

A Complex Systems Paradox of Organizational Learning and Knowledge Management

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ABSTRACT

Many organizations are striving to survive and remain competitive in the current uncertain and rapidly changing economic environment. Businesses must innovate to face this volatility and maintain their competitiveness. Organizational learning is a complex process with many interrelated elements linking knowledge management with organizational innovation. In this paper we use several theories (i.e., organizational learning, knowledge management, organizational innovation, complexity theory, and systems theory) to discover and study the interrelationships among the organizational learning elements. The purpose of this paper is threefold: (1) We identify organizational learning as a mediating variable between knowledge management and organizational innovation; (2) We further present a paradox where decisions that are expected to improve organizational learning, surprisingly do not work; and (3) We show this paradox is not the result of overlooking organizational learning elements, but rather, caused by neglecting to consider the complex interrelationships and interdependencies among them.

Keywords: Complexity Theory, Knowledge Management, Organizational Innovation, Organizational Learning, Systems Theory

INTRODUCTION

Organizational learning has attracted considerable attention from both academia and industry during the last three decades (Crossan et al., 1999; Dodgson, 1993; Duncan & Weiss, 1979;

Easterby-Smith et al., 2000; Fiol & Lyles, 1985; Huber & Daft, 1987; Hung et al., 2010). Yeh et al. (2006) argues that “knowledge management and organizational learning are the keys to the success of an organization”. Other researchers argue that these concepts are the determining factors

DOI: 10.4018/ijkbo.2013070104

of innovation in organizations (Johannessen & Dolva, 1997; MacDonald, 1998; Nonaka and Takeuchi, 1995). Organizational learning is of crucial importance since it is the mediating variable between knowledge management and organizational innovation. To put it differently, using systems terminology, knowledge management is an important input, organizational learning is a key process, and organizational innovation is a critical output. In this study, we use the definition of organizational knowledge proposed by De Holland and Philips (2004) and define *organizational knowledge* as the collection of assets, rules, routines, standard operating procedures, and other organizational attributes that shape member behavior; and the dominant logics, mental models, culture, sense-making devices, and other organizational attributes that shape cognition; that, when combined, allow an organization to perform collective actions.

There have been many theoretical and empirical studies which have substantially contributed to the expansion of the literature on organizational learning (Boreham & Morgan, 2004; Lopez et al., 2005; Levitt & March, 1988; Lyles et al., 1996). Recently, several scholars and researchers have discussed some overlooked aspects of organizational learning and proposed new and novel theoretical dimensions in the field (Engelhard & Nägele, 2003; Nutley & Davies, 2001; Sadler-Smith, 2008; Uhlenbruck et al., 2003; Vince, 2002).

In this paper, we propose a complex systems paradox of organizational learning and knowledge management. We show that in addition to the overlooked aspects of organizational learning, a holistic and systems view must be espoused to understand the complex interrelationships among these aspects and elements. The use of the term “systems” in analyzing organizational learning issues is not new and has been studied in the literature (Beddoe, 2009; Daft & Weick, 1984; Dibella et al., 1996; Filstad & Gottschalk, 2010; Lee et al., 1992; Shrivastava, 1983). What is missing is the lack of adequate¹ attention to the concept of

“complexity” - which goes hand in hand with the concept of “systems thinking” - and the interrelationships between the organizational learning elements and components.

Complex systems theory describes how many natural phenomena occur. Whenever there is an emergent property in nature - that is, a property of a system as a whole that the elements of the system do not exhibit - then that system is considered a complex system. Any human system is, in fact, a complex system including organizational learning systems. As Forrester (1991, 1994, and 1964) suggests, human systems are as complex in nature as engineering systems and should be engineered with the same level of intensity. Senge (1990) highlights the difference between detailed complexity (“arises when there are many variables”) and dynamics complexities (“arises when cause and effect are distant in time and space, and when the consequences over time of interventions are subtle and not obvious to many participants in the system.”). Moreover he argues that the leverage in most management problems lies in understanding dynamic complexities. We will discuss the dynamic complexities associated with the organizational learning systems from two perspectives: complexities associated with the consequences of organizational learning (*i.e.*, the effect of learning on performance) as well as those associated with its antecedents.

This paper is organized as follows. We begin by suggesting a three-dimensional definition of organizational learning extracted from the existing definitions in the literature. We then discuss the relationship between learning and organizational performance and follow this discussion with an examination of the interrelationships between different organizational learning dimensions. Next we develop an integrated model of organizational learning and identify some barriers to learning through various case studies. We then argue the need for “organizational learning systems engineers” and end the paper with our conclusions and future research directions.

ORGANIZATIONAL LEARNING DEFINED

Organizational learning has emerged as a promising concept with a variety of definitions emphasizing different ideas from various schools of thought, such as systems theory, engineering, management, economics, information science, sociology, and psychology. In exploring a range of definitions of organizational learning, Dixon (1994) has isolated a number of key themes that can be seen to exist within the literature, namely:

- The expectation that increased knowledge will improve action
- Acknowledgment of the pivotal relationship between the organization and its environment
- The idea of solidarity, as in collective or shared thinking
- A proactive stance in terms of the organization changing itself

Table 1 presents the most widely cited definitions of organizational learning.

These definitions can be classified with respect to two perspectives: content of learning and unit of analysis (Crossan et al., 1995). From the content of learning perspective, two major points of view are dominant. The first view sees learning as a tool for expanding the potential actions - or behaviors, alternatives, rules or routines (Benner et al., 2007; Crossan et al., 1995; Fiol & Lyles, 1985; Miller, 1996; Mitsuhashi & Yamaga, 2006; Slater & Narver, 1995). Within this point of view, the expansion of the potential actions is, in turn, attributed to two main processes. The first process is the cognitive identification and understanding of new alternatives (Benner et al., 2007; Crossan et al., 1995; Fiol & Lyles, 1985; Huber, 1991; Kim, 1993; Slater & Narver 1995). The second process is the behavioral development in the implementation of the already cognitive identified alternatives (Fiol & Lyles, 1985; Crossan et al., 1995; Kim, 1993).

The second point of view sees learning as enhancing the knowledge of action-outcome

relationships (Barnett, 2001; Daft & Weick, 1984; John, 2009; Lee et al., 1992; Levinthal & March, 1993). In other words, learning helps organizations evaluate their alternative courses of action and decide which ones should be implemented and which ones should be avoided.

In short, organizations can (cognitively or behaviorally) learn new potential actions, and also can learn how to choose and implement the best action to attain the best outcome.

From the unit-of-analysis perspective, there are different kinds of learning including individual learning, group learning, and organizational learning (Crossan, 1995; Milia & Birdi, 2009; Perkins et al., 2007; Sanchez, 2002). Also, to some, learning can be defined as the transfer of knowledge among these units (Joshi et al., 2007; March & Olsen, 1975; Sanchez, 2002). In this paper, we do not consider how learning is transferred from individuals to organizational units but rather we view learning through organizational routines (Levitt & March, 1988; Sproull, 2010).

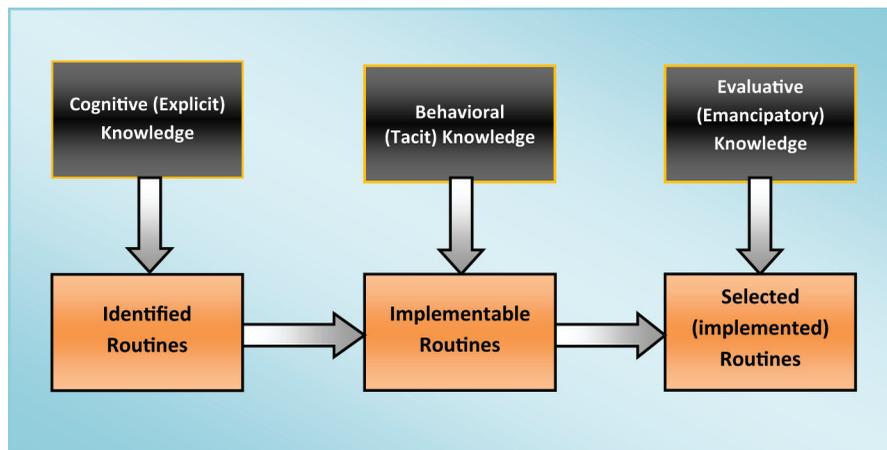
We use the aforementioned perspectives to propose a definition for organizational learning that has two fundamental characteristics: (1) it is similar to the definitions suggested by March and Levitt (1988) and Friendlander (1983) which are rooted in routine (alternative) identification and implementation; and (2) it is based on three learning components; namely, cognitive learning, behavioral learning, and evaluative learning. Figure 1 depicts a graphical representation of our definition.

As shown in Figure 1, there are three distinct forms of knowledge: cognitive, behavioral, and evaluative. These forms of knowledge are important because they affect organizational routines. As depicted in Figure 1, there are three kinds of organizational routines: identified routines, implementable routines (which are a subset of identified routines), and implemented routines (which are, in turn, a subset of implementable routines). Cognitive knowledge determines what routines an organization has identified and understood. Behavioral knowledge is concerned with which one of the identified routines in an organization is practically

Table 1. The cognitive (C), behavioral (B), and evaluative (E) definitions of organizational learning in the literature

Author (Year)	Proposed definition	C	B	E
Argyris & Schön (1978)	Organizational learning is a process of detecting and correcting errors.	✓	✓	✓
Friedlander (1983)	Change resulting from learning need not be visibly behavioral. Learning may result in new and significant insights and awareness that dictate no behavioral change. In this sense the crucial element in learning is that the organism be consciously aware of differences and alternatives and have consciously chosen one of these alternatives.	✓		✓
Daft & Weick (1984)	Organizational learning is knowledge about the interrelationships between the organization's action and the environment.			✓
Fiol & Lyles (1985)	Organizational learning means the process of improving actions through better knowledge and understanding.	✓	✓	
Stata (1989)	Organizational learning is the principal process by which innovation occurs.	✓	✓	
Huber (1991)	An entity learns if through its processing of information the range of its potential behaviors is changed.	✓	✓	
Lee et al. (1992)	The organizational learning process is viewed as a cyclical one in which individual's actions lead to organizational interactions with the environment. Environmental responses are interpreted by individuals who learn by updating their beliefs about cause-effect relationships.	✓	✓	✓
Kim (1993)	Organizational learning is defined as increasing an organization capacity to take effective action.		✓	
Levinthal & March (1993)	Organizational learning copes with the problem of balancing the competing goals of developing new knowledge (exploration) and exploiting current competencies (exploitation) in the face of dynamic tendencies to emphasize one or another.	✓	✓	
Crossan et al. (1995)	Learning is a process of change in cognition and behavior, and it does not necessarily follow that these changes will directly enhance performance.	✓	✓	
Slater & Narver (1995)	At its most basic definition, organizational learning is the development of new knowledge or insights that have the potential to influence behavior.	✓		
Miller (1996)	Learning is to be distinguished from decision making. The former increases organizational knowledge, the latter need not. Learning may in fact occur long before, or long after, action is taken.	✓		
Edmondson and Moingeon (1998)	Organizational learning is a process in which an organization's members actively use data to guide behavior in a way as to promote the ongoing adaptation of the organization.			✓
Schwandt & Marquardt (2000)	Organizational learning represents a complex interrelationship between people, their actions, symbols, and processes within the organization.		✓	
Barnett (2001)	An experience based project through which knowledge about action-outcome relationships develops, is encoded in routines, is embedded in organizational memory, and changes collective behavior.	✓	✓	✓
Sanchez (2002)	Organizational learning aims to generate, disseminate, and apply knowledge in an organization. It consists of five learning cycles: (1) individual, (2) individual/group, (3) group, (4) group/organizational, (5) organizational.		✓	
Yang (2003)	Knowledge is a social construct with three distinctive and interrelated facets: explicit (consists of the cognitive component of knowledge that represents one's understandings of reality), implicit (the behavioral component of knowledge that denotes the learning that is not openly expressed or stated), and emancipatory (the affective component of knowledge and is reflected in affective reactions to the outside world) knowledge.	✓	✓	✓
Yeo (2005)	Organizational learning deals with the process of change and transformation. Such processes more often focus on increasing the overall adaptability of the organization as opposed to solely seeking short term solutions to problems.		✓	✓
Benner et al. (2008)	Organizational learning should be defined as a process of knowledge-based change through the questioning of the means and/or ends of addressing problems. The process manifests itself in the acquisition of knowledge and reviewing of experience, leading towards the development and implementation of new rules and routines for the organization's actions.	✓	✓	✓
John (2009)	Strategic learning is about understanding the global strategy and how each part of the organization, wherever it is located, contributes their best, most innovative thinking followed up by actions that execute the strategic intent of the organization.			✓

Figure 1. The organizational learning definition



implementable. Finally, evaluative knowledge is the organization's ability to recognize, among its implementable routines, which ones should be implemented and which ones should not.

Therefore, we assume that an entity is involved in organizational learning if:

- It detects and understands. For example, if an organization finds out about the possibility of setting up an intranet system and understands the methods of setting up such a system, it has learned cognitively (*Cognitive Learning*).
- It acquires the ability to implement those detected routines which it was not able to implement before. For example, if the organization has the capability of setting up and using a practical intranet system, the routine of "setting up and using an intranet system" becomes implementable which means that the organization has learned behaviorally. Note that whether or not the organization actually runs an intranet system has nothing to do with behavioral learning. With regards to the notion of behavioral learning, it is enough that the organization has acquired the *ability to implement* this routine (*Behavioral Learning*).

- It improves its evaluation quality regarding which routines should be implemented and which ones should be dropped from consideration - in order to achieve a higher level of organizational performance (Shrivastava, 1983; Schmitt, 2009). For example, suppose that the costs associated with running an intranet system outweigh its benefits. Now assume that the organization does not know this and, hence, is running the intranet. If the organization becomes aware that it should terminate the intranet, it has learned not to implement one of its implementable routines (*Evaluative Learning*).

In summary, organizations should on the one hand have positive potentials and, on the other hand, utilize their potentials to achieve higher performance levels. The cognitive and behavioral knowledge provide organizations with greater potentials while evaluative knowledge enables organizations to better utilize their potentials.

We should note that our definition does not cover the transfer of knowledge from an individual unit to an organizational unit which is one of the most important concepts of organizational learning. We ignore the transfer of knowledge not because it is unimportant, but because we want to maintain the consistency

of the subjects and concentrate on a detailed analysis of the three main components.

Furthermore, we see two distinct differences between cognitive and evaluative learning. First, whatever is learned cognitively should also be learned behaviorally, but this is not the case with evaluative learning. When an organization identifies a new routine, it should also learn to implement it. For instance, when American engineers learned that the Japanese do not have separate jobs for designing different parts of a car engine, they learned something cognitively. They learned it also behaviorally when they implemented this learning as a routine in the American car industry. However, this is not the case with evaluative learning. It was evaluative learning to find out that the holistic approach to design was better than the modular one. But it is obviously meaningless and irrelevant to ask “do the organizational decision makers know only cognitively that the holistic design is better than modular design? Or do they also know that behaviorally?”

Another distinct difference between cognitive and evaluative learning is that while evaluative learning usually needs management knowledge, cognitive learning needs specialized knowledge in the organization’s working scope. That is why engineers and corporate executives are generally concerned with cognitive learning while managers and those in the decision making positions are mainly concerned with evaluative learning. The distinction between evaluative and cognitive learning is not emphasized in the literature but one can see its reflection in some well-known articles. For example, Daft and Weick (1984), Hsu and Pereira (2008), and Rahmandad et al. (2009) discuss managers’ and top level decision makers’ learning. One notices that the words “tacit” or “behavioral” are not mentioned even once in their paper.

Finally, according to our definition of organizational learning, not every incremental increase in knowledge is considered organizational learning. If an organization’s knowledge increases in areas not related to its special working scope or its managerial knowledge, then, it is not considered learning. Although

as we discussed in following sections, this kind of knowledge may result in increasing an organization’s absorptive capacity (Cohen & Levinthal, 1990) which may then contribute to organizational learning.

Stata (1989) argues that organizational learning is the most significant tool of competition between organizations. Two important questions should be answered with regard to this statement. What is the function of such a tool? And, how and by means of which factors does it function? In the following sections we will address these questions separately.

ORGANIZATIONAL LEARNING & PERFORMANCE-LEARNING CONSEQUENCES

The effects of organizational learning on organizations and their performance are widely discussed in the literature; however, there is no consensus among the scholars in the field. Some like Baker and Sinkula (2007); Cangelosi and Dill (1965); Duncan and Weiss (1979); Garcia-Morales et al. (2007) and Shrivastava (1983) believe that learning directly improves organizational performance, while others like March and Levitt (1988), March and Olsen (1975), Huber (1991), and Sun et al. (2008) do not agree with this proposition.

In this section we examine the relationship between organizational learning and performance in the context of our previously stated definition. Note that for such an analysis, there is no need to define performance. Two ideas are relevant: first, performance is something desirable for an organization. Second, each combination of routines leads to a specific level of performance and the organization may or may not be aware of its values (in fact the better the organization knows the level of performance associated with different combination of routines the more it has evaluative knowledge).

An organization’s performance improvement is a positive change. Learning improves the organization’s performance when it changes the *selected routines* of the organization or the

quality of the ones being currently implemented and this change results in a positive effect on the organizational performance. Organizational learning can be advantageous to organizational performance when:

- New routines are identified and become implementable which are better than the organization's current routines, and the organization is also aware that the new routines are better and decides to implement them.
- The organization becomes stronger in implementing the routines currently under implementation. This is the case when behavioral learning results in performance improvement.
- The organization notices that it can improve its performance by using a different mixture of its implementable routines from the mixture it is using currently. This is when evaluative learning takes place and also improves the organization's performance.

The enhancement of organizational performance through organizational learning is in the form of one or a combination of the methods mentioned above.

Meanwhile, with regard to our definition, there are times when organizational learning has a negative impact on organizational performance. Organizational learning can be ineffective or disadvantageous to organizational performance when:

- The organization identifies new routines but is not still capable of implementing them. In other words cognitive learning has happened but since it has not been learned behaviorally, it is ineffective and cannot change the organization's set of implementable routines.
- The organization learns the implementation of some new routines. The current routines are better than those just learnt, but the organization mistakenly decides to implement the new ones. Consider a person who does

not know how to start a car and is such a bad driver that he would have an accident if he drives. If this person learns to start the car, behavioral learning has occurred (a non-implementable routine has become implementable). Now if he starts the car, drives it and crashes into another car, then, this learning has been disadvantageous. The reason is that a person who is poor in evaluation has chosen to execute the routine, although it is not suitable for him.

- The organization gets better in implementing its current routines (behavioral learning) and its performance improves. As a result the organization insists on using its current routines more than before. If it had chosen a different set of routines, its behavioral improvement may cause much better performance for the organization; this is called a *competency trap* (Levitt & March, 1988). In this case behavioral learning has occurred, but since the organization was unable to evaluate the longer term results dynamically, this behavioral learning has worsened the organization's performance.
- The organization learns that its current routine is performing better than expected. For instance, imagine that an organization has decided to acquire company *X* because it thinks it is slightly better than acquiring company *Y*. Let's further imagine that the organization learns that *X* is in fact substantially better than *Y*. In this situation evaluative learning has happened, but it has not resulted in a change in the organization's choice of acquiring *X* rather than *Y*. This learning is ineffective because it has had no effect on the organizational performance.

It is also worth mentioning that with regard to our model, superstitious learning is not considered learning at all. March and Olsen (1975) and Levitt and March (1988) believe that when organization's behavior does not affect its environment, the organization gets confused in deciding which routines to implement. For example, when the organization does not get closer to its goals regardless of its operation,

its idea about which routine is good and which one is not, changes continuously. Because each time the organization implements a routine (which it believes to be a good one) nothing changes (because the output is not a function of organizational routines) and the organization will mistakenly conclude that the routine is less than optimal. As one can see, no learning actually occurs in superstitious learning. Although the organization's evaluation changes, it does not get better. Therefore, we can conclude that superstitious learning is solely a type of change and should not be considered learning.

In summary, the relationship between organizational learning and organization's performance is very complex and we know very little about it. In this section we discussed several circumstances in which learning affected organizational performance in specified ways. With regard to this complexity, the three components of learning, their interrelationships, and their linkage to the organization's performance have a substantial role in identifying the association of organizational learning and performance. This observation provides a possible explanation to Crossan et al. (1995) who claimed that we do not know much about the learning-performance relationship. As we suggested earlier, learning and maybe even performance are multidimensional concepts. Asking questions such as "is this relationship positive or negative?" or "is it weak or strong?" are not questions whose answers can unveil the complex nature of the learning-performance relationship. To do this, we need to analyze this relationship by taking it apart and examining it with a magnifying glass.

THE ANTECEDENTS OF ORGANIZATIONAL LEARNING

There are two important prerequisites for an organization to learn. The first is the existence of motivation or willingness to learn and the second is the ability to learn. In this section we discuss these components separately.

Motivation and Willingness to Learning

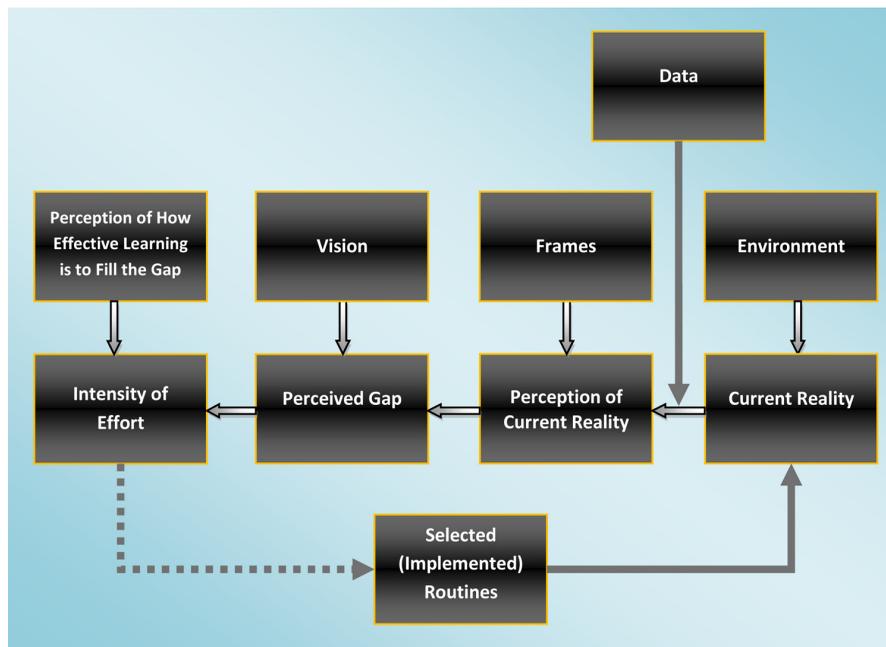
The presence of several factors is necessary for an organization to have a motivation or willingness to learn. These factors are presented in Figure 2. There should be a discrepancy between the organization's vision and its current reality; and the organization needs to be aware of this discrepancy (Senge, 1990). If the organization is not aware of the discrepancy, then, it will not feel the necessity of learning. In order to recognize this discrepancy, an organization should understand the current reality which is referred to as "commitment to truth" by Senge (1990). The organization's understanding of the current reality depends on two main elements. First, the necessary information to perceive the reality should reach the organization's members (Argyris, 1977; Huber, 1991; Zagorsek et al., 2009); and, second, the organization should be able to interpret this information properly (Huber, 1991; Škerlavaj et al., 2007).

Another important factor in shaping the organization's motives for learning is for the organization to believe that learning is an influential way of filling the gap between the current reality and the desired vision. If the organization is aware of the gap between its current and desired situations and believes that learning is not of that much influence or, even if it is, it is too expensive and there may be better ways to fill the gap, then the organization would not have enough motivation to learn. It seems that this latter influential factor has not been emphasized in the organizational learning literature.

Prerequisites to Learning Ability

Factors affecting learning ability are schematically represented in Figure 3. Successful organizational learning is dependent on the organization's ability to: (1) absorb knowledge from its environment; and (2) create new knowledge from its existing knowledge base. As for *knowledge absorption*, vicarious learning and grafting are methods that if implemented

Figure 2. The organizational learning motives



properly, enable organizations to absorb appropriate knowledge from their environment. Meanwhile the organization's structure and how much the boundary spanning roles are active in the organization are very influential in absorbing knowledge from outside. As for *knowledge creation*, organizations need to utilize different tools for evaluative, cognitive, and behavioral learning. Learner engagement is one of these tools that can increase knowledge in organizations and Noe et al. (2010) show how learner engagement is influenced by the organization's climate, interpersonal dynamics and individual differences and can be promoted using different learning methods such as on-line learning, blended learning, and job experience. We study the organizations' learning capabilities in three different parts.

Evaluate Learning Ability

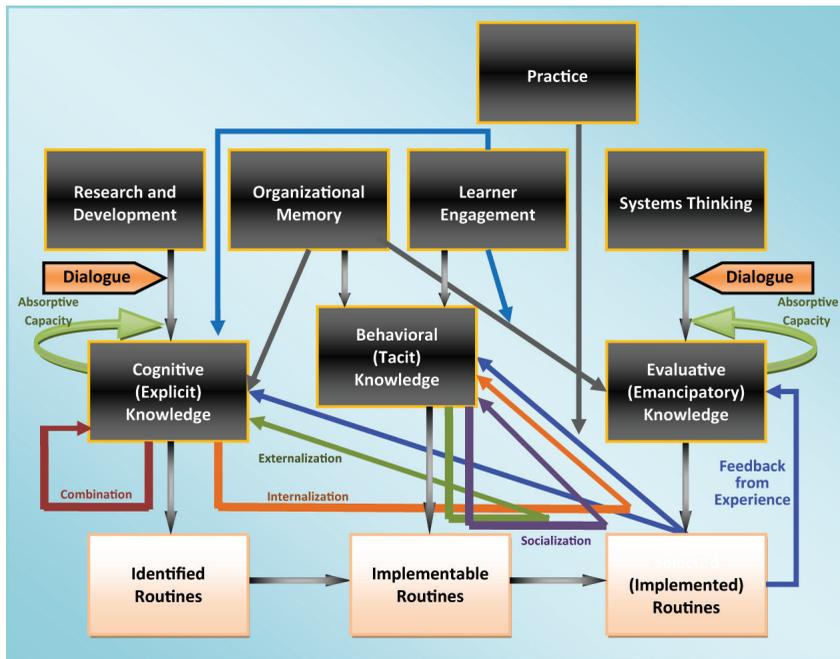
Learning to evaluate the effectiveness of routines in organizations can occur by learning from one's own experiences and/or by using

the techniques of management science. This classification can be seen in many prominent and classic works such as Daft and Weick (1984) and Shrivastava (1983).

The interpretation of lessons gained from experience is a difficult task (Daft & Weick, 1984; Espedal, 2007; Levitt & March, 1988) as mental frames and thinking biases have significant roles in these interpretations. The importance of these roles is so great that Levitt & March (1988) consider them to be more influential than the experience itself. Therefore, organizations need tools to overcome the barriers created by mental frames. One good tool is dialogue (Senge et al., 1994; Isaacs, 1993) which enables organization's interpreters see their mental frames about experiences and revise them if needed. Dynamic simulations can also help dialogue to be more effective (Kim, 1993).

Management science and the more comprehensive field of systems thinking also have an important role in organization's evaluative capability (Senge, 1990; Daft & Weick, 1984). As Forrester (1994) suggests, systems thinking

Figure 3. The learning factors



has no working definition. Systems thinking is more than thinking about systems, talking about systems, and acknowledging that systems are important. Systems thinking implies a rather general and superficial awareness of systems. Learning systems thinking is equivalent to learning the appropriate systems diagnosis which itself is evaluative learning. For example if the decision makers in the organization are familiar with “shifting the burden” archetype (Senge, 1990), the probability that they fall into a competency trap is reduced. As Bui and Baruch (2010) and Forrester (1992) state, without system thinking, people and organizations use policies which not only do not solve any problems but even make them more complicated.

We should also note that evaluative learning by experience and interpretation and also evaluative learning by means of management knowledge are nothing more than organizational routines and the organization’s decisions to choose from these routines depends on the organization’s evaluation of their fruitfulness.

Cognitive and Behavioral Learning Ability

The organization’s abilities regarding cognitive and behavioral learning are so close and intertwined that it would be better to analyze them together rather than separately. The most important studies in this field have been conducted by Nonaka (1994) and Kim (1993). Although Kim (1993) concentrates mostly on the individual dimension and Nonaka (1994) analyzes the organizational dimension, there is a good deal of similarity between their studies which is summarized in Table 2.

As shown in Table 2, there are four processes of cognitive and behavioral knowledge creation. The first is socialization through which organizational members learn by observing, imitating and practicing the routines being implemented (see Figure 3 as well). Socialization is the building of tacit knowledge through shared experience. The second process is called combination which is the way in which new cognitive knowledge is created by sorting, add-

Table 2. The conformity of Nonaka's (1994) and Kim's (1993) learning cycles

	Behavioral To Behavioral	Cognitive To Cognitive	Cognitive To Behavioral	Behavioral To Cognitive
Nonaka (1994)	Socialization	Combination	Internalization	Externalization
Kim (1993)	Observe	Design	Implement	Assess

ing, re-categorizing and re-contextualizing its current cognitive knowledge (Nonaka, 1994). Through "internalization", the organization learns how to put into practice what it knows cognitively. As Nonaka (1994) asserts, and as is depicted in Figure 3, internalization takes place through action. Finally, "externalization" is the process of creating cognitive knowledge from the implemented routine (Nonaka, 1994).

For an organization to manage these processes appropriately it needs to enhance two skills. For socialization and internalization - which involve behavioral learning- it needs to practice² (Crossan et al., 1995) and for externalization and combination - which involves cognitive learning - it needs to strengthen its dialogue skill (Crossan et al., 1995; Isaacs, 1993).

Meantime, Nonaka (1994) mentions some other prerequisites for managing these processes some of which (like intention, environmental fluctuation, and creative chaos) are considered motivational factors and others (like autonomy, redundancy, requisite variety, middle-up-down management style, and hypertext organizational structure) are factors enabling the organizations to learn.

Factors Influencing the Learning Dimensions

There are two important factors which affect the cognitive, behavioral and evaluative learning dimensions. The first factor is absorptive capacity (Cohen & Levinthal, 1990) which depends on the organization's previous knowledge in the related field. The greater the level of absorptive capacity the greater the organization's ability to learn.

The second factor is organizational memory. Walch and Ungson (1991) define

this concept as the stored information from an organization's history that can be brought to bear on present decisions. If the organization's memory is weak, it quickly forgets whatever it learns or it has problems retrieving them. Walsh and Ungson (1991) also argue that organizations should consider memory when designing their structure. Figure 3 summarizes the prerequisites of an organization's ability to learn.

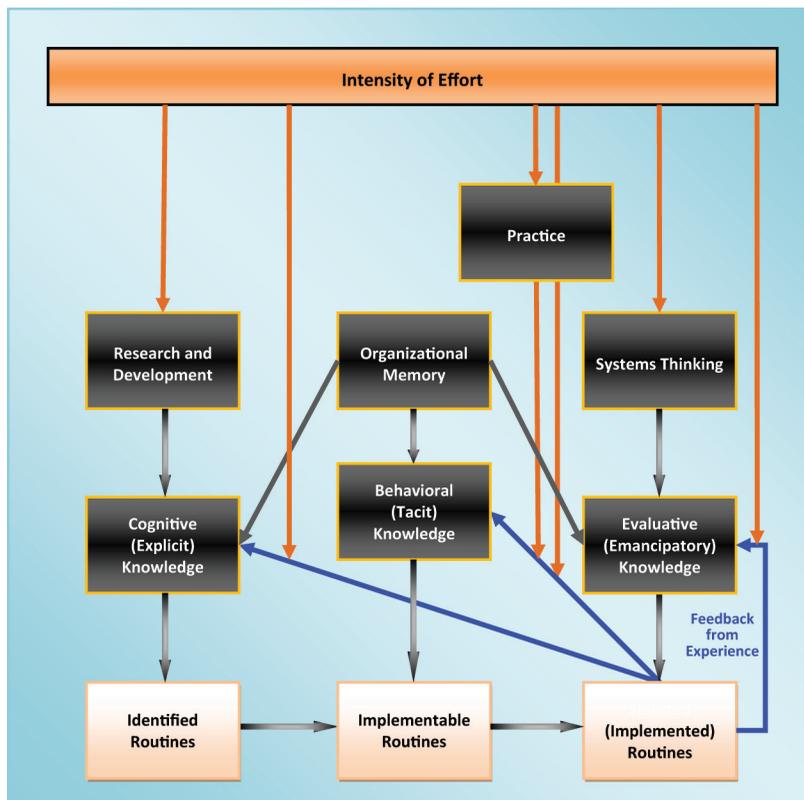
The two fundamental determinants of organizational learning in our model, organizational learning motives and learning factors, are depicted graphically in Figures 2 and 3, respectively. Next, we superimpose the two figures to develop Figure 4 and show the relationship between organizational learning motives and learning factors.

Figure 4 completes the integration represented earlier in Figures 2 and 3. This figure shows in detail how different efforts affect the selected routines. These different efforts were aggregated in just one arrow shown with a broken line in Figure 2. An organization may intensify its effort through cultivating its R&D, eliciting more useful lessons from practice, spending more time and energy on acquiring the ability to think systematically, trying to enhance the organizational memory, spending more money on grafting, or by running the cognitive-behavioral learning cycles more intensively.

Integrated Model of Organizational Learning

The integrated model of organizational learning (represented in Figures 2, 3, and 4) assimilates different motives and factors of organizational learning into one integrated and cohesive system with interdependent parts. This model could be

Figure 4. The relationship between organizational learning motives and learning factors



used to identify and analyze barriers preventing a successful operationalization of organizational learning in organizations.

A barrier exists when there is no gap between the organization's current and desired states. This barrier usually occurs because of bad visioning methods which are thoroughly discussed in Senge (1990). For instance, in many cases the organization's vision is reflective or negative because of the existing organizational problems but as soon as the problems fade away, the desired and current states start to coalesce and learning stops. The coincidence of the desired and current states also takes place when the organization experiences "emotional tension" instead of "creative tension". In other words, when the organization cannot withstand the discrepancy of the desired and current states, it might change its vision so that the vision is

more compatible with the current situation, instead of trying to change the current state.

Another learning barrier is "perception barrier" which occurs when there is a gap between the organization's desired state and its current state but this gap is not perceived by the organization. This barrier happens when the organization is not "committed to truth" (Senge et al., 1994) and it might occur because of two factors. The first factor is when organizational members (especially decision makers) do not receive the essential information for perceiving the organization's current reality. Argyris and Schön (1978), Huber (1991), and Zagorsek et al. (2009) are among those who have studied this subject from different perspectives. Argyris & Schön (1978), Greenberg (2009), and Yang (2007) claim that a great deal of important information showing organizational problems

is never revealed because of issues pertaining to the organization's members' relationships. As a result, this information may never get to the decision makers who are able to solve the problems. Huber (1991) and Škerlavaj et al. (2007) focus on information distribution. They argue that because of inappropriate information distribution, organizations "might be unaware of what they know". In other words, the information exists, but not in the appropriate places.

The second factor hindering commitment to truth is when organizations have the information necessary to perceive the current reality, but have problems analyzing it. Levitt & March (1988) have discussed organizational problems in information analysis. They have identified two different sources of error in this domain. The first set includes biases like insensitivity to the base rate, insensitivity to the sample size, linear thinking and also mental frames of decision makers. The second set is the managers' tendency toward positive interpretation of their own actions and negative interpretations of others. In the words of Daft and Weick (1984), we could say that a perception barrier exists and is a result of two weaknesses, weakness in scanning and weakness in interpretation.

Another learning barrier is disappointment; this is when the organization does not believe that learning can fill the gap between the organization's vision and its current state. Disappointment does not necessarily mean that the organization is disappointed in achieving its vision, but that it is disappointed in obtaining it by learning. Another important point to consider is that disappointment is merely a barrier to organizational growth. Sometimes organizational growth is not a result of organizational learning.

So far we have discussed the barriers to the motivation and the willingness for organizational learning. However, according to the integrated model of organizational learning, there are also barriers weakening the organization's ability to learn. Weakness of organization's memory (Walsh & Ungson, 1991), lack of absorptive capacity (Cohen & Levinthal, 1990), absence of proficiency in working with mental models (Argyris & Schön, 1978; Senge et al., 1994), lack

of skill in team working and dialogue (Isaacs, 1993; Senge et al., 1994), weakness in getting feedback from experiences³ (March & Olsen, 1975) and finally being faulty in systematic thinking (Senge et al., 1994) are all obstacles enervating organizations' ability to learn.

Organizational Learning Case Studies: Combined (or Complex) Barriers to Learning

Another important aspect of the integrated model of organizational learning is to analyze the "combined barriers" that hinder organizational learning. The interaction of two or more of the abovementioned barriers creates a complicated mechanism which can become a severe obstacle to organizational learning. We present two case studies to explain this phenomenon.

Case Study 1

In this case study we show how a weak method of documentation in an organization could result in a lack of commitment to truth which, in turn, can hinder resolving the problem with documentation. We consider a nonprofit debt counseling organization with 18 employees. The organization is currently encountering a high turnover rate which brings about a weak *organizational memory* because whatever knowledge the organization acquires cannot be retained (Walsh & Ungson, 1991). Another factor contributing to the problem of a weak memory is a weak documentation system. Although the system retains the acquired knowledge in an established computer information system, it has a poorly designed database management system that causes poor memory *retrieval* (Walsh & Ungson, 1991).

In order to boost the quality of its memory, the organization cannot just reduce the rate of its turnover because the high turnover rate itself is an endogenous problem. As a result of these complications, the newcomers find themselves bewildered since they do not exactly know what they are supposed to do because there are no good documents nor are there experienced colleagues to guide them.

On the other hand, the organization also has some *framing* problems preventing it from recognizing the problem of the documentation system. Although having a computer database does not necessarily mean that the organization has a good organizational memory, it may provide the decision makers with the *data* that can be *framed* as such. Other data may not be capable of bringing about such an interpretation. For instance, if the organization does not have a computer information system, its decision makers would not mistakenly postulate that they have a good *organizational memory*.

In such circumstances, the organization may mistakenly consider the lack of some other information or skills - kinds of *cognitive and behavioral knowledge* - as the root of its underperformance (which in fact may not be the case) and spends time, money, and energy on eliminating this weakness through workshops, discussion sessions, etc. Such a decision indicates a weakness in the organization's *evaluative knowledge* because the organization believes that the *routine* of teaching those cognitive and behavioral skills to the employees will improve its performance, while it actually doesn't even though the organization is learning.

While the organization tries to teach its employees irrelevant knowledge, two scenarios might occur. The first is that the organization finds the routine of teaching new skills not working and, hence, finds itself having to spend time and money on something which is not going to solve the problem. Since teaching new skills is the only solution the organization knows, finding it not working leaves the organization with no alternative to resolve the problem. This may create *emotional tension* which in its turn might cause in the *vision* to diminish.

Another scenario is that the organization does not find out that its training is not working. The training program provides the decision makers with the *data* that "we are training our employees" which can be *framed* as "we are solving our problem". If the situation is framed this way, then, the organization may decide to expand its *vision* since it thinks that its current reality satisfy the current vision and it is time

to enlarge the scope of its activities. Such a mechanism will go on until the organization gets a negative *feedback* from its environment which makes it clear that it cannot be *framed* any further.

As can be concluded from the above discussion, the documentation system seems to be a leverage point of this systemic problem. If the organization corrects the documentation system, not only it will compensate to some extent for the high turnover, but it might also help to eliminate the turnover problem as well.

Although the organization's commitment to truth would have stopped it from falling into such a trap, "being committed to truth" is not necessarily the solution to the problem. An uncommitment to truth may be endogenously induced by how the organizational learning system works rather than be the fault of the decision makers. A non-committal to truth can occur when, on one hand, there is a great deal of pressure on the decision makers - because of the large gap between the desired situation and the current reality - and, on the other hand, there is some data which can be interpreted as showing the situation to be better than the reality.

In this case study, what takes place separately over time cannot be explained by using all of the present organizational learning theories. On the other hand, there is no need to develop and use another theory. What explains this case is, rather, the *interrelated* use of some well-known organizational learning theories and models. The problem of the wrong method of documentation can create emotional tension and diminish the vision; and the problem can still persist even if the organization tries to revitalize the vision, unless the documentation problem is resolved. In other words, the reason for emotional tension may not always be bad methods of visioning as Senge (1990) believes. There may be some forces brought about by the complex nature of the organizational learning system which make the vision approach the current reality regardless of how that vision is set. Also there may be forces that endogenously prevent the organization from visioning based on the recommended methods.

Case Study 2

An organization is strong in cognitive and behavioral learning but does not perform as well as it could due to not having a correct evaluation of “what it should do” using its own experiences or systematic thinking. If this poor performance continues for a long time, the organization may conclude that learning is not basically useful and is too costly. This way the organization’s cognitive and behavioral learning, which were working properly, would stop working. What has really happened here is that weakness in evaluative knowledge - whether rooted in weakness in systems thinking or weakness in learning from experience - has caused disappointment through a *dynamic mechanism*. This mechanism would go on if the organization fails to make its current situation close to its vision through some means other than learning. Thus, after a while, it would experience emotional tension and this is when another learning barrier would rise; its current and desired states would conform.

As illustrated in the above cases, barriers to organizational learning are interrelated and if not diagnosed and eliminated in time, they might intensify each other which usually would result in disappointment and eroding visions. The events described in these case studies could be called “organizational learning system defects” or “diseases of organizational learning systems”. As illustrated in the second case study, the remedy of these system defects (diseases) is improving systematic thinking and organization’s ability to learn from its own experience. But if this is not done, these diseases will impede other parts of organizational learning from working properly. If one thinks that the problem has occurred because of improper vision setting a new vision for the organization might cause this cycle to recur and once again the current situation may match to the desired state.

With regard to the two case studies, the integrated model of organizational learning on the one hand introduces and explains a concept called “organizational learning system defects” or “diseases of learning systems” and on the

other hand shows the treatment to prevent these diseases from happening.

One important outcome of this model is systematic insight toward organizational learning which, we believe, deserves more attention in the organizational learning literature. Even though Shrivastava (1983) has mentioned the concept of the “organizational learning system”, he has merely represented a typology of them and has not discussed them using a systems approach which relies on complex interrelationships among parts. We believe that the organizational learning literature has progressed (i.e., has identified the components of organizational learning) so much that now the new concept of “engineering of organizational learning systems” can be proposed, developed, and be used in practice. By “Engineering” we mean the recognition of the dynamic and complicated interrelationships among the organizational learning elements which are more complicated than identifying the elements themselves.

THE NEED FOR ORGANIZATIONAL LEARNING SYSTEMS ENGINEERS

We showed that organizational learning systems are complex in nature and decision making without adequate analysis of the interrelationships among the parts within these systems could result in less than optimal decisions. Organizational learning system engineering can address this complexity since organizational learning systems are systems which should be designed, engineered, and analyzed similar to chemical plants, cooling systems, and electronic devices (Forrester, 1991). Given that the complexities inherent in organizational learning systems are similar to those in engineering systems, we argue that engineers are vital to organizational learning systems as they are to the engineering systems. That is, organizational learning systems need *specialists* who are able to *design, engineer, and analyze* them.

Adopting the term “engineering” helps thinking like an engineer about organizational

learning issues. An organizational learning system engineer is one who knows that in order to achieve a well-oiled functioning learning system one should analyze and understand how the entire learning system works as a whole. Such a specialist knows that if the learning system works with defects, the root of the problem may not necessarily be because of a part being neglected, but because of the dynamic interplay among the parts. Such a specialist knows that the causes of the “learning system defect” may be far from the symptoms in time and space, similar to the way that a computer engineer knows that because of a small error in one line of the source code, another part of the program may stop working properly. In a similar vein a doctor knows that “the specific interplay between cause and symptom is highly complex and usually defies specific documentation (Chrzanowski, 1986). Such a specialist also knows that sometimes there might be common symptoms for different system defects, exactly in the same way as a doctor knows that “starting treatment without knowing the cause of the symptom will frequently be ineffective because treatment for different causes of the same symptom vary widely and because the symptoms might not easily predict the cause” (Andreyev, 2007). Similarly, a computer programmer knows that while testing the source code of a program may reveal a symptom of an error, it may not uncover the exact cause of the problem (Berard, 1994).

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

In this paper, we proposed the concept of “organizational learning system engineer” and theoretically argued its crucial role in the practice of organizational learning. We first derived a definition of organizational learning which was based on routines on one hand and consisted of the three parts of cognitive learning, behavioral learning, and evaluative learning. Using such a definition, we analyzed the

complexities regarding the consequences and antecedents of organizational learning.

We analyzed the effects of organizational learning on organizational performance using the multidimensional definition we have derived. Then we showed that the effect of learning in each dimension on performance is substantially affected by the knowledge of the organization on the other dimensions. In other words, different mixtures of learning have different effects on performance and the effect of each dimension of learning on performance should be investigated within the context of the mixture and not by itself.

We investigated the complexities regarding the determinants of organizational learning with the aid of an integrated model. The model added no new element to the literature of organizational learning but rather a system of integrating the existing elements. We used the integrated model and analyzed two cases in which decisions that seemed logical using each of the building blocks of organizational learning theories, surprisingly proved to be harmful if evaluated based on the complex interrelationships of those building blocks.

Finally, we argue that the complexities inherent in organizational learning systems are similar to those inherent in engineering systems. Such a similarity requires organizational learning specialists who we named “organizational learning system engineers”. An organizational learning engineer should be an expert in how an organizational learning system works as a whole as well as in designing, planning, controlling and detecting and correcting the defects of the organizational learning system.

This work can serve as a basis for future research by using the model proposed here to analyze and explain real-world problems where the adoption of organizational learning results in paradoxical situations. The second direction is to expand this model in the areas where the transfer of knowledge between an individual and an organizational unit creates problems because of the interrelationship with other facets of organizational learning. Finally, we believe that an important contribution of this

work is the proposition of the concept of “organizational learning systems engineer”. While the development of the concept is beyond the scope of this paper, further development and operationalization of the concept is an important area of future research.

ACKNOWLEDGMENT

The authors would like to thank the editor, the anonymous reviewers, and Ali Mashayekhi for their insightful comments and suggestions.

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