

# Tools of knowledge management: convergences toward organizational learning

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A review on the origin, object of application, and forms of expression on knowledge management is conducted, as well as on the strategic processes associated with this activity. Also, considerations are presented about the knowledge audit, and the most used tools in the organization to identify knowledge. Emphasis is laid on the existing convergences between the conceptual maps and the knowledge maps. Criteria are exposed to support the idea that the former is associated more with knowledge management in general and the latter, with aspects led by knowledge audit. Among the main conclusions, knowledge management is noteworthy because it is the basis for conducting the rest of the organizational processes (that is, intellectual capital management and organizational knowledge acquisition), for the institution may be in conditions for learning more through a continuous improvement process. It is recommended that research institutions, whose more significant principle is knowledge, should have among their premises to identify where the knowledge is located and how to manage it, in function of the welfare of the organization itself.

**Key words:** *knowledge management, knowledge audit, knowledge map, conceptual map, organizational learning.*

## INTRODUCTION

Specialized literature on Information Sciences and other related sciences shows the formation of a theoretic and practical field referred to the tools for knowledge mapping. In them, they include two trends: authors that use and term «conceptual map» to the tool for managing knowledge (Ausbel *et al.* 1989 and Rovira and Mesa 2006), and others that term it knowledge map, including it in specific processes of knowledge audit (D'Alos-Moner 2003, Nuñez 2006, Anon 2008 and Piloto 2008).

Current society – so-called Informational Society (Castell 2001), Information and Knowledge Society (Bell 1973), or Society of Organizations (Drucker 1995)- is influenced by the processes and approaches of knowledge management (KM) because, according to Boisot (1998), it is more similar to a practice rather than to an intellectual discipline in itself. Thus, a new society is coming combining, on one hand, management<sup>1</sup>, conceived as human action, voluntary and decided in resources to attain certain goal. On the other hand, knowledge<sup>2</sup>, is conceived as a human intellectual act that allows to know the nature, characteristics, and qualities of an action or thing (López 2006).

Since the ends of the 80s, Ausbel *et al.* (1989) creates the conceptual maps with the aim of understanding the level of learning and of association in a group of students. Up to date, the importance of them has been proved in the practices of knowledge management and its more concrete evolution into knowledge maps, related specifically to the approach of knowledge audit (Piloto 2008).

Both are knowledge management tools that have been applied in learning organizations and positive outcomes have been obtained (Rovira and Mesa 2006). Thus, conceptual maps are the precursors of what it is known as knowledge maps, where the principles and theories of both terms are interrelated to enrich knowledge management.

Due to the importance of the tools used to audit knowledge in an organization, this review has as goal to provide an approach on knowledge management and its strategic processes, especially in respect to knowledge identification, as well as to show the existing convergences between the conceptual maps and their application in research organizations of agricultural sciences.

## KNOWLEDGE MANAGEMENT

According to Salazar del Castillo (2004), knowledge has always been fundamental for economic development, and enterprises traditionally has been managing it; but, in time, the object on which the managed knowledge has been applied has been changing.

This author distinguishes three phases according to the object on which knowledge is applied in an enterprise activity: industrial revolution, productivity revolution or

second industrial revolution, and management revolution (figure 1).

Industrial revolution (1750-1880) generalizes mechanization – the use of machinery in industrial processes- to attain a more abundant production, faster and cheaper. Thus, in this stage, knowledge is applied mainly in tools, processes, and products.

Frederick Winslow Taylor, creator of the influencing theory of the scientific management, started around 1880

<sup>1</sup> Management as an action will is exerted in motion to attain a programmed goal, searching for both the means and necessary resources.

<sup>2</sup> Knowledge is a human action, the subject makes his own the object as he gets closer to the object and knows it better. Knowledge is attained through the intellectual capabilities of comprehension and understanding.

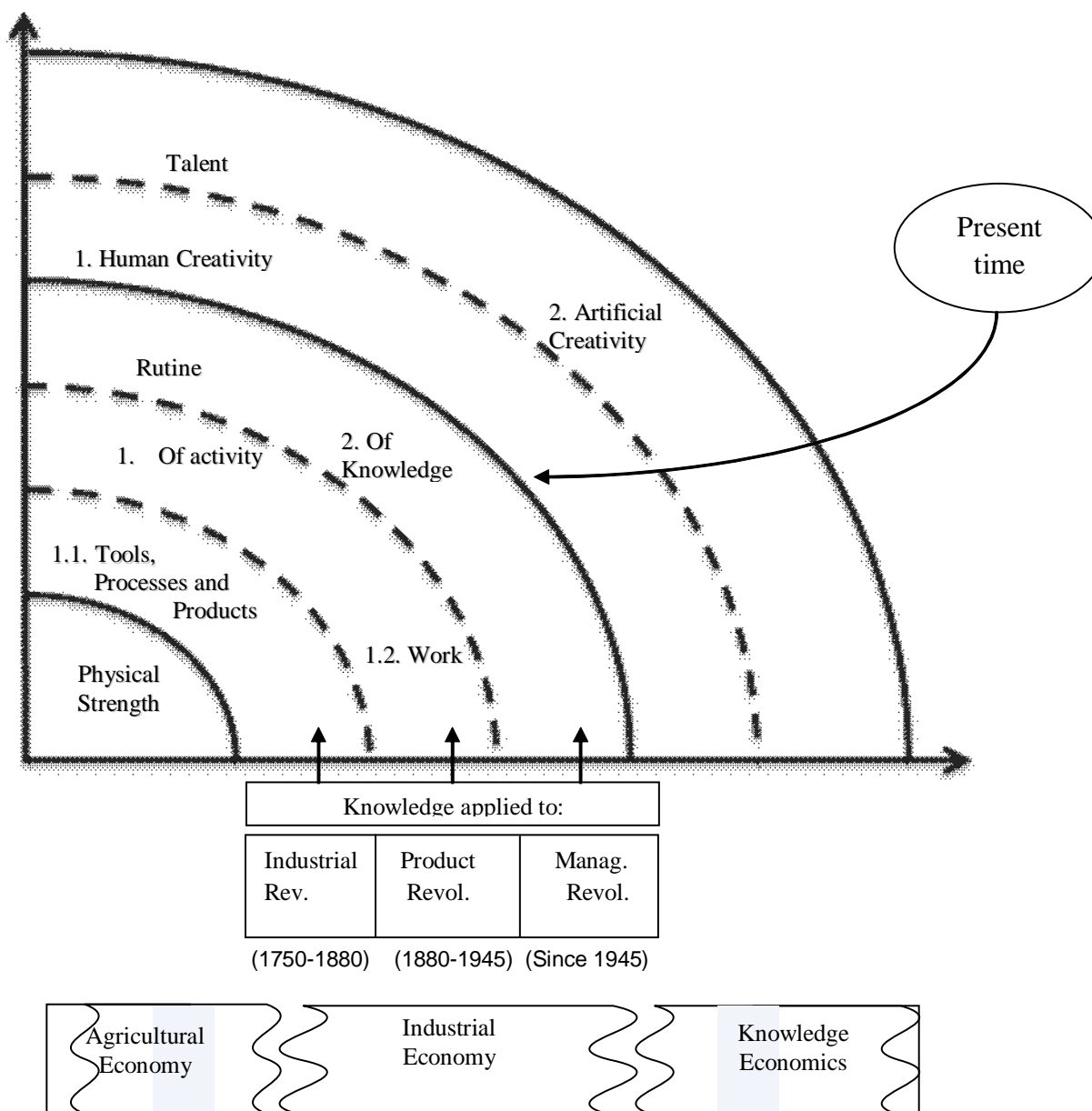


Figure 1. Objet on which knowledge is applied in the enterprise activity (Salazar del Castillo 2004)

the step of the industrial revolution of the productivity. Around that time, he started his studies on the improvement of efficiency in production and knowledge is applied for the first time to the study of work, increasing considerably the productivity in manual workers through automation. A system of production was built not taking into account the initiative or imagination from workers, and it certain body movements are turned into automated.

At present, management revolution searches also for automation, but through robotics, a technique that is used by informatics for the design and use of industrial apparatuses. Thus, knowledge is applied on knowledge itself.

As synthesis, in agricultural economics, machinery substitute manual work; in industrial economics, manual work was managed to be dominated and now in the divisor line between routine of activity and routine of knowledge, our work lives are reconfigured submitting

to the same process to repetitive mental tasks. This implies that enterprises, at present, will demand ingenious people (human creativity) to be differentiated and attain competitive advantages, replacing the economic strength from the routine to the talent.

Following the line of thought of Salazar del Castillo (2004), one manages to understand the relevance of quantifying, at least approximately, the knowledge generated in the enterprises or the intellectual capital. This term emerged at the start of the nineties in United States and Sweden, and it measures the value of the knowledge of the enterprise in its different fields: people (human intelligence), organization (know-how of the enterprise, patents, and brands), and market (satisfaction of clients). However, measuring the intellectual capital is interesting, mainly; if it is incorporated to the compromise of making it believed, thereby being associated immediately with another similar term, knowledge management. Nonaka

<sup>3</sup>Term from the Japanese language used by the scholars I. Nonaka y H. Takeuchi. It is the mental, physical, and/or virtual context that favours knowledge management.

and Takeuchi (1995) proposed to do it through four modes of knowledge conversion: socialization, externalization, combination, and internalization, where each mode of knowledge conversion is developed through a concrete «ba»<sup>3</sup>, shared mental space that favors the relations and that can be represented as a physical site –an office-, a virtual site –e-mail-, or a mental site –the shared ideals or experiences.

Bosch (2002) states that the site in which knowledge works is led by changes in work conditions, changes in the form of representation, and information record, and new considerations and studies on the complexity of the knowledge processes involving tacit forms within the explicit.

The combination between the four modes of knowledge conversion stated by Nonaka and Takeuchi (1995) and the site where knowledge is moved in the organization (Bosch 2002) are factors that, in our view, play a primordial role in the identification, creation, and transfer of knowledge - processes that will be studied herein- and that evidently propitiate that the institution may be an organization that generates permanent learning

In the 90s, in this site where the concept of knowledge management emerged, understood as the process of capture of collective skills in an organization (whether enterprise or institution), and its availability to improve its transfer and circulation, and, at the same time, allow innovation. Its subject is to use the accumulated intellectual work, although it has been made by other developments (Bosch 2002). Related to the people having tacit knowledge in the organization, D'Alos-Moner (2003) states that managing today an institution goes, mostly, through managing these «knowledge workers». Therefore, it is necessary to know the following questions:

How to have access to the tacit knowledge of the employees?

How to motivate, incentive compromise and the identification with the values of the organization?

How to make the experts, the professionals (sometimes the most reluctant to changes) get involved and accept changes?

How to manage the time of the experts because knowledge management implies always a dedication sometimes difficult to handle?

How to change the culture based on «knowing is power»?

Likewise, Nonaka and Takeuchi (1995) noted that the creation of a new knowledge depends on the view, perception, personal intuition, and that, for this aim, it is key the commitment of the people that work in the organization. They mentioned also the vital role of the work teams in the creation of knowledge and the role of the directors, which are in charge of enhancing the acquisition, production, use, and transfer of knowledge. In the case of agricultural research organizations, directors should be conscious of the importance of incorporating such processes to everyday research activities, the creation of efficient and efficacious products and services with high added value and to the

transfer as maximum expression of the extrapolation of knowledge. This is a cycle in which directors should be focused with their utmost attention due to the preponderant place of agricultural production and its impact on social level.

In these last approaches are the ones in which this review is focused because people are the main creators of knowledge in the organizations. Out of them and their motivation, actions of knowledge management depend upon at the organizational level.

Thus, knowledge management seems to be weapon to minimize the loss of intellectual capital that may occur due to people's exit. In this respect, it is proposed to create a culture within of the organization for each member store what he has learned in each process of work and that may be able of transmitting it, that is, make knowledge grasp a step in the processes of knowledge management (Bosch 2002).

As to what it is understood as knowledge management, Esteban and Navarro (2003) proposed that knowledge management is, thus, the discipline dealing with research, development, application, and innovation in procedures and instruments needed for knowledge creation in the organizations with the aim of increasing its value and competitive advantage. The object of its practice is the construction of a knowledge production system useful in an organization for taking decisions and the resolution of its strategic business processes, related to its corporative objectives and values and its strategic plan through the design, implantation, maintenance, and evaluation of a program of identification, conservation, organization, integration, analysis, valuation, protection, share, and efficacious use of the information resources available and of intellectual capital of its members, with the support of the information and communication technologies (ICT).

As seen, this is a definition comprising the creation of knowledge until its transfer for the welfare of the enterprise, thereby being associated with the processes of enterprise intelligence and to the need for the ITC support.

Ortiz de Urbina (2003) offered a definition that relates knowledge management to intellectual capital, understood as the intangible organization resources. Knowledge management is understood as the series of processes that use knowledge for the identification and exploitation of the existing intangible resources in the enterprise, as well as for the generation of new ones. This is given by the union of the specific activities and initiatives carried out to increase its volume of corporative knowledge.

This same author states that this way knowledge management constitutes a flow variable through which a certain magnitude of intellectual capital is transformed into another. The result is a new dimension of intellectual capital. Figure 2 illustrates these relations showing how intellectual capital is, at the same time, the entry and exit of knowledge management because this is the part of certain level of knowledge that through its better use attains a new and higher knowledge level.



Figure 2. Intellectual capital and knowledge management (Ortiz de Urbina 2003)

McElroy (2003) stated that there is a new generation in knowledge management and it defines as the first generation that dealing with distribution, spread, and use of the existing knowledge; whereas the second is developed on the basis of knowledge production. Also, he established that the existence itself of this second generation, addressed explicitly to knowledge production needs to assume conveniently the schemes of the first about the value of the existing organizational knowledge.

It may be stated that, even when it is possible to define certain knowledge generation, the different organizations make actions that may be included in any of these generations. This means that the organization not necessarily has to assume all the elements from certain organization to explain that is truly managing knowledge.

On the other hand, Bueno (2002) stated in respect to organizational learning that knowledge management is a holistic approach integrating key concepts derived from three leading words of knowledge society (information, knowledge, and learning) are intellectual capital, knowledge management, and organizational learning, lined up with the strategy of the organization. This proposal of strategic nature has been possible in the so-called conceptual triad (figure 3). Its analysis defines that organizational learning, knowledge management and intellectual capital are concepts related and complementary.

This author provides a succinct definition of the elements of the triad:

- Organizational learning is the underlying approach that provides sense and continuity to the process of creation of value or of intangible. Learning, in short, is the key for people and the organization may be smarter, memorizing and transforming information into knowledge. The concepts of «intelligent organization» or «learning organizations» may be associated with this approach.

- Intellectual capital represents the strategic perspective of the «account and reason» or of the measurement and communication of the intangible assets created or possessed by the organization. There are several models trying to measure and manage the intangible capital of the organization (mainly private enterprises) and the difficulties and problematic leading to measure and increase these intangible elements.

- Knowledge management (direction of knowledge according to the proposal of Bueno) reflects the creative and operative dimension of the form of generating and spreading knowledge between the members of the organization and also with other related agents.

Organizational learning is the basis of a good knowledge management and this knowledge is the basis for generating intellectual capital and organizational capacities. Therefore, knowledge management occupies a supreme place in the obtainment and development of competitive advantages for the organizations and, evidently, affects greatly the organizational learning.

Aja (2002) reported that the organizations based on learning support their development on information

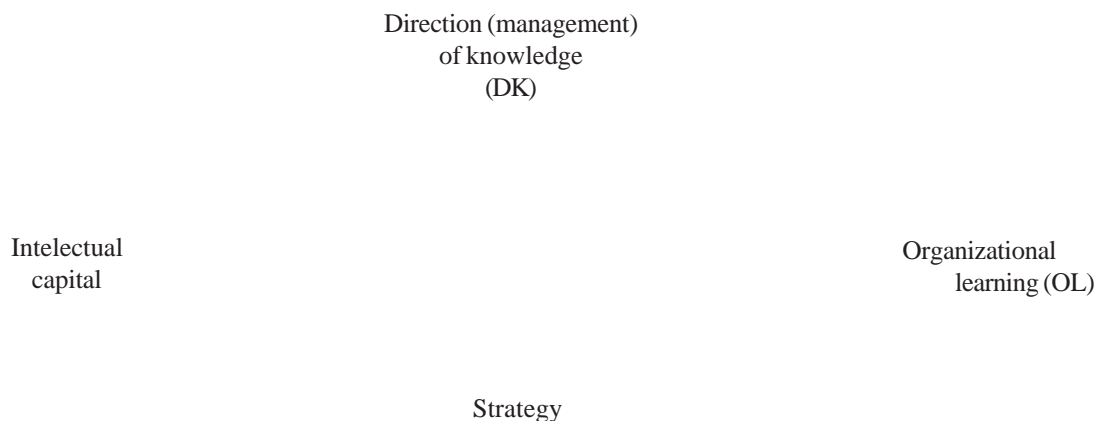


Figure 3. The conceptual triad (Bueno 2002)



management are in general knowledge organizations that learn with feeling of belonging, of collectivity, that perfect their culture as organization, regardless their execution, competitiveness, and profits, which are regenerated themselves through the creation of knowledge from the learning at the system level. In knowledge management, there are common factors, needed for the survival and progress of any organization such as Innovation, Response capacity, Productivity, and Competence.

Knowledge management as process of identification, grasp, organization, and spread of key data and the information for helping the organization to respond to the needs of the clients, searches for the perpetuation and materialization of the potential of the organizations.

According to Fernández (2000), organizations that develop knowledge management has the following common traits:

- Capacity of cohesion and generation of a strong feeling of identity.
- Sensibility to the environment with the aim of learning and adapting.
- Tolerance to non-conventional thought and experience.
- Financial precaution to retain resources that ensure the flexibility necessary for the current environment.

In respect to the objectives that can be fulfilled with knowledge management, Pávez (2000) cited the following:

- Formulate a strategy of organizational grasp for the development, acquisition, and application of knowledge.
- Implant strategies oriented to knowledge.
- Promote the continuous improvement of business processes with emphasis on the generation and use of knowledge.
- Follow and evaluate the achievements obtained with the application of knowledge.
- Reduce the times of the cycles in the development of new products, improvements of the existing ones and in the development of solutions to the problems.
- Reduce costs associated with repetitions of mistakes.

Thus, it may be derived that knowledge management is the basis for conducting the rest of the organizational processes –that is, the management of intellectual capital and the acquisition of the organizational learning–, once it may be a concrete part of the organization, the rest of the processes will be made conscious to all other members and evidently the institution will be in conditions to learn more through a process of continuous improvement. The benefits attained from knowledge management propitiate the improvement of the services and products of the institution, as they are the result from the existing knowledge in the environment and in the internal organizational sphere.

## FORMS OF EXPRESSION OF KNOWLEDGE MANAGEMENT

In the literature consulted, it was proved that Soto and Barrios (2006) recognized the existence of different forms of expression of knowledge management that may be established by any organization.

However, in order to define the forms of expression of knowledge management in a way that they may get closer to the Cuban environment, the concepts established in the document «Basis for the introduction of knowledge management in Cuba», cited by Soto and Barrios (2006), were selected. It identified the following:

- Use structured knowledge in the organization.
- Identify the most known.
- Identify those that know how to perform certain tasks.
- Identify the knowledge leaders of the organization.
- Multiply knowledge leaders.
- Learn out of practice.
- Give value to knowledge.
- Use knowledge for decision making.
- Incorporate added value.

The forms of practical expression of knowledge management may be interpreted by the different entities, according to their conditions and possibilities. The authors proposed the following interpretations:

- Use of structured knowledge in the organization
- Use of structured knowledge in the organization means take advantage of it in form of internal reports, norms, methodologies, patents, event presentations for the organization, and reutilization in new products and knowledge projects.
- Identify the ones with more knowledge.
- The experts should be identified in the different areas of interest and they should be invited to meetings, seminars; a network of experts and knowledge networks should be created in the organization; as well as databases with reports on them.
- Identify those with knowledge on certain tasks
- The mapping or inventory of the existing knowledge should be conducted in the organization and it maybe useful to reach the aimed goals, as well as to know the competences of each individual in the organization and know when it is necessary to capacitate or incorporate external personnel for the development of a product or service.
- Identify the knowledge leaders in the organization.
- It is necessary, both for practical tasks as for the projections at middle and long terms and for the support of knowledge management, the identification of

experts and other sources of information in the organization itself.

- Multiply knowledge leaders.
- Through the creation of «knowledge work teams», in which new knowledge is shared and created, and leadership qualities are cultivated.
- Learn out of practice.
- Through the development of work methods allowing the fast use and widely lessons resulting from the contact with users and clients, the deficiencies, the difficulties and achievements in production, the services and others identified.
- Assess knowledge.
- The economic apparatus of the organization should be able of including in its balances the value of the intellectual capital: copyright, patents, non-spread information, licenses, etc.
- Use knowledge for decision making.
- Through the compilation, analysis and synthesis of information from the internal environment as from outside the organization, use of bases and banks of data, bibliographies or of other kind, information of patents, oriented to national and international events, and other important resources.
- Protect knowledge.

## STRATEGIC PROCESSES OF KNOWLEDGE MANAGEMENT

Piloto (2007) presented a system of knowledge management in which emphasis was laid on three important elements: Production, Validation, and Integration of Knowledge. In these three macro-processes, several system components are combined, being: Human Resources, Information, and Information and Communication Technologies, all operating harmoniously in an adequate environment of communication, culture, and organizational environment. However, in our view, this proposal is limited to these macro-processes and they manage to be comprehensive and non-specific, thereby not attaining their assumption at the organizational level.

Thus, it is presented herein the proposal of strategic processes associated with knowledge management of Rodríguez and León (2006). In it, the seven specific processes of knowledge management are combined from a cyclic approach related to organizational learning. According to this approach, the inevitable relation between knowledge management, information management, technology management, organizational culture, and human resource management is attained as fundamental elements for the process may be efficient. The following processes are identified, being explained as follows (figure 4)

*Identification of knowledge.* The process of identifying knowledge in organizations acquires more importance everyday. Alternatives have emerged for solving aspects related to the transparency of

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- Through the signature of contracts of confidentiality, the classification of confidential information, decision making for the protection of know-how, the record of knowledge susceptible to protection by means of the record of intellectual property –software, brands, patents, etc.

- Incorporate added value.

- From the increase of value of products and services and through the incorporation of a larger amount of knowledge to make them better and eventually with higher application of technology.

Evidently, the forms of expression of knowledge management vary from one institution to the other; however, the institution itself should be able of creating sites that allow an efficient an efficient organizational knowledge management.

These forms of expression are manifested in any institution and even more in those supported on knowledge generation such as Research Institutes. Thus, this type of organizations should incorporate to their everyday activity aspects that go from the identification and multiplication of key knowledge actors until the use, valuation, protection, and incorporation of products and services of added value inside and outside the organization.

organizational knowledge. Hierarchies are removed and horizontal styles are developed. The superiors stopped being barriers in respect to spread of knowledge and experts communicate between them. Organizations are oriented to the internal networks out of the use of certain techniques and tools that facilitate these actions.

The members of the organization have knowledge, abilities, experiences, and intuition. Nevertheless, this only controls a minimum part of them. Thus, it is necessary to develop strategies to attain employees make explicit their knowledge that it is turn into information and that it may be record in documents.

The act of people in the organization is indispensable for an adequate interrelation between documental management, information management and, finally, knowledge management.

Knowledge management has several tools to identify knowledge: the directories and yellow pages of experts, knowledge maps, knowledge topographies, active knowledge maps, knowledge source maps, which are used indistinctively according to the proposed objectives, but all with results proved in several contexts.

Once knowledge has been identified, organizations should plan strategies to «clarify» them and allow their use:

*Knowledge acquisition.* Once the knowledge has been identified in the organization, it grows and multiplies as it is used. This demands the organizations to be in constant process of transformation, work intensely to

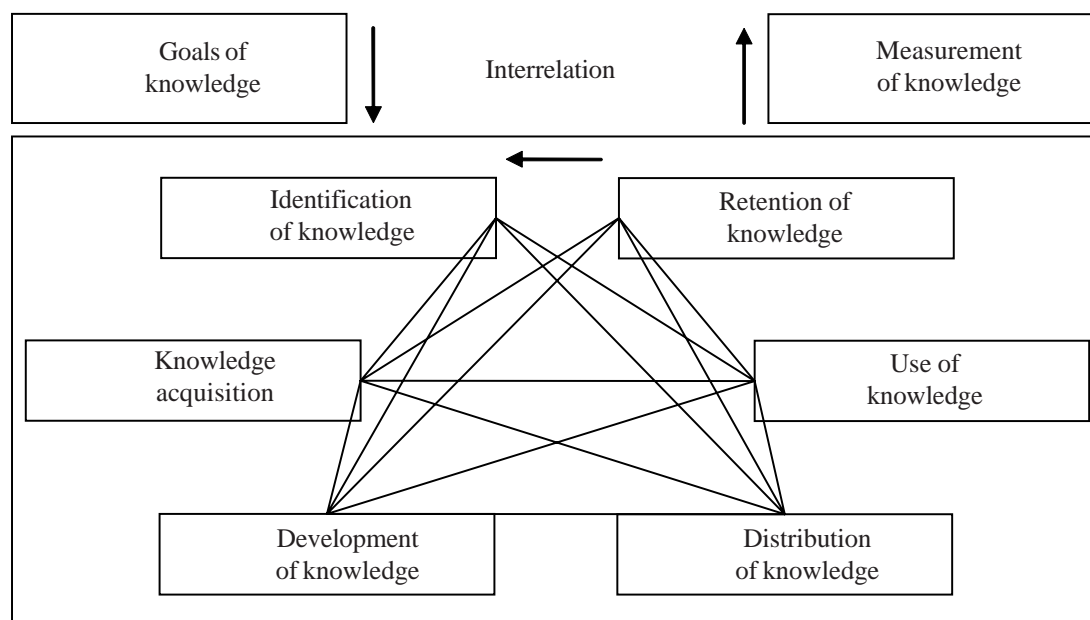


Figure 4. Strategic processes of knowledge management (Probst *et al.* 2001)

renew their knowledge. It is precisely for this reason that knowledge management cannot be considered as isolated process in the organization, but aligned with its strategies. Equally, and considering that knowledge is expressed by means of information and that it should be recorded in documents that back up the actions of the organization, it is said that all system that manages knowledge should have for its development the process of effective acquisition of information systems and documental management. In the case the organization has no specific knowledge needed, it should search for it in its environment to acquire it or simply develop in its insides.

*Development of knowledge.* As referred in the process of knowledge identification, when the organization does not possess certain knowledge, it should create conditions and invest in its development in the organization itself. This process of creation or development of knowledge is but a process of development of the competences and abilities of individuals belonging to an organization, it is a process where the establishment of an environment that favors the emergence of new ideas is propitiated to encourage innovation and thus, generate solutions contributing to the progress of society in general.

*Distribution of knowledge (share).* Organizational knowledge may come from internal sources, native to the organization, or external, when acquire from others. If located or identified, the knowledge assets in the organization, it is possible then to share and spread knowledge.

Organizations face problems to distribute and put the needed knowledge at the disposal of their members. It is necessary to consider that knowledge is transferred through personal actions, and, therefore, this process can be performed from one center of knowledge distribution to another or several specific individuals, between or

within the groups and work teams of the organization or between individuals. For this, they are supported on technological tools, create certain platforms, software that facilitate sharing and distributing knowledge, although this does not mean that it will be used in the same form by all the individuals of the organization. It has to do with providing knowledge needed by each individual for making the specific tasks.

Also, knowledge may be spread though its reproduction, that is, by means of training. Both it and professional development are part of knowledge reproduction which is fulfilled by means of making activities such as events, forum-debate, etc. These techniques favor the preservation of the organizational knowledge because by sharing it, it is prevented that the absence of one individual, by any reason, deprives the organization of certain knowledge needed.

*Use of knowledge.* In the cycle of the strategic processes of knowledge management, the use of knowledge is located at the end; however, this location is relative, due to the processes of identification, acquisition, development, and spread of knowledge are always in agreement with the needs of the users. Therefore, it is necessary to consider a system of information management that facilitates updated information on the needs of users with the aim of attaining an efficient knowledge management.

In order to have an effective knowledge management, platforms of knowledge, intranets, portals, sceneries, among other tools, should be created to encourage individuals to consume information and increase knowledge.

There are certain elements such as forms of direction, policies, and culture of the organization that affect the use of the new knowledge. These elements should be managed to enhance the process of knowledge management. It is necessary a proactive attitude in view

of the challenges imposed by the organizational environment everyday more complex and changing. Also, challenges should be accepted and learning encouraged. Knowledge in the organization constitutes a resource whose use will provide relevant benefits.

*Retention of knowledge.* Retention of knowledge is an essential process in knowledge management. If it is not possible to retain knowledge within the organization, efforts in the previous processes will be lost.

Retention of knowledge means preservation of information and knowledge used by means of a documental management system that backs up the action of the organization and that facilitates its consult when needed. Thus, the history of the organization is written, as well as its evolution as a way of facing the new changes and challenges that modern society imposes to its institutions, in a renewed and constant manner.

The new organizational knowledge can only be developed on the basis of previous knowledge. Neither the individuals nor the organizations erase their previous experiences with new ones. They are put apart and not used in current circumstances; however, they remain as an alternative.

According to these authors, based on Probst *et al.* (2001), for the retention of knowledge, there are three fundamental sub-processes:

- Select, from the multiple events of the organization, the people and processes that due to their value are going to be retained.
- Keep the experience in an appropriate form.
- Guarantee that the organizational memory may be updated constantly.

In all of them, the information professional has a very important place and function; they are an important part of the professional's responsibility.

An alternative to retain knowledge can be the creation of work teams composed of members of the organization, regardless their levels of experience and with the object of generating knowledge transfer from the most experienced to the youngest. Thus, it is possible to minimize the risks of the organization in case of any eventuality with the most qualified and experienced individuals.

*Measurement of knowledge.* Measuring knowledge does not imply calculating its monetary value, but

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evaluating how the purposes of knowledge are attained or not in the organization. Thus, different techniques are applied. The process of evaluation and measurement of knowledge can be divided into two phases:

- One, where the changes in the basis of organizational knowledge are observed.
- Another, where these changes are interpreted in relation to the objectives of such knowledge.

The main problem to measure knowledge relies on the characteristics of the traditional accountability systems, which should be transformed to account for the operations with the intangible assets; they allow only providing tangible financial value to knowledge once it has been incorporated to the marketable assets.

Probst *et al.* (2001) assured that the idea that knowledge may be measured induces to attend for objectivity where there could be only approximation. Therefore, in this sense, the measurement systems can only offer approximations on the performance of this indicator (knowledge) in the organization due to its inner intangible nature.

Each of these strategic processes interacting with knowledge management is susceptible to being measured through several indicators to determine to what extent they are fulfilled or not with efficiency, and make corrective decisions when necessary. This, undoubtedly, allows potentiating an adequate knowledge management that contributes directly to the increase of intellectual capital in the organizations.

Because knowledge management requires adequate information management, the appropriate use of information technologies and a correct and modern management of human resources, the development of knowledge management in different organizations can attain different levels, regardless its form of expression (Orozco and Carro 2002).

Thus, it is seen that the previously mentioned processes can attain different levels of action depending on the type of organization, as well as it may be seen that different organizations emphasize more on one rather than other processes. The important thing is the application of each of these processes in the search for balance between spaces (the so-called «ba») in the organization that propitiate the production, generation, and transfer of knowledge.

## KNOWLEDGE AUDIT

According to Núñez (2006) and Henczel (2000), knowledge audit is performed to identify knowledge resources in an organization, how they are produced, and by whom. Thus, it permits to assign a level of significance or importance to these knowledge resources using already-established data from the organization, and identify those that are critical for the success of the organization.

Knowledge audit manages to determine, according to Henczel (2000), the forms, times,

resources, etc., for accessing, capturing, and storing knowledge in the organization (logically, transformed into information). In this sense, it is evaluated as positive the suggestion that in knowledge audit the variables (aspects) related to people having impact on creation and transfer of knowledge are identified, highlighting those of communication, cultural aspects, and of policies that may act as facilitators or handicaps.



However, Henczel (2000), after defining its conception of knowledge audit, does not develop it but considers it as a further step, and concentrates on the description of a methodology of five steps defined as Information Audit.

Piloto (2008) presented knowledge audit as a tool that may support the development of human capital within the organizations because, out of it, it may be obtained a quite objective picture of the state of knowledge resources and its use within the organization, which facilitates the schedule of actions to improve management and thus the development of Human Capital.

This author considers that knowledge audit is research, test, measurement, and systematic assessment of the knowledge sources and resources to determine how there are effective and efficiently used in the organization. It is a diagnosis of the health status of the organizational knowledge by means of which it is known toward which aim the organization needs to focus its efforts of knowledge management, which are its needs, strengths, opportunities, threats, and risks in this concern.

This author also reported that, through it, the origin, absence, availability, nature, characteristics, application, quality, value, and meaning of the different types of knowledge sources of the organization may be identified. Also, it is examined the culture of work and the attitudes of the people within the organization and the state of the organizational processes in relation to the actions of collaboration and the interchange of knowledge, as well as the provision of a quite trustful picture of the capacities and potentials of knowledge in the members of the organization.

According to Piloto (2008), the benefits derived from the application of knowledge audit are the following:

- Help to the organization to identify which knowledge is needed for supporting the

organizational objectives and the collective and individual activities.

- Show which knowledge is managed in an effective form and where it is needed to carry out improvements in this sense.

- Evidence which knowledge exists in the organization and how it moves and is used within.

- Identify knowledge in the organization and where it is located, showing the gaps and duplications.

- Reveal the knowledge sources that are not used for the creation of advantages, thus, evidencing the hidden potentials within the organization.

- Identify the communication flows and networks by means of which it is evidenced the good practices, the obstacles, and barriers of them.

- Provision of an inventory of knowledge resources, facilitating with it, make them more visible and thus more measurable and countable making clearer the understanding on the contribution to the role of the organization.

- Provision of important information to be considered for the development of effective initiatives and programs that are relevant to specific knowledge management required by the organization

- Facilitate the conformation of the organization's knowledge map.

Knowledge audit responds to the interests and goals of the organization, as well as all the audits may be conducted both by internal and external experts. The object of the knowledge audits is to improve the efficacy of the processes, satisfy better the user, and get competitive advantages. Contrary to other audits, the aim of this one is not to apply measures to people, but improve the organization management system in a way that favors the learning and perfection of the organization work.

## KNOWLEDGE MAP VS CONCEPTUAL MAP

Knowledge maps, according to Anon (2008), identify the location of knowledge in organizations, as well as in the different levels attained by it within the Value Chain, its sources, relations, and application sites, as well as the people having it. This definition is identified in the processes of knowledge audit. However, according to Rovira and Mesa (2006) a conceptual map is the graphic representation of a series of interrelated concepts. It is about a graphic scheme that shows a group of ideas (concepts) and the relations established between them.

Conceptual maps are associated more with a tool that allows representing any group of concepts and interrelate them, that is, it is more embracing, but its aim is still the same, representation and organization of knowledge. Thus, it is associated more with knowledge management in general.

Thus, there is shared information but mainly there is shared knowledge that facilitates enormously the work; certain knowledge generated by someone is allowed

others to use it and associate with certain processes: attend petitions of information, in the first instance, and develop projects, in the second. This knowledge associated with processes can be called knowledge map (D'Alós-Moner 2003).

In this regard, several definitions of knowledge maps have been provided; among those adjusted to this publication are the following:

- Inventory or database of the different knowledge existing in the organization, indicating to which processes it is associated.

- Representation of the key knowledge shown, in any process and procedure of the organization, the interrelation in the knowledge at the start and end of the process.

On the other hand, Ausubel *et al.* (1989) mentioned three conditions associated with the significant learning in the context of a formative action:

- The information that has to be learned should be presented in a clear conceptually manner for it

could be related to the previous knowledge of the student.

- The student should have previous knowledge that could be related to the new information that has to be learned.

- The student should make decision to learning in significant manner.

From this point of view, conceptual maps permit expressing in a graphic manner the relations between the concepts and showing thus the form in which an individual interrelates the concepts already known with the concepts that have been taught to him. Based on this principle, Ausubel *et al.* (1989) used the conceptual maps as indicator to determine if a student had learned in a significant manner and as instrument to evaluate the form in which the contents assimilated had been organized.

In respect to the organizational area, D'Alós-Moner (2003) expressed that knowledge maps permit having a graphic view of which is the situation of the organization in respect to knowledge, understood as part of the intellectual capital. They permit indentifying and showing the dysfunctions and making priority the aspects needed to be improved to minimize risks, save money, or improve the service to the client.

In this regard, Serrano and Zapata (2003) stated that knowledge plays a role in an organization when people

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apply their knowledge, and conjugate it with the information available to develop their work. Thus, it is necessary that organizations search for this perfect connection between the knowledge they possess and the problems they face everyday, because if this dos not occur, they will not be able to use knowledge and, therefore, this will not be productive.

These same authors have as premise that before developing any strategy of knowledge management it is necessary to identify the existing knowledge in the organization and where it is necessary to support their decisions and actions. Thus, the organization will be able to give value to knowledge available as a resource.

From our point of view, knowledge maps are tools of knowledge management applicable to institutions of varied nature, thus using the principles of knowledge audit to permit identify the existing knowledge in the organization, the knowledge needed to develop efficacious and efficient services and products, and establish the links between the experts inside and outside the organization itself. Likewise, conceptual maps serve as basis for knowledge maps because they provide the latter with their principles and theories, thus, being applicable in general to any process of knowledge management.

## IMPORTANCE OF THE APPLICATION OF KNOWLEDGE MAPS

According to Anon (2008), knowledge maps evidence the form knowledge is incorporated to the strategic management of the institution; the contribution of knowledge to attain corporative goals, its support to the consolidation of the business core or special competences; the distinctive capacities permitting to generate a highly value adder portfolio with products and services.

This material also expressed that it allows evaluating the differential between created, existing, and circulating knowledge in an organization and the «state of the art» (state of the field) of this knowledge at national and international level, within the environment/industry where the institution works.

When evaluating this difference, the organization may determine objectively its real capacities, those which they know about and those which they should know about, to act with capacity; those things which they may do in respect to those which they should do, to have success in presence of homologous institutions and different sectors of the economy to fulfill its mission.

The main contribution of knowledge maps is the possibility of providing knowledge to organizations, those things they effectively do and should do with their knowledge available and its forms of conversion.

All these insights lead to consider the need for determining indicators that permit evaluating in a real form the intangible assets in agricultural research

organizations, which are represented in its cognitive web of its community of collaboration with knowledge and, then, to know how much they are worthy and how they supply to society licenses, invention patents, and, in general, the different realizations attained with the social use of knowledge.

Thus, it is important its application in any institution; however, the institutions of agricultural research, whose most significant asset is knowledge, should have between their premises to know where knowledge is located, and how to manage it in function of the welfare of the organization itself. Thus, the question is: Do you know where knowledge is located in your organization and where you can find it somewhere else? As long as this question is answered by ourselves, we will be prepared to carry out all the processes that followed the identification of the key knowledge in our enterprise.

Likewise, in such agricultural research organizations the measurement of knowledge from the application of knowledge maps should occupy a preponderant place within the productive chain of these organizations due to it permits detecting the dysfunctions as to generation, production, use, and transfer of knowledge. Likewise, it may provide the understanding of the efficient and efficacious use of the existing products and services, an instance on these institutions will be associated with detecting possible partners or collaborators to conduct new research and collaboration projects based on the

identification of the possessors of knowledge outside the organization, which are nothing else but the key external actors. This action of identification will permit potentiating science and encouraging the development of new actions of interchange.

## FINAL CONSIDERATIONS

Knowledge management is the basis for conducting the rest of the organizational processes (that is, intellectual capital management, and acquisition of organizational learning), once that it may be real part of the organization, the rest of the processes will be made conscious by all the members and evidently the institution will be in conditions of learning more, through a process of continuous improvement.

Knowledge audit is identified as the knowledge resources in an organization, how they are produced and by whom, thus determining the difference between the existing knowledge inside and outside it, and addressed to the creation of new knowledge that is critical to have success in the organization itself.

Knowledge maps permit having a graphic view of which the situation is in the organization in respect to its

Also, those people in the organization key for the success will be indentified due to the knowledge they possess, which will permit the creation of research teams according to subject matters, as well as the strengthening of the organization with the acquisition of new knowledge.

knowledge, understood as part of its intellectual capital. Thus, they are a tool that applies the principles of knowledge audit permitting to identify the knowledge resources present in an organization.

In agricultural research organizations it is needed to know where knowledge is produced, used, and transferred and by whom, this will allow determining and concentrating the critical points that are key for the success of these organizations in animal production and conducting new research and collaboration projects.

It is recommended the application of the principles and theories of knowledge maps to conduct and efficient knowledge audit in agricultural research organizations because it will serve as basis for process of knowledge management at organizational level and the people will feel more identified with the productive chain.

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