ORGANIZATION KNOWLEDGE MANAGEMENT CHANGE FROM A COMPLEX ADAPTIVE SYSTEMS PERPECTIVE WITH ABILITY FOR AMBIDEXETERITY

Abstract

We are working on the confluence of knowledge management, organizational memory and emergent knowledge with the lens of complex adaptive systems. In order to be fundamentally sustainable organizations search for an adaptive need for managing ambidexterity of day-to-day work and innovation.

An organization is an entity of a systemic nature, composed of groups of people who interact to achieve common objectives, making it necessary to capture, store and share interactions knowledge with the organization, this knowledge can be generated in intra-organizational or inter-organizational level.

The organizations have organizational memory of knowledge of supported on the Information technology and systems. Each organization, especially in times of uncertainty and radical changes, to meet the demands of the environment, needs timely and sized knowledge on the basis of tacit and explicit. This sizing is a learning process resulting from the interaction that emerges from the relationship between the tacit and explicit knowledge and which we are framing within an approach of Complex Adaptive Systems.

The use of complex adaptive systems for building the emerging interdependent relationship, will produce emergent knowledge that will improve the organization unique developing.

Keywords: Knowledge Management, Complex Adaptive System, Organization Memory, Emergent Knowledge, Ambidexterity.

1 INTRODUCTION

We are working on the confluence of knowledge management, organizational memory and emergent knowledge using construct from complex adaptive systems. In order to be fundamentally sustainable organizations search an adaptive managing ambidexterity in the relation for day-to-day work and innovation.

Individual's ability to use both hands with equal ease has been developed as a metaphor in various organizational contexts and defines the concept of ambidexterity. Early works, suggest that organizations management implementation of dual structures trade-offs, are able to develop emergent behavior with a simultaneous focus on knowledge and adaptation (Rothaermel & Alexandre, 2009).

Organization can be approached as an entity of a systemic nature with collaborative groups of people and technology coordinated to achieve objectives, sustained in a fundamental knowledge capture, storing and sharing within each interacting element. This knowledge can be generated in the intra-organizational or inter-organizational level but must be focused on the absence of organization physical boundaries.

This knowledge, when related to time, is live organizational memory, developed from the knowledge of each element, being supported and stored on the information technology and communication systems. Each organization, in particular in times of uncertainty and radical changes, to meet the demands of the environment, needs timely and seizing differentiation on the basis of tacit and explicit knowledge exploitation. Organizational learning can be this exploitation process and is a resulting process from the interaction that emerges in the relationship between the tacit and explicit knowledge and which we are framing within an approach of complex adaptive systems (CAS).

The adoption and integration of technology into organizations of people addresses exploitation of explicit knowledge, that is supported in information technology and communication, and forces the acquisition of tacit knowledge about people. With the use of complex adaptive systems, focused on conceptions of emerging interdependent relationship from basic rules, emergent knowledge that will improve the organization and developing unique constraints, can be constructed.

Organization knowledge management, comes from a business need, to make sustained differentiator development based on common artefacts, commodities, such as power and ICT (information communication and technology) (Carr, 2004, 2005). In this reality, knowledge management must be able to deal with organization absence of boundaries and discover the emergent information flow that happens in the typical organization semi-autonomous organization levels. It's the emergent discover of relation between tacit and explicit.

Looking to knowledge management in the light of complex adaptive systems, knowledge is a dynamic construction where different meanings are possible and desirable, based on different interpretations of incoming information to the contexts or at different times. There are a sustained number of defined basic rules that can be combined, in a first stage, to address a new challenge.

Complex adaptive systems concepts come from a first approach made by J. Holland, in the Santa Fe Institute (J. Holland, 2006; J. H. Holland, 1992a), and has been used in many situation from organization analyses (Schneider & Somers, 2006), to web (Rupert, Rattrout, & Hassas, 2008) and also and fundamentally in natural science (Bonabeau, 1998; Bonabeau & Dessalles, 1997) from which come its fundamental concepts.

So, we are in the edge of define this interdependent ambidextrous development of knowledge under the complex adaptive systems approach. This paper starts with addressing the knowledge management, section 2, next discusses complex adaptive systems, section 3, and in section 4 describes how we think it's possible to discover emergent knowledge trough complex adaptive systems interdependence and how it transforms organization and in section 5 are presented conclusions and future work.

2 KNOWLEDGE MANAGEMENT

An organization is an entity of a systemic nature, composed fundamentally of groups of people who interact to achieve common objectives (Lootty & Szapiro, 2002). Adoption of Technologies and Information Systems, by organizations, allows them to improve their information flow and facilitating their interaction and when used strategically, positively differentiates them, providing competitive advantages, dissemination and updating of essential organizational knowledge in a globalized world. This transforming organization is them an achievement of systemic nature with interacting instances of people and information systems technology.

Organizations recognize the need for collaborative innovation based on how to create, accumulate and exploit knowledge that improves the competitiveness and vitality of the organizations not only to revolutionize working ways and creation, but also how to promote organizational learning, generating and managing knowledge and interact with the environment. Knowledge management should be used to stimulate organizational knowledge within optimization of tangible and intangible resources.

Through globalization, the success of organizations depends on its ability to interact with the environment and its ability to operate globally (Bradley, Hausmann, & Richard, 1993). There is a need to identify and define technology models that can effectively support this interaction, pursuing an innovative and entrepreneurial approach. In this pursuing knowledge management has a central role.

The creation of knowledge can occur in different forms, (T. Davenport & Prusak, 1998; T. H. Davenport & Prusak, 2000) found five ways to generate knowledge; acquisition, dedicated resources, fusion, adaptation, and knowledge networks, Generated knowledge is analysed (the generated knowledge is internalized and analysis determines whether it is useful to the organization), verified its usefulness, it is systematized and filed (it is the codification of knowledge and coordination). According to authors, this aims to make knowledge accessible to those who need it. To determine how it should be encoded, you must define the knowledge in tacit or explicit way.

Tacit knowledge is the kind of knowledge that individuals or groups have, but not consciously accessible, it's not yet part of reality [(Popper, 1965, 1979). This knowledge is acquired, in an effort to understand, by processes that are not directly controlled by the learner. Explicit knowledge is the kind of knowledge that was explicit and thus brought to a conscious level. Thus, not only the person or group recognize as having certain knowledge, as they can convince others that this is so (Santos & Ramos, 2009).

An important component of knowledge is called organizational memory that enhances organizational knowledge to capture, organize, disseminate and reuse knowledge created by employees inside the organization. Organization memory is defined as a system capable of storing, resulting perceptions of experience or of keeping the construction abstract memory registers, for a long period of time and recovering them later (Maier, 2007).

Organizational Knowledge Management is a field of multidisciplinary research that cuts across areas such as information systems, computer science, human resource management and organizational sciences among others, addressing the sharing and reuse of knowledge, including individual and group skills, in order to improve quality, increase efficiency, increase customer and employee satisfaction, reduce risk and capitalize on the knowledge exploitation, through imagination, experience and experimentation.

The process of knowledge management can be structured in four fundamental ways (Santos & Ramos, 2009):

    i) knowledge creation;

    ii) retention and retrieval of knowledge;

    iii) sharing and knowledge transfer;

    iv) application of knowledge.

These four elicitations conducts continuous learning, essential to keep up to date human resources in relation to technological innovations and work practices, and at this four elements, information technology, made learning easier.

Organizational memory that also supports previous four elements, is the system capable of storing perceptions resulting from experience or abstract constructions, keeping records of memory for a long period of time (Maier, 2007) and according to many scholars, is the basis of knowledge, as such, must be crafted and stimulated. With this assumption, in the context of organizations, can be understood as a set of organizational information memory demonstrative of the organization's history to be remembered and used in future operations, providing that increase the effectiveness and efficiency of the organization.

Traditional concepts of knowledge management, which support most of KMS, the centrality of information processing, mainly depend on routines that are programmed in a computational logic and data reside in a database (data warehouse) (Malhotra, 2000; Prusak, 2001). In the previous four constructs this is clear. Based on predetermined specifications in a programmed logic, the input information and consequent connections produces the results of predetermined information, such systems are based on consensus, convergence and accordingly to ensure alignment with organizational routines.

In this sense the information systems will always be the repository of corporate history, experience and knowledge accumulated over time by employees. In this context the information systems tend to become a stable structure of the organization, while people tend to move in and out of the organization, verifying that increasing turnover in line with the increase of competitiveness driven by globalization, being naturally necessary to retain their experience, which will be incorporated in systems that help them and their successors run the business activities. Many companies are trying to push for the adoption of computer technology to store the knowledge of its employees in databases based on best practices, benchmarks and rules that tend to define the assumptions that are not only included in the databases of information but also the organization's strategy.

Knowledge Management promotes an integrated approach to identify, capture, retrieve, share and evaluate information from an active business. These information assets may include databases, documents, policies, procedures, and tacit knowledge and experience not captured but stored in the minds of individuals.

Such entries, oriented mechanism and static representations of knowledge not provide any clue on how these inputs affect business performance, or suggest how to deal with relationships and specific contexts that characterize tacit knowledge and new challenges (Nonaka & Toyama, 2003).

Knowledge creation, from point i), can be better represented as intelligence in action, it is a construct compound, resulting from the interaction data, information, rules, procedures, best practices and features, such as attention, motivation, commitment, creativity and innovation. This contrasting representation of knowledge, as intelligence in action instead of static computational representations is remarkable for several reasons. The active representation, emotional and dynamic knowledge makes more sense from a pragmatic perspective and in line with theoretical construct representation beyond the realm of information technology management.

From a practical perspective, the dynamic representation of knowledge provides a more realistic construction where the human and social interactions are present while this building is located closer to the performance results (Malhotra, 2000). A dynamic Knowledge Management Systems provides a better representation of reality, since it takes into account two main features:

- Is made with data, information and best practices, depends on subjective interpretation ("construction") of individuals and groups that transform these inputs into actions and performance;
- Performance results must be continually reassessed to ensure that they truly represent the best business performance for the company with regard to changes in market conditions, consumer preferences, competitive offerings and business models constantly changing, and organizational structures.

Forms of highly routine and structured can also represent processing knowledge through systems and information technology, allowing default pre-programming, and predetermination of data inputs to obtain performance results pre-specified. Instead, the human process of decision making, may represent a complete contrast, where decision-making is influenced by attention, motivation, commitment, creativity and innovation of individuals and groups.

3   COMPLEX ADAPTIVE SYSTEM (CAS)

CAS integrates the concept of emergence, from which adaptability and evolution. Organization development is supported, in the ability to use information flow as source for relevant results, when facing change and competition along space and time (Bonabeau & Barabási, 2003; Desai, 2005).

The paradigm that has been used to model organization development changed. This change can be found in a fundamental core of articles and books that deal with enterprise dynamics (Don Tapscott, 2006; Hamel, 2008; Memmel & Schirru, 2007; Nonaka, 1994; Nonaka & Toyama, 2003).

Now, organizations are centred in developing and maintaining dynamical core structures, in order to support the unpredictability of change in the edge of chaos. However, for supporting this in a viable manner, this is, with efficiency and effectiveness, information systems become a core structure.

In this context, information systems as a fundamental element, supported within an attached reductionist vision, will never have relevance. A paradigm shift should be achieved and developed. The prosperity in this new world demands dynamics for complexity and CAS is a great way to deal with this (Iansiti & Levien, 2004; Schneider & Somers, 2006; Sutherland & van den Heuvel, 2002).

Complex adaptive systems are systems with great number components, sometimes called agents, that interact, adapt and learn and many contemporary problems are under complex adaptive system's theory (K. J. Dooley, 1996; Kevin J. Dooley, 1997; Schneider & Somers, 2006; Sutherland & van den Heuvel, 2002).

Dependency of complex systems from initial conditions can be expressed, in a very exponential level by the butterfly metaphor; butterfly flapping its wings in South America can affect the weather in Central Park (Desai, 2005; Mazzocchi, 2008). Complex systems exist on the edge of chaos presenting a regular and predictable behavior, but suddenly, can start a mass change response, to what can be seen as a minor change (Brownlee, 2007).

With five central elements, parallelism, conditional action, modularity, adaptation and evolution, CAS development, rely on agent interactions, using basic rules. Agent changes through time and space and from this change normally comes adaptation, allowing performance increasing, over random variation.

Agent performance is then the result of the interaction schema that runs over space and time. It's rare that there is enough available information, within open information about an option state, which can lead to performance improvement.

Rule discovery problem becomes obvious since some rules are inefficient or ineffective and the replacement of ineffective rules by new ones, randomly generated, will not solve the problem. This is something like the introduction of random instructions into a computer program.

The goal is to produce a new useful set of rules at the agent experience level. Although through time CAS presents perpetual uniqueness, sub-patterns exist. Sub-patterns are usable blocks used as critical structures for effective rules and for good rules discovery already in production (J. Holland, 2006). Complex systems are a network or "*meshwork*" characterized by relations defined by informational flow processing [28] and with qualities that only become effective in system level, this is called "*emergence*"(De Wolf & Holvoet, 2004, 2005).

Emergence occurs on systems, near or in, the limit of thermodynamic equilibrium. Such systems are common on the physical world and have "*emergent*" properties that result from interactions that are global and collective. Simple emergence is a characteristic of near equilibrium systems being relatively predictable and computable (Halley & Winkler, 2008). Emergence development is

transversal, going from the system simple properties at the equilibrium point to a stage of complexity as the result of the equilibrium nature and with the increase of the system non-linearity (Halley & Winkler, 2008).

Complex emergence arises only in non-linear systems that are far from equilibrium and trough the introduction of matter and/or energy (Halley & Winkler, 2008). Emergence presents some fundamental characteristics (De Wolf & Holvoet, 2004, 2005) such as micro-macro effect, radical novelty, coherence and interactive components, dynamic, no centralized control, two ways connections, robustness and flexibility.

Foundation of emergence is the existence of a global behavior that is new when related to all parts that compose the system.

Information flow defines emergent patterns that can lead to adaptation, a familiar form in the biological process, trough which organism evolves, reorganizing genetically material to survive in environments that confront them. This process allows the modulation of non-linearity that comes from complex interactions (J. H. Holland, 1992b).

4 DISCUSSION

Knowledge management long time approach relates the knowledge discovery with organization performance. Long time organization performance and sustainability deals with the challenge to have the right new knowledge at the right time. This is all about adaptation, evolution and emergence.

Tacit knowledge is the kind of knowledge that individuals or groups have from which they don't have conscious awareness, been very hard to represent in ICT. Explicit knowledge is under ICT fundamentally represented and more related with organizational memory. Into this discussion it's for use relevant that uncover that is the relation of emergent interdependence between tacit and explicit that comes possible to improve knowledge management.

Using a framework of knowledge management analyse and discussion from (Rubenstein-Montano et al., 2001) they came to the conclusion that knowledge management is a prescriptive tasks, fundamentally as presented in discussion of knowledge management steps by (Santos & Ramos, 2009). The notion of learning is based on feedback loops.

Complex adaptive systems are sustained in basic rules and emergent behavior that comes from interdependence and when relating to knowledge it can be more related with learning. This basic ruled agents could be something similar to semi-autonomous structures of organizations.

So the central elements of acquisition, dedicated resources and fusion are properties of those semi-autonomous agents.

The unique characteristic, that results from the unique combination at the organization level, between ICT and people. Knowledge management as define by (Santos & Ramos, 2009) can be achieve if we use CAS for developing an additional step called emergent knowledge.

CAS as parallelism, conditional action, modularity, adaptation and evolution all reflect aspect in knowledge management acquisition, dedicated resources, fusion, adaptation, and knowledge networks.
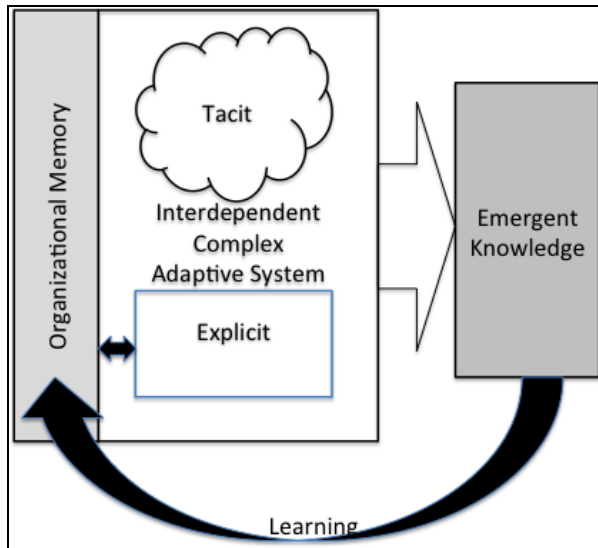
Figure 1-Expected development of proposed approach.

Figure 1 represent what is expected as achievement. The four fundamental sets of knowledge management are the starting point for the construction organizational memory. Organizational memory is the main core of sustainable knowledge management integrating basic develop rules for organization continuity.

Adopting and integrating technology and people organization produces explicit knowledge that is supported under ICT, and acquires tacit knowledge regarding people. With the use of complex adaptive systems construct the interdependent emergent relation will produce emergent knowledge that will improve organization development and unique characteristics. That natural process of learning will introduce that emergent knowledge as fundamental organizational memory.

5   CONCLUSION

Its not our goal to propose a framework for deployment of knowledge management as complex adaptive system, but to discuss, how common are some characteristics and how they can be useful for uncovering emergent interdependent relations between tacit and explicit knowledge.

When we compare this approach with traditional knowledge management we considerer that this can improve:
- Business and technology strategy trough the definition and integration of a re-everything context;
- Organizational control could improve with the emergent discovery of new knowledge that can be used as self-control for innovation;
- Information sharing culture trough the creation of complex adaptive system structure;
- Dynamic knowledge representation in an evolution from static rules;
- Organization structure can easily evolve to inclusive (tacit and explicit) and self-organized.

These are clearly challenging points for present approach and clearly are candidates into future research.

It comes clear that the evolvement from traditional knowledge management is on the move and that CAS as a constructing from basic rules, that are clearly accommodate under information systems technology, is a strong element for the development of a new kind of knowledge, the emergent one.

We considered that it should be looked into more detail the introducing of the emergent step in the four knowledge management steps.

CAS will provide ambidexterity within an approach due to its availability of basic rules, day-to-day operation, and emergent constructs from basic rules for the quest of innovation and development.

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