i) a technological approach that answers a demand of solutions based on the technologies of information, communication, and artificial intelligence and (ii) a managerial and sociological approach, which is people-focused and integrates knowledge as resources contributing to the implementation of the strategic vision of the organization.

[3] SIGECAD Research Group is created in 1998, in which domain topics are information system, knowledge management, and decision aid.

Snowden [28] consolidates our research when writing about developing practices of knowledge management (pp. 241–242). He identifies two different approaches to KM: (1) an approach that arises from information management where knowledge is seen as a thing or entity that can be managed and distributed through advanced use of technology and (2) an approach that sees the problem from a sociological vision where knowledge is seen as human capability to act.

3.1 Technological approach of knowledge management

Taking into account our researches and observations, we can say that technological approach of KM is the most widespread. Considered from the point of view of the information system, knowledge is implicitly treated as an object independently of the person who creates and uses it. It is a positivist approach that can be considered according to the cognitivist perspective of knowledge within organizations. In this perspective, knowledge exists as a "truth" that can be stored and transmitted.

Typically, the positivist approach considers knowledge independently of its links to the action and context of its implementation. As a result, it neglects the role of tacit knowledge. The same phenomenon is analyzed by [21] who states: The fact that we can possess knowledge that is unspoken is of course a common-place and so is the fact that we must know something yet unspoken before we can express it in words. It has been taken for granted in the philosophical analysis of language in earlier centuries, but modern positivism has tried to ignore it, on the ground that tacit knowledge was not accessible to objective observation (p. 306).

In the technological approach, the KM refers to information systems and databases. Emphasis is placed on the quality of the IT system to create and preserve knowledge in order to create value. Most often, the goal is oriented by the notion of knowledge management system (KMS). For instance, let us quote the definition [29]: "Knowledge management systems refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage, retrieval, transfer, and application."

Moreover, although authors are careful to propose a definition to distinguish between data, information, and knowledge concepts, when applications are addressed in terms of computer systems, these three concepts are rapidly declining in terms of data processing: knowledge being only a form of enriched data. This leads to the characterization and organization of knowledge according to a hierarchical vision of objects. Thus, the authors who join this perspective are mainly interested in the content of the knowledge of the organization. They focus on building and managing knowledge stocks.

3.2 Managerial and sociological approach of knowledge management

3.2.1 Current of economic and managerial research influence

The emergence of the managerial and sociological approach of knowledge management comes, according to [11], in three phases:

First phase: a change of paradigm of the corporate strategy called "the approach based on the resources," to which Edith Penrose strongly contributed. She was the first one to begin this change of paradigm in 1959, with the publication of her book entitled "*The theory of the growth of the firm*" [30]. She explains in this work that the company undergoes a loss of capital when a capable employee, who is an employee whose services interfere in the process of production, leaves the firm. By conferring on the knowledge an economic value, in the same way as any other

material resource being a part of the capital, Edith Penrose opened the way to a new economic theory which has to place the knowledge in the center of the process of creation of the wealth.

Second phase: a new vision of the company, through the notions of directory of knowledge and of organizational routines expressed by [31]. In their work *An Evolutionary Theory of Economic Change*, the authors define the notion of skill as a capacity to coordinate a sequence of behavior to reach goals in a given context. Besides, they define the notion of organizational routine as a predictable and regular behavioral plan. These routines are the siege of the knowledge of the organization, because beyond any formalization, the best way of storing the knowledge of the organization lies in the exercise of these. So, all the routines of an organization constitute its directory of knowledge [30].

Third phase: an organizational change taking care of the problem of capitalization of the knowledge of the company [1, 31, 32]. Concretely, the company has to learn to establish connections between her members. This means connecting people whose cooperation will generate new and useful knowledge for themselves and for the company. These connections can take place as well at the individual level as at the level of a team or at the level of the whole organization.

3.2.2 Managerial and sociological approach of knowledge management

Thiétard [33] proposes the following definition of management: "Management can be defined as the way to conduct, direct, structure and develop an organization. It touches on all the organizational and decision-making aspects of how she works. Management is less concerned with the procedures to be applied, whether they are accounting, legal or social procedures, than the animation of groups of men and women who must work together for the purpose of a finalized collective action" (p. 1).

Thus, the diversity of situations, the complexity of problems, and the multiplicity of actors concerned by the KM should be studied. We can say that managerial and sociological approach of the KM emphasizes the link between learning and action and the constraints of the social system which requires giving meaning to working hours. This last point of view is based on the theory of needs and motivations pointed out by [34–38] and in particular on a pyramid hierarchy of motivations determining the human behavior proposed by the American psychologist Abraham Harold Maslow (1908–1970), who distinguishes five levels of need [37], notably level 5, the need to use and to develop one's abilities, to flourish in one's work.

Consequently, each employee must have a sense of belonging to the company; he must be integrated into a network of people and have good relations with others; he must be respected and recognized; he must take pleasure in the accomplishment of his work. The KM must provide the means to be autonomous and to develop its own potential.

3.3 International standard ISO 30401:2018

Finally, we introduce the last International Standard ISO 30401:2018 (November 2018) [39] entitled "Knowledge Management Systems Requirements." This document sets out the requirements for the knowledge management systems of organizations, leading to the successful implementation of knowledge management. However, the document preserves a certain latitude in the application of these requirements, which allows each organization to comply with them in accordance with characteristics and needs.

In the introduction of this standard, knowledge management is envisaged in the following way: Knowledge management is a discipline focused on the ways in

which organizations create and use knowledge. Knowledge management has no recognized single definition and no international standard predates this management system standard. There are many known barriers to successful knowledge management. Similarly, there are many confusions with other disciplines such as information management and many widespread misconceptions about how to achieve knowledge management [39], for example, the misconception that simple acquisition of technological means can be enough. From our point of view, this standard should be very useful for a management based on knowledge operation.

3.4 Outcomes

At the end of this section devoted to KM, it appears that this discipline has followed developments strongly rooted in two contradictory and complementary paradigms: the positivist paradigm and the constructivist paradigm. Although not always leading to expected results, the KM positivist paradigm remains the implicit paradigm most recognized by KM researchers and practitioners.

From our point of view, this paradigm needs to be expanded to a more general point of view based on a constructivist paradigm. We refer to this approach as "the managerial and socio-technical approach to KM" (Section 2.4). This perspective brings together the elements on which the "management based on knowledge" is founded.

4. Organization's information and knowledge system

In this section, opting for a socio-technical approach to the organization, we introduce the concept of "organization's information and knowledge system."

4.1 Socio-technical approach to the organization

The socio-technical approach of organization is to consider the organization as a system consisting of a social system interacting with a technical system [40]. The following reflections are essentially based on the book *Knowledge Management in the Sociotechnical World*. Coakes [40] states that the term "socio-technical" is commonly used in systems studies, particularly in the design of organizations. Based on numerous writings, some dating back to 1920, she says that the best incarnation of this paradigm is found in the work of Fred Emery and Eric Trist at the Tavistock Institute, London, and in the study of Trist and Bamford (1951) in which the researchers identified the need for a socio-technical approach to develop a social system appropriate for the establishment of a new technical system. Elayne Coakes defines the term "socio-technical" as "The study of the relationships and interrelationships between the social and technical parts of any system" (p. 5). Thus, this term describes a broader view of the role of technology in an organization: "technology should be considered, discussed and developed not only as a technical artifact but in the light of the social environment in which it is exploited" (p. 4). She suggests that "Knowledge management from a socio-technical perspective requires managing the organization through continuous change and a continuous learning process supported by appropriate technologies" (p. 10). In addition, [41] consider that "adopting a socio-technical perspective avoids a purely technological approach to information systems" (p. 27).

Thus, an information and knowledge system of an organization could be considered as a subset of the organization in which the technical system would be the digital information system (DIS). This system interacts with the members of

the organization considered both as users and as components of the system. This system is described in the following subsection. We refer to it by the expression "the organization's information and knowledge system".

4.2 Organization's information and knowledge system

4.2.1 Description of the organization's information and knowledge system[4]

Figure 1 represents the organization's information and knowledge system. This system is a local subset of the organization's socio-technical system (individuals interacting between themselves, with machines, and with the system itself).

The organization's information and knowledge system consists of:

- A digital information system, an artifact based on information, communication, and artificial intelligence technologies (including Web 2.0 and Big Data applications) that ensure the consistency of the different DIS specific to the socio-technical subsets of the organization [16] (p. 202).

- An information system (IS), constituted by individuals who, in a given context, are processors of data to which they give a sense under the shape of information. This information, depending of the case, are transmitted, stored, processed, and diffused by them or by the DIS.

- A knowledge system (KS), consisting of the tacit knowledge embodied by the individuals and the explicit knowledge formalized and encoded on any form of media (document, video, photo, digitized or not). Under certain conditions (Section 2.3.1), digitized knowledge may be transmitted, stored, processed, and disseminated by the DIS. In that case, knowledge is no more than information. We refer to them by the expression "information source of knowledge for someone."

Information systems and knowledge systems are based on digital information systems. The latter constitutes, on the one hand, the source and support of the company's decision-making and management processes and, on the other hand, the structuring base of the companies in which they are designed and deployed. The DIS is the artificial system (artifacts) designed from information, communication, and artificial intelligence technologies. Considering the possibilities provided by artificial intelligence, in particular "deep learning" technologies, "several interactions must be considered: a "Man to Man" interaction; a "Man to Machine" interaction; and a "Machine to Machine" interaction." [16].

We insist on the importance to integrate the individual as a user and a component of the system. In their study on the design of knowledge management collaborative systems (CKMS), Chua and Brennan [42] reinforce our point of view. These authors point out that "One of the most important components of CKMS is the knowledge workers, who are also the users of the system, and the Workspaces they are associated with" (p. 172).

4.2.2 Impact of individual's culture on the organization's information and knowledge system

We think that the individual's culture is one of the bases on which employees' interpretative frameworks are deeply rooted. As employees' interpretative

[4] SICO in french: Système d'Information et de Connaissance de l'Oganisation.

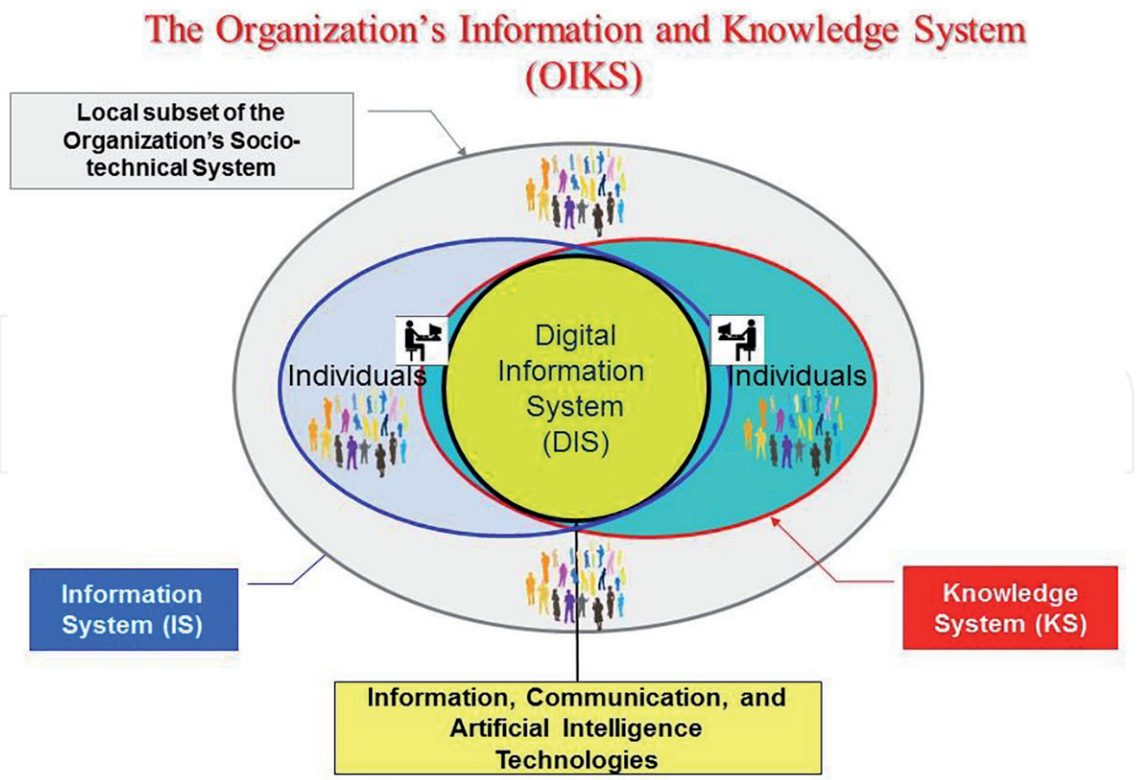

Figure 1.
The organization's information and knowledge system (OIKS/SICO).

frameworks are transducers that give sense to information and codified knowledge, individual's culture is a key factor to enable employees to make sense to information that they access from the digital information systems and so internalize it and transform it into action. Consequently, we stress the role of cultural factors every time social interactions and sharing of information and knowledge are essential to enable efficiency in an intercultural world.

In their research, [43] state that "one of the main difficulties in the analysis of culture and its impact on KM initiatives is to separate the business from the national culture" (p. 233). They focused on five national cultural dimensions, which are power distance, tolerance of ambiguity, individualism/collectivism, time orientation, and doing/thinking (pp. 241–242). These indicators provide empirical evidence that they have an impact on the individual's cognitive abilities and so develop different interpretative frameworks. Accordingly, when considering the knowledge worker as a user and a component of the organization's information and knowledge system, we suggest regarding these indicators as criteria to develop a cultural analysis study in order to conceive, realize, and implement collaborative information systems.

5. From capitalization on organization's knowledge to management based on knowledge within organizations

In this section, looking to the capitalization on knowledge problem within organizations, we position our vision of the management based on knowledge.

The concept of "capitalization on organization's knowledge" was first expressed back in 1990 in a large French company. The object was to preserve and obtain greater value from the know-how and the skills acquired in the field of knowledge engineering, in extension of the company's deployment into applied artificial intelligence and knowledge-based systems.

5.1 Capitalization on knowledge problem within organizations[5]

In what follows, we propose to define the problem of capitalization on knowledge within organizations, irrespectively of the different currents of influence that contributed to the emergence and propagation of the concepts of "capitalization of knowledge" and "knowledge management." So, we define the concept of capitalization on knowledge as follows [44]: "Capitalization on knowledge within the organization means considering some knowledge used and produced by the organization as a storehouse of riches and drawing from these riches interest that contributes to increasing the organization's capital" (p. 141).

Several problems co-exist. These problems constitute a general problem focused on crucial knowledge. They are recurring problems with which the company was always confronted. We classified them into four categories and their interactions, which are represented in **Figure 2**: Locate crucial knowledge, preserve crucial knowledge, enhance crucial knowledge, and actualize crucial knowledge.

5.2 Concept of "crucial knowledge"

In this subsection, we suggest the following definition of "crucial knowledge." Crucial knowledge is knowledge that, regardless of its nature, is tacit (embodied within the head of a person or embedded in an artifact) and explicit (incorporated into a document or another physical support):

1. Contributes to the added value and performance of organizational and production processes or to the innovation of products and services or to the maintenance and improvement of a competitive position.

2. Is vulnerable, that is, rare, specific and unique, inaccessible, poorly distributed, inimitable, and difficult to transmit.

3. Has a high cost and/or high acquisition time.

4. 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, in case of possible loss.

Crucial knowledge supplies essential resources that are used by value-added processes activities of an organization. Value-added processes are derived from the value chain described by Porter [25] who identifies nine value-added activities that he classifies into two main categories. The "primary activities" are (1) inbound logistics, (2) operations, (3) outbound logistics, (4) marketing and sales, and (5) services. The "support activities" are (1) business infrastructure, (2) human resource management, (3) technological development, and (4) supplies. In this way,

[5] The expression "capitalization of knowledge" is strongly influenced by knowledge engineering in the early 1990s. We transformed it in 1993 following our meeting with Professor Shigehisa Tsuchiya [20]. Until that time we were talking about "capitalization of knowledge," and we changed to the expression "capitalization on knowledge." In fact, the technological approach to the knowledge engineering considers knowledge as an object, which is a reality external to the individual in the form of concrete and perceptible things. This is implicitly inferred by the expression "capitalization of knowledge." Subject to conditions specified in Section 2.3.1, we changed the paradigm considering that in organizations, knowledge created and used is above all a knowledge related to action that is specific to people and cannot be thought of as an object, hence the expression "capitalization on knowledge."

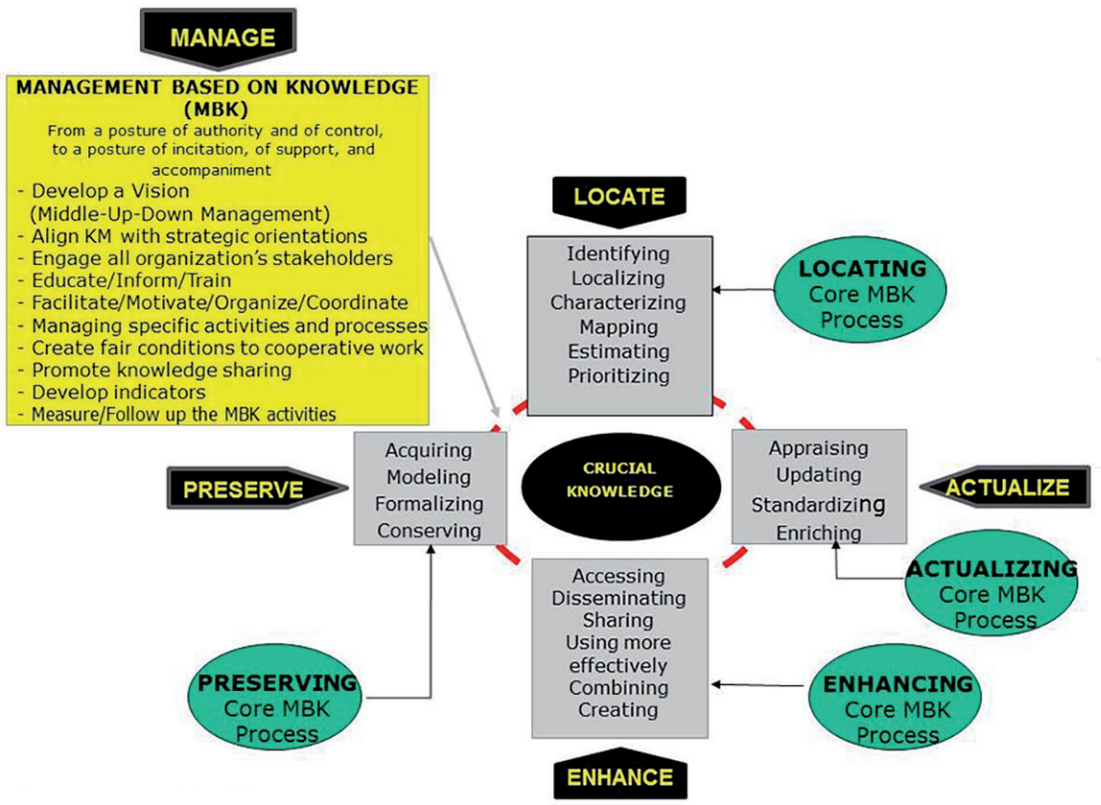

Figure 2.
Management based on knowledge: the core MBK processes.

value-added processes represent the organizational context for which knowledge is essential factors of performance.

5.3 Core MBK processes to capitalize on company's knowledge

The core MBK processes answer the problem of capitalization on company's knowledge. Thus, we have identified four core MBK processes corresponding to the resolution of the categories of problems: locating core MBK process, preserving core MBK process, enhancing core MBK process, and actualizing core MBK process. Each of these core processes contains sub-processes designed to solve all the problems involved. These sub-processes are integrated into the overall management based on knowledge processes implemented in the organization.

We describe these processes below.

The following description of the core MBK processes is not necessarily cyclical in nature. Each category contains, in itself, a set of problems that can be addressed in a different order depending on the situation and context of each organization.

- The ***locating,*** *core MBK process*, deals with the location of crucial knowledge, that is, knowledge (explicit or tacit) essential for decision-making processes and for the progress of the value-added processes. 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 our approach named GAMETH® [45] (pp. 271–285), specifically aimed to support this process.

- The ***preserving,*** *core MBK process*, deals with the preservation of know-how and skills: when knowledge can be explicit, 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 notably described in Schreiber et al.

[48]. When formalizing knowledge is not feasible, then interactions of people through social networks, communities of practice, or other types of networks implemented, and the transfer of master-apprentice-type knowledge should be encouraged.

- The ***enhancing,*** *core MBK 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,*** *core MBK 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.

5.4 Positioning management based on knowledge within organizations

When considering the capitalization on knowledge problem within organizations, we do raise the problem that concerns interactions between the core MBK processes mentioned above and the management process for knowledge creation and use. This problem is linked to our vision of the managerial and socio-technical approach of KM that, from our point of view, is adapted to the digital transformation of the organizations. Indeed, this transformation leads to replace a determinist attitude strongly deep-rooted in our education, by a constructivist attitude that characterizes our approach of KM. We call it "management based on knowledge" problem (**Figure 2**).

Thereby, managers have to pass from a posture of authority and of control to a posture of incitation of support and accompaniment. We have to:

- Develop a vision like the middle-up-down management suggested by [1] (pp. 124–159).

- Align the MBK with strategic orientations of the organization.

- Engage all organization's stakeholders.

- Educate/inform/train the members of the organization.

- Facilitate/motivate/organize/coordinate concerned employees.

- Manage specific activities and processes.

- Create fair conditions to cooperative work.

- Promote knowledge sharing.

- Develop indicators.

- Measure and follow up The MBK activities.

Our vision of KM, defined in Section 2.4, induces a well-balanced, technological, organizational, and socio-technical management based on knowledge strategy that

mutualizes and structures the various themes discussed in this chapter. It should result in a MBK that takes into account the individuals and which has to allow them to be autonomous and to achieve their potentialities. Thus, the MBK fosters a "people-focused KM" as proposed by [9] who states: "our emphasis is on people and their behaviors and roles in enterprise operations" (p. XXV). MBK rests on the *general system theory* first established by [46] who cares very much on the humanist approach. It is inspired by the work of [47] who focused on complexity.

5.5 MBK guiding principles

The MBK guiding principles should bring a vision aligned with the enterprise's strategic orientations and should suggest a MBK governance principles by analogy with COBIT® 5 [48].

In particular, MBK indicators must be established. Numerous publications and books relate to that subject. From our viewpoint, two main categories of indicators should be constructed in order to monitor a MBK initiative: (1) a category of indicators that focuses on the impacts of the initiative favoring enhancement of intellectual capital and (2) a category of indicators that insures monitoring and coordination of MBK activities, measuring the results, and insuring the relevance of the initiative. Furthermore, we can add a category of indicators focused on knowledge itself. For instance, indicators of knowledge complexity are presented in **Table 3**.

In addition, we should find a way to get a good articulation between the Deming's cycle and the organizational learning. **Figure 3** shows this articulation. Firstly, we refer to the PDCA cycle of activities—plan, do, check, and act [49]. This cycle, first advocated by Deming (1992) is well known as the *Deming's cycle* by quality management practitioners. The PDCA cycle has inspired the ISO 9004 (2000) [50] 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 and Schön's organizational learning theory [51]. Thus, we point out the key contribution of Knowledge Management to *Change 2* defined by [52]. **Figure 3** shows the articulation between Deming's cycle and organizational learning.

Indicators	Objective
Nature of knowledge	Distinguish between declaratory knowledge (knowing what) and procedural knowledge (knowing how)
Quality of knowledge	Characterize specialized knowledge that relates to narrow areas with precise limitations (e.g., knowledge acquired in a scientific discipline) and commonsense knowledge (knowledge that is generally used and used unconsciously)
Depth of knowledge	Determine the surface knowledge that is implemented by experts in tasks within their field (knowledge that allows them to associate with a known situation the appropriate actions, without having to "go down" to the level of a causal model) and deep knowledge (those of laws and principles, implemented by novices or by experts confronted with unknown cases)
Extent of knowledge	Characterize specialized knowledge that relates to narrow areas with precise limitations (e.g., knowledge acquired in a scientific discipline) and commonsense knowledge (knowledge that is generally used and used unconsciously)
Stability of knowledge	Distinguishing static knowledge (those that do not depend on time at least in sufficiently long intervals) and dynamic knowledge (those which concern evolutionary processes and are accompanied by a temporal modality)

Table 3.
Indicators of knowledge complexity.

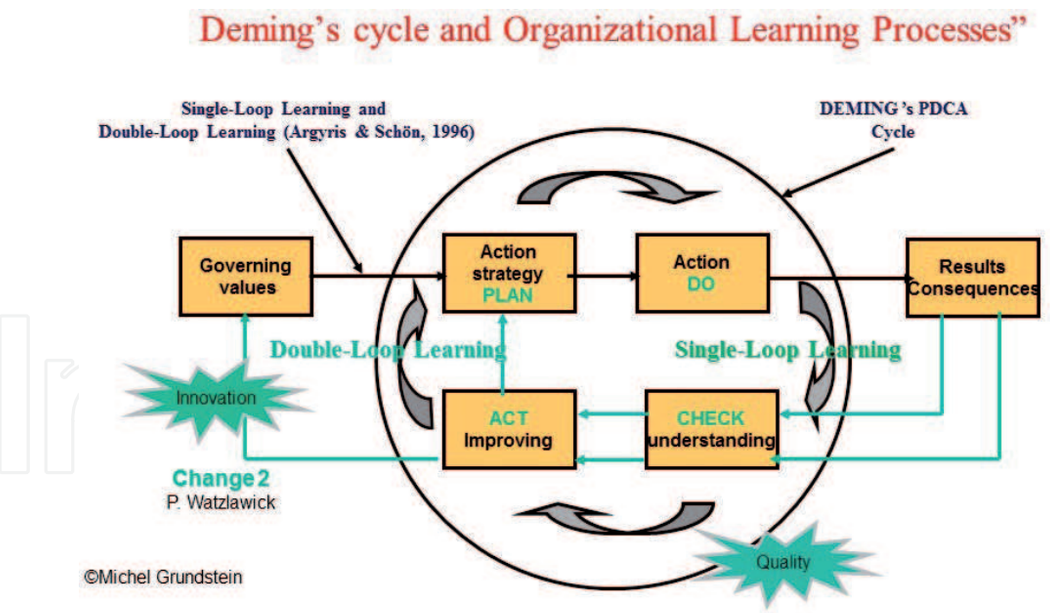

Figure 3.
Deming's cycle and organizational learning articulation.

We note that single-loop learning generates a cycle identical to the PDCA cycle. These two cycles, which are indispensable from the point of view of quality, are not favorable to innovation. The MBK-specific management principles should lead to a balanced dialogical between the two learning processes defined by Argyris and Schön. A balance leads to quality without prejudice to innovation.

6. Conclusions and perspectives

In a world disrupted by the omnipresence of digital technologies, organizations have become complex socio-technical systems in perpetual mutation. Cooperation and mobility become an essential form of work which requires that decision-makers have specific individual and collective skills, adapted to the values and cultures of each geographical location. Organizations become aware of the need for continuous personal and collective learning and of the contribution of each, especially of the crucial impact of their tacit knowledge.

In this paper, we provided theoretical and practical reflections and outcomes from our industrial experience and our researches. Thus, we have transferred our managerial and socio-technical approach of knowledge management to our concept of management based on knowledge as a managerial function. It consists in animating, organizing, coordinating, and monitor activities and processes to enhance the use and the creation of knowledge within an organization. That is done according to a well-balanced perspective of the knowledge within organization: a cognitivist perspective and a constructivist perspective. We identified two main approaches underlying KM: a technological approach and a managerial and sociological approach. We described the three fundamental postulates that are the basis of our own approach called "managerial and socio-technical" approach to knowledge management. We introduced the concept of organization's information and knowledge system. We positioned our concept of the management based on knowledge with regard to the problem of capitalization on knowledge within organizations. Finally, we suggested MBK guiding principles and indicators on knowledge complexity.

In this paper, we state that knowledge is not manageable as if it was data or information. Consequently, faced with digital transformation, one should be aware

of limitations of "Big Data" and the associated techniques. Effectively, these technologies might suggest that digital information systems provide access to the tacit knowledge crucial for decision-making and action. However, taking into account the elements brought in this chapter, we argue that digital information systems provide only information whose data are filtered by the decision-makers' interpretative frameworks and then interpreted with their own tacit knowledge in order to give them meaning. Moreover, we should consider that data are gathered and processed by algorithms, themselves, influenced by the interpretative frameworks and tacit knowledge of their designers. So, considering the information received by the user, though originated from the formalized and encoded knowledge of the experts, there is no evidence that the user's tacit knowledge that results from this process is identical to that of the experts who produced it. That presents the risk of misunderstanding and can lead to irrelevant decisions and actions.

From our point of view, researchers in the analytics and digital field should pay attention to the possible consequences of their work according to the domain and the context of their applications. To this end we could develop research on the rules insuring the relevance of information and enabling measuring the impact of algorithms with regard to their domains of applications. This raises the problem of ethic and responsibility of algorithms in the organizations' socio-technical systems.

To conclude, this chapter retraces and completes our road toward management based on knowledge. We hope that it would generate fruitful reflections to those who will be called to contribute to the digital transformation of the organizations: professionals, researchers, and students.

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