# Modeling the Knowledge Processing System through the Lens of Complexity Theory : Social Energies, Leadership, and the LIFE Model

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## Abstract

Existing models of knowledge processing do not feature a systemic meaning of knowledge management and ignore the role of leadership and social energy in the knowledge processing system (KPS). This conceptual paper introduces the Leadership Invigorating Flows of Energies, (LIFE) Model as an attempt to remedy that situation and provide a more useful description of the KPS. The LIFE Model highlights the role of emergent leadership and flows of social energies as forces encouraging knowledge creation and dynamic diffusion within an organization through the Knowledge Processing Cycle in eight activities interacting with its social knowledge base in a self-organizing system.

Keywords : Complexity Theory, Leadership, Social Energy, Knowledge Processing, Knowledge Management

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## 1. Introduction

Western management has traditionally viewed organizations as information processing machines that obtain and process information from their environments in order to solve current problems [Nonaka et al., 2001]. This is a highly structured and passive view of the organization that fails to capture the dynamism underlying the process of knowledge creation. Instead, an organization should be seen as a venue [Nonaka et al., 2001] or a field [Bourdieu, 1977] that facilitates interactions among the members of the organization. Guided by the rules specific to the given field, the role of an organization's members is to identify and analyze problems; in essence to apply existing knowledge of patterns of movement in an ever-changing, complex environment. This process results in the development and application of new knowledge. In order to understand an organization's knowledge management capabilities, it is therefore more important to appreciate the dynamics of its Knowledge Processing System (KPS) than to ascertain the depths and/or scope of its existing knowledge base.

Complexity theory suggests that innovation and creativity occur when systems operate at the "edge of chaos," where they show emergent behaviors that enhance their ability to adapt to a particular situation of their environment [Bak, 1996]. Hence, complexity theory provides a framework to understand how knowledge forms at the level of individuals and then influences knowledge processing at the collective level of the organization. It also gives insights into how each agent of the organization is self-evolving with its own rules and its own Knowledge Processing System, and how it influences the evolution of the whole organization [McElroy, 2003]. Hence, a key presumption of this paper is that organizations can appropriately be considered as dynamic open complex adaptive systems (CAS).

However, a review of the existing literature shows that a better understanding of the concept of Knowledge Processing System is needed. Existing models do not demonstrate a systemic meaning of knowledge management and ignore the roles of leadership and social energy in the Knowledge Processing System. The LIFE Model presented in this paper is developed from the principles of complexity theory and attempts to provide a more useful description of the Knowledge Processing System.

## 2. Characteristics of Complex Adaptive Systems

Complex systems have been recognized and studied in biology, physics, and economics, and are increasingly used to describe firms and their environments. Complex adaptive systems are defined as open systems with large variability and diversity of elements or agents, with dynamic interactions among them that create non-linear feedback systems [Bak, 1996; Byrne, 1998; Cilliers, 1998; Phelan, 1995; Stacey, 1992], which are related to learning activities and are necessary for many features of complex adaptive systems, such as self-organization and unpredictability.

It is difficult to define the exact border of

complex systems, as the scope of an open system is usually determined by the purpose of the description of the system [Byrne, 1998]. Because complexity results from interactions among the components of a system, it is not located in a specific and identifiable site in the system [Cilliers, 1998]; complexity is manifested at the system level itself, emerging from the whole. There is neither something at a level below (a source) nor at a level above (a meta description) that can help to capture the essence of complexity. Being non-linear, complex systems show a synergy among their parts, resulting in the whole being more than the sum of the components; a holistic approach is therefore necessary to understand the patterns of behavior that emerge from the system. Furthermore, if complex systems are fully open with respect to energy, many (such as human organizations) demonstrate some closure relative to information flows in order to protect themselves from their environment. This implies the existence of filters and barriers to compensate for the openness of the system, rendering analysis even more difficult.

Complexity occurs far from equilibrium at the "edge of chaos" [Stacey, 1992], also called the critical point [Bak, 1996]. This position defines the area between predictable periodic behavior and unpredictable chaotic behavior [Bak, 1996; Byrne, 1998; Stacey, 1992]. Complexity emerges as a result of the interactions between the elements according to the information they have locally [Byrne, 1998]. Complex behavior is the tendency of a system to evolve through spontaneous and autonomous processes into a critical state, in which a small disturbance may have a great impact on the whole system [Bak, 1996]. This is referred to as self-organizing criticality [Bak, 1996], and more commonly as self-organization [Byrne, 1998; McElroy, 2003; Phelan, 1995; Stacey, 1992]. As suggested by Bak [1996] and Buchanan [2000], self-organization is a fairly slow process, implying that the history of the system is an important consideration. Starting from equilibrium, a succession of slow changes in the system will eventually lead to a critical state, from which just one small change has the potential to launch a larger transformation of the whole system. Furthermore, Bak [1996] suggested that forcing a system away from a critical state would be a waste, as it would automatically revert to a similar critical state. Therefore, attempting to override the system's tendency towards a critical point works counter to its efficiency. This latter point is crucial when examining complex social systems; indeed, contravening self-organization implies waste in time and resources for an organization.

Self-organization is the process of attraction (obtaining inputs) and repulsion (expelling waste) in which the internal organization of a system increases in complexity without being guided by an outside source. [From a physics perspective, Schrödinger [1944] noted that living systems feed on negative entropy flows. Prigogine [1980] postulated that complex systems, which are thermodynamically open, can exchange matter and energy with their environment in order to produce negative entropy (i.e. the export of entropy or import of free energy). Such systems are called dissipative structures

and operate far from thermodynamic equilibrium, exchanging energy and matter with their environment in order to self-organize A constant flow of energy is necessary to maintain the self-organization of complex systems and to ensure their survival. Without energy, the system would gradually fall into a static state in which it is unable to adapt to its environment, eventually leading to the system's demise. In complex systems, energy flows can be identified as part of the interactions among the elements and between the elements and their environment. While conventional definitions of factors of production (such as capital and labor) are usually viewed as the inputs to organizational systems, they are insufficient when working with complex adaptive systems. They may earmark sources of energy, as do coal and oil in the natural world, but they do not describe the energy itself.

In the social world, most transformations of energy are irreversible and most social systems are essentially complex. Hence, they import energy to sustain their evolution and fight entropy. A distinguishing characteristic of social complex adaptive systems is the presence, indeed necessity, of flows of social energies to maintain the existence of the system. The next section introduces the concept of social energy and illustrates its importance for complex systems.

## 3. Social CAS and the Importance of Social Energy

A review of the literature shows that the term "social energy" is not commonly used in social science or business. Although the idea of social energy goes back almost a century in the work of sociologists such as Durkheim [1912] or Pareto [1916], the sole definition located in academic literature is presented by Ammon [2003, p. 292] ; citing her own work from twenty years earlier, she states that social energy is "emotional warmth and support of the own development of the identity." However, by focusing intently on the psychology of the individual, this definition is unsuitable for the purposes of this paper, as it does not address the intended organizational perspective. Several authors mention the term "social energy" in the title of their article [Hirschman, 1983; Werlin, 2004] or in their abstracts [Dhesi, 2000; Lawrence, Mauws, Dick, and Kleysen, 2005], but none actually define or discuss what social energy is. Could it be that everyone assumes its meaning? That possibility alone warrants returning to the roots of the term to extract a suitable definition.

According to the Oxford Dictionary, the meaning of *energy* in physics is "the power of 'doing work' possessed at any instant by a body or system of bodies," a definition that clearly addresses the "potential" nature of energy. Another definition not linked by the dictionary to any specific field but more appropriate for a social/organizational context, is "Power not necessarily manifested in action; ability or capacity to produce an effect." Social energy differs from physical energy (e.g. mechanical, chemical, and electrical energy) that comes from food and other energy supplies used by humans to operate in their environment. Social energy is the collective manifestation of mental energy, here

defined as the motivations, emotions, and cognition [drawing on work in psychology by Lazarus, 1991a, 1991b; Markus and Kitayama, 1991] that arouse an individual to act toward a desired goal. Mental energy can stay at the individual level without further interactions with the organization, although in many instances it will flow into social energy. Hence, social energy equates with human network mental energy, with *social energy* defined as the ability or capacity [the potential] to engender, sustain, diminish, redirect, or terminate an effect [an action or outcome] within a human organization. The ideas of ability and capacity capture the notion of power in the physical definition while work is reflected in the different types of actions that are relevant to the organizational context. In our model (presented below), this energy is drawn into the Knowledge Processing System from organizational social networks.

In the physical world, energy is released through interactions (usually between the element storing the energy, and the element that will store it once transformed). Indeed, the process of transformation of energy requires the interaction between elements of the system at work. For example, the water of a retention lake has to interact with the turbine of the dam in order to release the gravitational potential energy stored in the water molecules and transform it into electrical energy. In the same fashion, social energy is released through social interactions. Examples range from informal discussions to formal meetings, and from emails to telephone conversations; strikes can be viewed as the occurrence of the release of large amounts of social energy; documents can also store social energy as suggested by the work of Greenblatt [1988], and Hawes [2005]. The important point here is that social energy is something every organization has in different forms and varying quantities, and that it can be channelled. Every social system has emergent patterns that need to be understood in order to avoid fighting the system in counterproductive ways. Even if social energy is the outcome of self-organizing social processes, and hence is hard to 'manage,' it can still be understood or handled in efficient ways.

Survival of an organization (avoidance of entropy, or recovery from it) requires sufficient inputs of social energy to sustain its normal activities as well as to create new ones. Thus, social energy can be described at the same time as an individual and an organizational resource, as well as an enabler of emergent properties of the organizational system. As interactions occur among elements of the organization, flows of energies are created, altered, and destroyed in day-to-day activities. These flows, of both social and physical energies, are important elements of organizational evolution; they intervene across all organizational levels (individual, group, inter-group) by creating vital positive and negative feedback systems within organizational processes. Negative feedback leads to consequences that counterbalance or compensate the original deviation [Parker and Stacey, 1995]. In contrast, positive feedback leads to consequences that reinforce or amplify the original deviation. Assuming that human organizations are complex adaptive systems implies that flows

of energies sustain self-organization processes.

In the LIFE Model, as explained below, several flows of energies are identified and discussed. These are termed 'Leadership Invigorating Flows of Energies'; together they sustain the self-organization of the Knowledge Processing System.

## 4. The Leadership Invigorating Flows of Energies (LIFE) Model

The LIFE Model is based on the holistic approach of complexity theory and aims to give a general picture of the Knowledge Processing System [Faucher, Everett, and Lawson, 2006]. As argued by McElroy [2003], knowledge management is not so much about managing knowledge but about managing knowledge processes. Therefore, the focus of knowledge management should be on studying the KPS, defined here as the system of social processes through which knowledge is created, diffused, and utilized within a human organization. The LIFE Model emphasizes the dynamism of the KPS that exists in organizations and shows the different feedback systems created and influenced by social processes, knowledge activities, and flows of social energies within the organization. The model has a strong focus on flows of social energies and leadership. These important aspects are not included in previous models (such as Senge's [1990] Deep Learning Cycle, Nonaka and Takeuchi's [1995] SECI model, McElroy's [2000] Knowledge Life Cycle, or Trott's [2002] model), while in the LIFE Model they are presented at the core of the understanding of knowledge processing in organizations. Furthermore, the model emphasizes the importance of interactions between the Organizational Knowledge Base and the different stages of what is called the Knowledge Processing Cycle.

The name of the Leadership Invigorating Flows of Energies Model designates its purpose and key characteristics : The model illustrates the synergies between leadership and flows of social energies within the context of organizational knowledge management. As described by Lash [2006], the notion of *life* favors the idea of flow and flux, emphasizing *becoming* as opposed to *being*, of movement versus stasis, of action over structure (echoing the name of Prigogine's 1980 book *From Being to Becoming*). This idea is consistent with the concept of living systems portrayed in complexity theory. The following section provides an introduction to the components and processes constituting the LIFE Model.

### 4.1 The Organizational Knowledge Base (OKB)

The OKB is at the same time the foundation of the KPS and the repository of all its outcomes. The OKB is the aggregate of all knowledge possessed and shared within the organization, through all its members, experiences, and facilities. In this paper, knowledge is defined in a broad way as a texture of various interrelated skills, experiences, know-how, and perspectives [Styhre, Ingelgård, and Roth, 2000], encompassing all constituents of the knowledge taxonomy as portrayed in the E2E (existence to enlightenment) model [Faucher, Everett, and

Lawson, 2008]. Hence, the OKB contains both tacit and explicit knowledge.

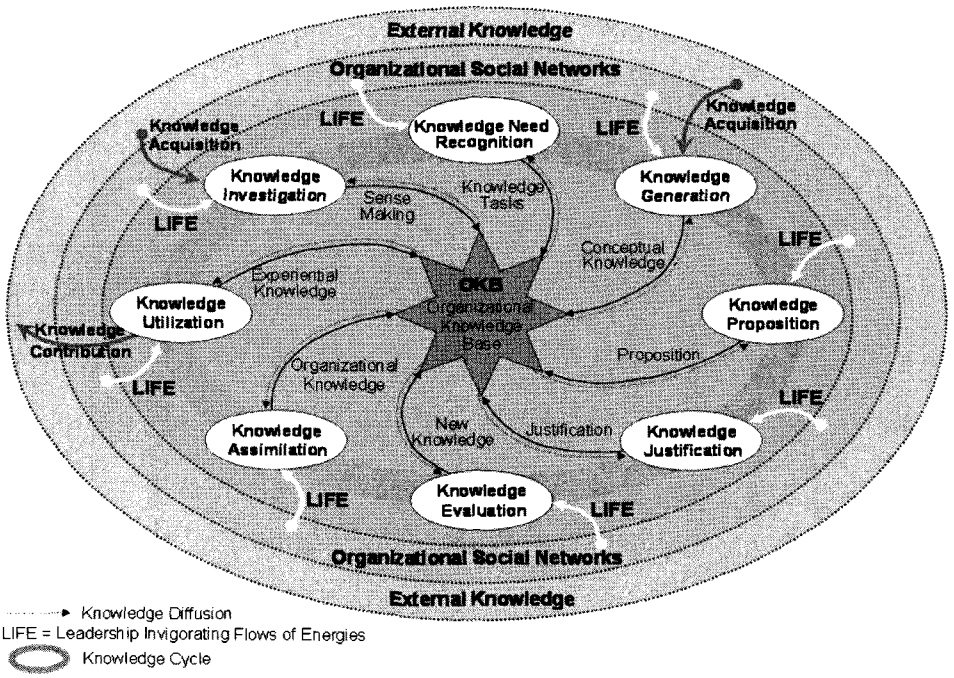
The OKB is a social knowledge base that interacts, through flows of knowledge and energies, with all of the processes of the Knowledge Processing Cycle. It is the center of positive and negative feedback, allowing for incremental accumulation of knowledge as well as selective forgetting mechanisms. Such a feedback system is the basis of the emergence of complex adaptive systems, indicating that the OKB is a social CAS with emergent properties, arising from its self-organization capacities. It forms part of a scale-free representation of the Knowledge Processing System present in both individuals and organizations. Every organization has an OKB. Therefore, one needs to understand the OKB and its role in the processes that occur in the Knowledge Processing Cycle.

## 4.2 The Knowledge Processing Cycle

The Knowledge Processing Cycle is a self-organizing social process expressing emergent patterns of knowledge flows. Knowledge processes are natural and exist on their own; they do not need to be created, but they can be formalized and managed in order to improve performance. The organizational Knowledge Processing Cycle is a core constituent of the Organizational Social Network, which is the knowledge processing environment supporting the self-organization of the KPS. Hence, the objective of knowledge management is not to create the KPS but to enhance and strengthen its behavior. If this is ignored, organizational rules or policies will work against these natural processes, making them inefficient. Managerial interventions should not go against this behavior, as it would result in a situation where the KPS is no longer sustainable through time, thereby disrupting the functioning of innovation and learning.

As shown in <Figure 1>, the Knowledge Processing Cycle is divided into eight interdependent activities, interacting with the OKB, external knowledge, and the Organizational Social Network. This set of activities represents a synthesis of all models found in the literature, reconciling them within a new framework derived from complexity theory. The Knowledge Processing Cycle is characterized by an on-going mechanism, without a start or finish. Therefore, the eight activities described below interact with each other at the same time through the knowledge feedback system shown by the model. These activities can occur concurrently or after one another, and in any sequence, depending on the circumstances, indicating that this model is not as linear as traditional models.

This is a general model, and it is apparent that all knowledge will follow its own way through the processes of the model. Depending on the organization in which it occurs, the frequency and types of feedback, as well as the relative importance given to processes, may vary. The LIFE Model is built on the assumption that both tacit and explicit knowledge (at all levels of the traditional Data, Information, Knowledge, Wisdom taxonomy) can occur and be processed by the model. The order of presentation of the activities in the diagram of the




〈Figure 1〉 The LIFE Model

LIFE Model matches the commonly-perceived sequence described in a variety of (partial) published models [e.g. Argyris, 1993; Nonaka and Takeuchi, 1995; Luo, 2000; McElroy, 2000; Trott, 2002; Zollo and Winter, 2002; Awad and Ghaziri, 2004; Wiig, 2004], although this is not the only possible sequence. A fixed cyclicality is not essential and the activities can occur in any order depending upon the type of organizational learning that is taking place.

The **Knowledge Investigation** activity refers to the process of interpreting the knowledge being used inside and outside the organization. It involves comparing objectives and results, as well as checking the alignment between the organization and its environment. Knowledge Investigation includes what Argyris [1993] refers to as the detection of a mismatch between the real and expected outcomes of the organization's activities or objectives. At this stage of the Knowledge Processing Cycle, individuals analyze knowledge within all boundaries to which they have access, trying to make sense of it. During the process, external knowledge is acquired and added to the OKB. This activity is part of the strategic intelligence activities of the organization as it helps to organize and make sense of the content of the OKB for future development. Important positive feedback takes place at this stage; managers should look closely at this activity to discover emergent patterns that occur in the KPS.

The **Knowledge Need Recognition** activity is the formulation of knowledge needs and their related knowledge tasks. These tasks interact with the OKB, through which they are expre-

ssed and allocated. When possible, allocation of knowledge tasks should be governed by self-organizing processes and individual willingness. The idea here is to let individuals come forward themselves within the Organizational Social Network, rather than forcing them to do so. The advantage of this approach is that it fosters the motivation of individuals, helping them to feel at ease within the organization as they receive responsibilities for tasks they have chosen. This also invigorates flows of social energy and positive feedback which will support learning and innovation within the organization. However, this implies a diversity of individuals within the organization, in terms of skills, ambitions, and topics of interest, as well as sufficient transparency for members of the organization to see what is needed.

The **Knowledge Generation** activity occurs when new knowledge is created as the product of individual and group learning processes. This can be an outcome of a new way of combining prior knowledge held by the organization, a combination of completely new ideas, the combination of external knowledge acquired by some individuals, or a mix of these. This process by which groups and individuals challenge existing mental models combines both positive and negative feedback. Furthermore, the Knowledge Generation activity interacts with the OKB, as any conceptual knowledge should be retained by the system to help trace the history of the KPS, which facilitates pattern recognition. As suggested by Buchanan [2000], complex systems evolve when they attain a critical state built up by a history of irreversible and unexpected events. Therefore, better knowledge about the history of the system can greatly improve the understanding and management of that system.

The **Knowledge Proposition** activity addresses recognized knowledge needs of the organization, arising explicitly from the Knowledge Need Recognition or tacitly from other activities in the Knowledge Processing Cycle. Furthermore, every proposition should be historically stored in the OKB and open to the view of other members of the organization, allowing for future feedback and iterations. As suggested by McElroy [2003], to facilitate formulation of knowledge claims, organizations should be organized as open enterprises, which implies that the organizational KPS stays politically open. This is a more democratic way of organizing, giving to every agent of the organization the ability to propose knowledge, as well as access to proposed knowledge and the opportunity to criticize it. Additionally, hindering relationships between individuals could lead to less efficient self-organization within the KPS.

The **Knowledge Justification** process includes discussion and argumentation of both proposed and current knowledge to demonstrate how the knowledge addresses a need of the organization. It also refers to the search for approval by the appropriate authority within the organization [Ballantyne, 2003]. This activity can be influenced by any member of the organization. Hence, to be fully effective, the Knowledge Justification process implies openness and transparency within the organization and the OKB, as well as sufficient diffusion of

knowledge among the members of the organization through positive and negative feedback. People must recognize their capacity to influence as well as accept being affected by others. These necessary rich connections lead to a more robust, adaptive, and creative system [Regine and Lewin, 2000]. Finally, a history of the Knowledge Justification process should be stored in the OKB, thereby being visible to the members of the organization; this permits future examination and provides historical data to explain organizational developments.

The **Knowledge Evaluation** activity concerns the testing and evaluating of knowledge, including authorizing or denying the Knowledge Proposition. This consequently leads to the accreditation of the proposition (positive feedback emphasizing the original deviation) or to the refutation of the proposition (negative feedback countering the original deviation), in which case it is sent back to the Knowledge Generation or Knowledge Need Recognition activity. This process is usually the role of managers; however, as suggested by McElroy [2003] among others, representatives of employees from throughout the organization should be able to participate during the Knowledge Evaluation process in order to create more fruitful interactions. This stage interacts with the OKB, as any result of the Knowledge Evaluation process should be retained for historical reference, allowing current knowledge as well as previous evaluations to be consulted in reaching a decision. The principal outcome and interaction of this process with the OKB is the provision of validated new knowledge complemented by records of knowledge propositions that could not be validated.

The **Knowledge Assimilation** activity is the process whereby members of the organization gradually adopt and incorporate new knowledge from the OKB into their personal knowledge bases. This activity includes-but is not limited to-what Nonaka et al. [2001] refer to as internalization, when explicit knowledge is converted into tacit knowledge. The Knowledge Assimilation process also includes the direct transfer of tacit knowledge and of explicit knowledge, such as the amalgamation of newly perceived experiences into the existing cognitive structure. Socialization plays an important role in the assimilation process and continuously creates feedback from the Knowledge Utilization activity. Socialization is a learning stage during which tacit knowledge is transferred from one organizational member to another through shared experience [Nonaka, Toyama, and Konno, 2001]. This shared experience can involve assimilating knowledge or the experience from using it. The Knowledge Assimilation activity's interactions with the OKB should be monitored and shared among members via the OKB through tools such as story telling, interviews, meetings, etc., hence increasing the likelihood of innovativeness in the organization.

The **Knowledge Utilization** activity consists of the application of tacit and explicit knowledge to guide organizational activities, including decision making, information gathering, or any of the activities of the Knowledge Processing Cycle. Important feedback loops intervene at this stage, linking to such activities as Know-

ledge Need Recognition (recognition by doing), Knowledge Justification (illustration of a need), and Knowledge Evaluation (trial based). Additionally, performance monitoring processes direct feedback from the Knowledge Utilization activity into the OKB. The organization interacts with its environment through contributions such as publications, patents, or new products; such contributions help the development of links with other organizations, which can promote the process of knowledge acquisition from them.

The whole organizational Knowledge Processing Cycle is essentially a series of feedback mechanisms within the organizational network. The LIFE Model, illustrated in <Figure 1>, represents an open system, with interactions among the OKB, the Knowledge Processing Cycle, and their environment. Organizations continuously try to channel and manage flows of knowledge and energies within their organizational boundaries. The LIFE Model focuses on the role of leadership in relation to the flows of social energies that trigger the evolution of the KPS. Leadership in a complex adaptive system, such as an organization, needs to ensure that the feedback mechanisms are working towards amplifying the performance of the system relative to its objectives. The next section focuses on the flows of energies and explains why leadership plays an important role in them.

### 4.3 Leadership Invigorating Flows of Energies

In the context of this model, it is important to note that the term "leaders" does not mean the same as "managers." The term "leaders" here means emergent leaders, those who arise from within the Knowledge Processing System to enable and/or enhance it. Leadership in the context of this model equates to organizational knowledge intrapreneurship. Derived from the seminal work of Burgelman [1983], it is proposed that ideas regarding entrepreneurship and intrapreneurship are equally applicable to the knowledge management processes and systems of an organization as they are to a whole enterprise. Therefore, knowledge intrapreneurship consists of the development and application of new knowledge within an organization, while knowledge entrepreneurship refers to the ability of the organization to garner externally-derived gains from application of its knowledge in the marketplace. Although this aligns to a large degree with Nonaka et al.'s statement that "leadership is about enabling knowledge creation,-not controlling and directing it" [2006: 1192], it extends beyond their position that leaders are managers (top and middle managers being referred to specifically). Emergent leaders are defined by the relationships that they hold within the organization and the elements of the Knowledge Processing Cycle. Therefore, they can be any member of the Organizational Social Network (individual, team, or group), which is an extended view of the organization. It is their way of being in relationship to the whole organization that defines them as a leader, not their position. This perspective differentiating leaders from managers is in accord with that advocated by Alvesson [1992], Kotter [1985], and Zaleznik [1977], wherein managers rely on their formal position while leaders utilize non-coercive power.

Emergent leaders are the initiators, enablers, and enhancers of self-organization processes that take place in the Knowledge Processing System. These processes require and involve flows of energies, invigorated by emergent leaders, who are at the core of the negentropic activities (i.e., producing negative entropy) underlying self-organizing mechanisms. However, the production of negative entropy does not mean creation of energy, as that would be a direct violation of the first law of thermodynamics (i.e., conservation of energy). Emergent leaders do not create energy, but invigorate flows of existing energies-directing them toward accomplishment of organizational goals with respect to knowledge management. It means that the organization will dissipate entropy into its environment, implying that a systemic perspective is required due to the scale-free aspect of complex systems. Because any flow of entropy may have repercussions at various levels of the system, the system's boundaries remain crucial. Activities at all organizational levels can have system-wide repercussions.

Although there are some similarities with the notions of self-leadership and shared-leadership expressed by Pearce and Manz [2005], emergent leadership does not refer to the same understanding. Indeed, just as an organization can not always be considered as a team, neither can LIFE be compared to only an individual flow of energies. Therefore, LIFE is broader than those two ideas of self-leadership and shared-leadership ; in fact, they are both contained within LIFE, and describe part of the flows of energies included in it. Relationships in organizations are sources that can release enormous amounts of social energy that eventually enable the organizations to evolve [Regine and Lewin, 2000]. As part of the system, emergent leaders influence and are influenced by the activities of the Knowledge Processing Cycle. Therefore, feedback can occur at any time within the KPS, reinforcing or depressing its operation.

Emergent leaders play a crucial role in the KPS, invigorating its emergence and self-organization by providing, enabling, or fostering the vital energies that are needed for its functioning. A feature of systems approaches is the identification of flows of energies to sustain the system. Energy manifests itself in multiple forms in a social system, including mental energy (knowledge, motivation, ambition), with filters and catalysts (e.g., policies, meetings, recruitment providing fresh inputs, etc.). One essential role of managers is to understand what type of energy is needed to create a favorable environment that supports the Knowledge Processing Cycle and the emergence of the OKB. However, it is not the role of managers to provide all the flows of energies, nor (as it is a self-organizing system) can they control it. They can only help prepare and maintain the environment. Managers are able to serve as emergent leaders for some of the processes taking place in the Knowledge Processing Cycle, but this is a role that can be filled by any organizational member and in efficient systems this will be encouraged.

## 5. Implications and Discussion

Complexity theory leads to the understanding

that all organizational members should possess what Ward [1963] refers to as "negative capabilities." This means they need the capacity to live with and tolerate ambiguity and paradox, the willingness to accept change, and the ability to learn and allow one's mind to be changed by others [French, 2001]. As argued by Regine and Lewin [2000], managers have to be "paradoxical leaders"; they must be leaders by not leading. What Regine and Lewin [2000] suggest is that managers need to overcome three main paradoxes. First, their power rests not so much in controlling others but in their ability to allow others to achieve their goals. Second, managers don't have to be omniscient but accessible. Finally, they are not autonomous but rather interdependent with all the others agents of the organization of which they are part. Hence, managers have to understand, accept, and adapt to the flows of social energies that take place in an organization.

An implication of complexity theory for the business world is that senior managers need to facilitate the organization's evolution at the edge of chaos so that it may self-organize creatively [Nonaka, Toyama, and Konno, 2001]. Managers should stop thinking in terms of control and rigid structures, which are illusions of power and stability [Faucher, Everett, and Lawson, 2006]. Hence, senior managers should show enough flexibility to allocate trust and some autonomy to the members of the organization and liberate the creative interactions among flows of social energies. Good communication and trust among employees enhance socialization, which is vital to organizational innovation [Rhodes et al., 2008] as well as for knowledge diffusion [Štrach and Everett, 2006].

Self-organization also implies that sufficient variety of people and diversity of ideas are present in the organization. Giving autonomy to organization members involves letting them create knowledge on their own, and providing their opinion on the current and proposed knowledge within the company. This means that the organization needs to make its knowledge accessible to its members, such that its knowledge is subject to constant visibility and therefore open to improvement. Nonaka, Toyama, and Konno [2001] suggested that, in order for an organization to create knowledge, senior managers need to ensure that there exists an appropriate atmosphere, or culture, inside the organization. They suggest that love, care, trust, and commitment among members of the organization are the basis for knowledge creation and knowledge sharing processes. These key factors (among others such as job rotation, rewards, and flatter structure) have also been identified by Al-Alawi, Al-Marzooqi, and Mohammed [2007] as prerequisites for the success of knowledge sharing. Recent research has shown that strategies based on centered leadership [Barsh, Cranston, and Craske, 2008] could help individuals to develop more efficient leadership capabilities through the use of shared purposes, management of energy flows, and positive framing. Therefore, the key implication for managers is to provide a purpose to the system and create a supportive environment; self-organization will follow.

Although general patterns of a CAS may of-

ten be quite predictable, complexity theory stipulates the impossibility of *predicting* or *controlling* the future outcomes of an organization [Stacey, 1992]. Therefore, managers need to prepare themselves to adapt to the unexpected. Organizations require structures that allow self-organization, which is obtained by navigating a path at the edge of chaos [Faucher, Everett, and Lawson, 2006; Firestone and McElroy, 2003; Stacey, 1992]. Self-organization implies allowing the structure of the whole organization to evolve constantly. This can be done by developing a flat and flexible organizational structure in which different units are intertwined by a knowledge network [Faucher, Everett, and Lawson, 2006] nurturing the flows of social energies within the organization (as depicted in the LIFE Model). Indeed, the survival of an organization in a changing environment lies in flexibility and adaptation [Kourdi, 2003; Lindgren and Bandhold, 2003; Stacey, 1992; Watson, 1994]. Hence, managers need to introduce some mechanism to generate sufficient instability and variety, as well as a system of selection in order to stimulate novelty and emergent adaptation [Stacey, 1992]. They need to trust and support all organizational members, permitting the rise of change champions [McWilliam and Ward-Griffin, 2006], i.e., the emergent leaders. Senior managers need to focus on strategic recognition rather than planning [Burgelman, 1983]. They also have to provide policies that enhance the rotation of personnel and enable employees to develop interdisciplinary skills in order to deal with the complexity of the environment [Nonaka, Toyama, and Konno, 2001].

In an unpredictable, rapidly changing environment it becomes obvious that adapting faster than the competition is a competitive advantage [Phelan, 1995]. Hence, some organizational learning and innovation management tools such as the LIFE Model can help managers to handle complexity. However, managers must remember that they are part of the system. No matter how powerful they are, managers are both enabled and constrained by the availability of resources [Stacey, 1992]. Self-organization means that interactions between the agents of a system are made according to their own will, capability, and knowledge [Kourdi, 2003; Lindgren and Bandhold, 2003; Stacey, 1992]. If each element follows the blueprint that the manager designed, there won't be any self-organization [Stacey, 1992], but there may be an inefficient struggle to preclude or prevent self-organization. As argued by Spender [1996] a diffuse, non-bureaucratic management style is needed to provide a context in which employees at every level become independent agents. Hence, they would take responsibility, experiment, make mistakes, and learn as they aim for continuous improvement. This is echoed by recent research [e.g. Hasgall and Shoham, 2008] showing that the issue still needs to be addressed. As emphasized by Rutherford and Holt [2007], the manner in which a manager decides to foster organization-wide corporate entrepreneurship is a key factor in its success. In the case of the LIFE Model, this applies to the knowledge intrapreneurs who are emergent leaders.

## 6. Limitations and Further Developments

At this stage the paper has given an overview of the LIFE Model as a basis for describing the principles of a self-organizing KPS. Individual aspects deserve further conceptual analysis and the model should be tested against specific organizational contexts. This paper is an attempt to fill a vacuum in the current knowledge management literature-portrayal of a knowledge management process that fits the view of an organization as a dynamic venue for interactions including the necessary flows of energies implied by such mechanisms. There are several new proposals in our model that could be the subject for further research, discussion and development :

1. Knowledge intrapreneurship requires a more in-depth description and integration into the LIFE model and wider literature. Showing how knowledge intrapreneurship relates to organizational entrepreneurship would be a starting point.
2. New ideas on feedback systems have been identified within the model at group and individual levels. In essence, knowledge can be viewed as a form of mental energy, typically created, enhanced, and managed through flows of social energies (interactions among holders of mental energy). At a higher level, the analysis of interactions with organizational networks and the environment could also provide insight. At the organizational level, a finer description illustrating the difference between positive and negative feedback in the different activities of the Knowledge Processing Cycle could bring insights for the understanding of the KPS.
3. Studying an alternative view of the Knowledge Processing Cycle and the way the OKB emerges through the lens of organizational learning could be valuable. Indeed, it is possible that different organizations will manifest different patterns and may not employ all aspects of the Knowledge Processing Cycle, or at least not in the same ways.
4. Social energy is developed and proposed as the basic force within the Knowledge Processing System. The relationship between social energy and social capital warrants clarification. Although they may seem identical to some [e.g. Bebbington and Perreault, 1999], social capital and social energy relate to different levels of the organization, one being a constituent of the other. Social capital is composed of social connections [Bourdieu, 1986] and social structure [Coleman, 1988], and refers to opportunities [Burt, 1997]. Hence, social capital may be a source and storage of social energy. Under the lens of complexity theory, social capital may even take the form of self-organizing feedback systems present in the LIFE Model. This raises the question of what forms social energy can take. This paper has suggested motivation and knowledge, but other forms of social energy such as power in organization are relevant as well. Furthermore, this implies that social capital underlies knowledge flows in organizations, which is concurrent with recent research in knowledge management [Tsai, 2006; Mu,

Peng, and Love, 2008].

5. The place of organizational intelligence in the LIFE Model is another issue that will need to be examined. As shown by Akgün et al. [2006], organizational intelligence emerges from and is contained in the daily activities of the organization. Akgün et al. assert organizational intelligence to be a multidimensional and multifaceted construct, implicating the recursive interaction of the cognitive, behavioral, and emotional capabilities of organizations. This view can be directly related to the OKB of the LIFE Model, as it implies organizational intelligence.

## 7. Conclusion

This conceptual paper has introduced the LIFE Model in an attempt to provide a more useful description of the Knowledge Processing System, including consideration of the flows of energies underpinning its functioning. The LIFE Model highlights the role of emergent leadership and flows of social energies as forces invigorating the Knowledge Processing System, and describes how knowledge is created, assimilated, and diffused dynamically within an organization through the Knowledge Processing Cycle in eight activities interacting with the Organizational Knowledge Base, external knowledge, and the Organizational Social Network.

The concept of Leadership Invigorating Flows of Energies allows for a more complete description of the mechanisms underlying the Knowledge Processing System and its self-organization. Managers should understand, accept, and adapt to the flows of energies taking place in an organization by focusing on strategic recognition rather than planning. They should provide a purpose to the Knowledge Processing System and create a supportive environment enabling the knowledge flows within the organization and fostering the emergence of knowledge intrapreneurs. They are the facilitators of the self-organization of the Knowledge Processing System that can liberate creative interactions among flows of social energies.

Finally, the LIFE Model opens the path for a multitude of new research in entrepreneurship, organizational learning, social capital, and organization studies. Most of all, it provides a possible avenue for the creation of an integrated theory of knowledge management.

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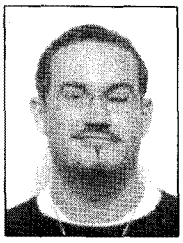

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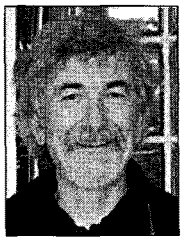

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