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The Effects of Information Technology on Organizational Learning Dynamics

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Introduction

This work aims to enrich the research regarding the relationship between *information technology* (IT) and *organizational learning* (OL). Despite organizational learning is an extensively developed field, studies rarely include information technology in the discussion. Information technology and organizational learning are both important matters for the organization. The successful or unsuccessful implementation of new IT systems can determine between life and death of an organization. IT permeates every aspect and dimension of the organization and its use is well established in every kind of organization. On the other hand, organizational learning encloses many important concepts such as information, knowledge, experience and so on. These topics are matter of dispute and research since they can represent sources of competitive advantage that can determine the survival of the organization in the environment.

In the paper will be analyzed the effects of IT implementation and use on organizational learning dynamics such as exploration and exploitation. The discussion will go through different important topics that will help to build the picture. Some of these topics are organizational memory, organizational action, learning processes, knowledge creation, social context, socialization and more. First, will be provided a discussion to understand the role of information technology in the organization, by addressing main benefits, dimensions affected, and effects for knowledge. Then, will be provided a conceptual framework about organizational learning. Finally, the discussion will go through the relationship between information technology and organizational learning.

This conceptual paper integrates results from literature on both information technology and organizational learning. It offers a vision of information technology as a precious resource which can affect all the major dimensions of the organization. The appropriate use of information technology in a proper context, leads to the promotion of organizational learning. Information technology fosters exploratory activities by promoting the emergence of innovative and alternative ideas. However, technology may not adapt to changes and turn out as a disabler for learning.

1 The Role of Information Technology in the Organization

This chapter will address the role and effects of information technology use and implementation in an organization. The most important benefit, namely the ability from information technology to link employees, will act as a starting point to address the effects on important organizational characteristics. In this chapter will be addressed other important topics such as the improved communication, information technology's effect on organizational culture, on the ways knowledge is created, on socialization, and will be ultimately addressed the supportive role for the creation of an organizational memory. The in-depth examination of all these topics will give fundamentals to understand the relationship between information technology and organizational learning, which will be addressed in the next chapter.

Literature about the relationship between *Information technology (IT)* and *Organizational learning* started to develop only recently. In the next pages we will try to give a glance about past research about both Information Technology.

(Dewett and Jones 2001) provided an overview of the role of Information Technology in organizations. This work can help us in having a broad view of what are the main dimensions of organizational learning that information technologies impact.

Later in the paper we will go through concepts such as *organizational memory*, *culture, socialization*, and so on. (Dewett and Jones 2001)pointed out what are considered the main benefits enabled by the implementation and use of information technology. By considering them we can understand the overall impact of information technologies on organizational dynamics, mainly *exploration* and exploitation. In fact, these benefits involve implications for organizational members, the organization itself, culture, information diffusion and other important aspects. These concepts will be addressed more

deeply later in the work, for now we focus on information technology. The four topics addressed as the main benefits of information technology implementation are:

1. *IT ability to link employees*
2. *Promotion of learning*
3. *Facilitating sharing of culture*
4. *Facilitating organizational memory*

First, at the root of the impact on outcomes is there what Dewett and Jones considered "*perhaps the most fundamental benefit resulting from IT use in organizations*" (2001, p.321), namely the ability to **link employees** through divisions and functions. Technologies help organizations to overcome barriers such as division boundaries, place and time. Connection among organizational members allow for an improved diffusion of information and for an enhanced communication.

Second, by allowing an easier access to information and by facilitating problem solving, information technology can promote **learning**. Technology helps individual in obtaining knowledge more easily, both from communicating with other individuals and by facilitating access to memory repositories. This is fundamental for us, since later we will explore more specifically learning dynamics in the organization and we will deeply explain how knowledge is created and acquired. The utilization of information technology by organizations is strictly related with learning, both on an individual level and organizational level.

Third, according to the authors, information technology facilitates the **sharing of culture** within the organization. The authors pointed out how it moderates the effects of culture on organizational outcomes depending on social circumstances. Findings from (Zack and McKenney 1995) show how distinct groups may show different technology use patterns given the different social context within which they are in the organization.

Fourth, IT helps to **codify knowledge base**, meaning that it facilitates *organizational memory* by making access to *knowledge* easier, other than making easier to store knowledge and retrieve it when needed. This has some important implications, especially for the creation of new knowledge and for the maintenance of a valuable organizational memory. Finally, other than making easier to access internal information, information technology makes the access to external information quicker and easier as well. Easier

access and retrieve turn out to be possible because technology makes *communication* efficient and less expensive.

(Dewett and Jones 2001) contributed also by describing accurately what are the aspects impacted by Information Technology, and how they moderate the effects on the organizational outcomes indirectly. In their research they focused on how it impacts organizational characteristics such as *structure*, *size*, *learning* and *culture*, which indirectly impacts outcomes, mainly **efficiency** and **innovation**. Other than linking and enabling employees, which is one of the main benefits as previously mentioned, IT **codifies the knowledge base** and increases boundary spanning.

1.1 Linking employees and increasing information availability

IT enables a diffused availability of information at different levels of the organization. Valuable information is not in the hands of the management only but is available more easily for all individuals. This because the costs of exchange, transmissions and processing are reduced. Since information technology enables information to reach the peripheries of the organization and potentially all individuals and groups, the spread of information can raise the average level of knowledge. Also, the overall communication is made easier and faster, and it can overcome those barriers such as time and space.

For now, it is fundamental to show how research found out that the diffused information in the organization impact structure, favoring the emergence of flattened horizontal structures that are prone to outsourcing.

Impact on organizational structure and size

Information technology have a direct and important impact on the way the organizational structure is shaped. (Dewett and Jones 2001) noted that the use of it enables strategic decision making to shift, lowering it in the organization levels. The shift is made possible because information technologies increase the presence and availability of local information as well as coordination and communication between decentralized decision makers. Information is not limited to the higher levels, but on the contrary is moved where is needed to be exploited. This phenomenon referred as *decentralization of decision making* was observed also by Hitt and Brynjolfsson (2015). The authors used empirical evidence from 273 large firms across different industries to examine the relationship between information technology and organizational architecture. Supported by evidences, they showed how firms that make extensive use of information technology usually adopt a complementary set of *organizational practices*. Basically, location of knowledge changes: highly specific information is likely to reside at lower levels in the organization. Furthermore, organizations which extensively use information technology, show a greater reliance on supporting subjective *incentives* and greater reliance on human capital. So, technology does not substitute individuals. Individuals still have a pivotal role even when organizations are supported by technology. With the implementation of information technology, the knowledge worker in particular gained even more relevance as well. In fact his experience and know how are determinant to promote learning.

Thanks to the fact that information is distributed within the organization more equally, vertical structures tend to be set apart to make more space to configurations characterized by a horizontal setting. Often the horizontal configuration is referred to as *virtual organization* (Hinds e Kiesler 1995). Virtual organizations extend the concept of collaboration and coordination beyond the boundaries of the organization thanks to electronic linkages. According to Clemons et al. (2015), information technology enabled a shift from vertically integrated structure to a layout that involves more outsourcing, due to its ability to lower coordination costs and risks of coordination.

Other than enabling a shift to more decentralized decision making, the utilization of IT as well as the greater information availability, enable knowledge to shift to the peripheries

of the organization (Hitt e Brynjolfsson 2015). Having specific knowledge available in the peripheries of the organization, a barrier to decentralization is represented by coordinating multiple decision makers. However, the barrier is pulled down by information technology, since it is able to lower coordination costs (Hitt & Brynjolfsson, 1997). Also, Fulk and DeSanctis (1995) support the enabler role of information technology for the evolution into organizational forms where strict hierarchies are replaced by decentralized decision making, which turn out to give more flexibility to the organization. The ability to adapt better to environmental changes is a fundamental ability for organizations.

The implementation of information technologies has an impact also on the size of the organization. Organizations that rely heavily on IT result to be smaller when considering staff size.

Communication also plays an important role in shaping the organizational structure, since the information is exchanged at all levels. Electronic communication technologies are huge enablers for changes in the structures of organizations (Dewett and Jones, 2001). For example, electronic community technologies enable more connectivity between different parts of the organization and outside actors. Also, they are capable of overcoming time and distance constraints. Furthermore, communication technologies overall increase speed of communication, while reducing costs of communication.

The flattened structure is also facilitated by the equalizing effect of electronic communication on individuals' interactions (Sproull e Kiesler 1996). With the utilization of information technologies, communication between individuals and actors spatially and temporally dispersed is in fact easier (Sarbaugh-Thompson e Feldman 1998). However, the range and capacity of such communication is more limited than face-to-face communication. Communicate through communication technologies brings benefits but have also some negative implications. For example, Walther (1992) shows how electronic mail provide fewer cues than face to face communication. Some scholars supported the idea that by receiving less signals and indications, individuals and groups are not aware of social dynamics and social hierarchies in the organization (Sproull e Kiesler 1996). This could turn out to be a problem for knowledge sharing, implying an inefficient communication that can lead to misunderstandings and waste of time. Nevertheless,

according to some others, individuals and groups compensate for the restricted capacity of communication by some Information Technology (Walther 1992).

Enabling coordination for interorganizational relationships

Information availability creates the right environment for the emergence of virtual organizations. Fulk and DeSanctis (1995) argued how electronic communication enabled a shift towards horizontal coordination and the so-called *virtual organization*. Since it a more dispersed structure, compared to a vertical structure, this form needs communication and information technology to function. Virtual organizations are characterized by a network of partners that the organization collaborate and build relationships with. Information technologies impact hierarchies of relationship between partners by facilitating the emergence of outsource-based structures, at the expense of vertically integrated ones. This effect is to be attributed to the fact that IT reduces coordination costs and transaction risk. Even though the structure is less vertically integrated, IT helps information to flow with less friction among partners (Clemons, Reddi e Row 2015).

The development of a more horizontal structure combined with a virtual setup by organizations that rely on information technology, is given also by the fact that information flows more easily between firms enabling a higher degree of coordination. According to (Zaheer e Venkatram 1994), the fact that information can be transmitted and utilized more easily and faster, involves cost savings for the organization. An example is the reduction of costs of coordination between buyer and suppliers, or otherwise the reduction in costs of processing information, or even transaction costs (Zaheer e Venkatram 1994).

Relationships are subject to dynamics that would not even be possible without IT. Organizations can keep an eye on each other. IT enables an easier coordination between firms by giving access to shareable information more easily. Transaction costs are reduced since IT can reduce costs about exchanging and processing information, therefore

it reduces costs of coordination. At the same time, it increases information availability, thus facilitating monitor of partners' performance (Clemons, Reddi e Row 2015).

As a major effect, communication systems support relationships between organizations, diminishing the need of absorbing another entity from a bigger firm (Fulk e DeSanctis 1995). Then, organizations can share and obtain information fast. Organizations do not need to increase in their size to guarantee the support, the capabilities and knowledge of other companies. On the contrary, as pointed out before, organizations that rely heavily on IT are smaller.

Furthermore, information technology may facilitate synergies to support interorganizational innovative streams (Alvari, Yoo e Vogel 1997). In fact, studies demonstrate that information technologies such as electronic mail can support the emergence of weak ties between members belonging to different organizations (Feldman 1987). These types of ties may emerge because the members of two different organizations need to solve a common problem.

Another strong example of how information technology enabled the **coordination** between organizations, the flow of complex information for the development of an otherwise unlikely possible project is the study presented by Argyres (1999). Argyres studied the development of a common information system between two companies for the development of a military project and the process through which information technology can facilitate coordination between organizations. The authors pointed out the development of a higher level of coordination between the two organizations. Specifically, higher coordination was enabled by making information processing less costly. Furthermore, the **higher level of information processing**, enabled a better overall management on the project. That was possible due to the developing of a common language and common social conventions, in the studies referred as *technical grammar*. The development of such conventions allowed a better overall coordination without the need from higher management to intervene, so it allowed a substantial decentralization of decision making.

Enhanced communication

As pointed out before, virtual organization and horizontal structures need communication to spin their gears. Flattened organizational structures are based on communication and influence (Reich 1991). The fact that horizontal forms are characterized by the presence of non-fixed rules, generate a particular communication culture, characterized by a shift of authority relationships and to a non-physical workspace.

Hinds & Kiesler (1995) went deeper in analyzing the communication in the so-called network structures. They used evidence from a study in a large telecommunication firm to show different patterns of communication media usage by different types of employees. The authors considered two types of employees: *administrative workers*, namely the workers that deal with management skills, developed in on-the-job training and experience; and *technical workers*, defined as those employees that deal with analytical skills developed through a formal training in a socialized field (Dewett and Jones 2001). Both crossed boundaries when communicating, but they do it differently. The authors showed how technical workers used to communicate laterally across departments, this is due to several reasons. First, the flattened horizontal structure of the organization is promoted due the use of information technology, which in turn promotes **lateral communication**. Then, the nature of technical tasks, leads technical workers to communicate and discuss nonroutine problems that arise on the daily basis. On the other hand, administrative employees are associated with more fixed communication which constrains them into a limited hierarchy.

The authors analyzed also the different use of communication media by technical and administrative workers. The media took in exam were the telephone, the voice mail and the email. This is an example of how the same technology can be used in diverse ways by different individuals and lead to different learning outcomes. As we will show later, research showed how the effects of technology depend considerably on the context in which the technology is utilized and from the individual itself (Fiol e Lyles 1985). A lot of variables can determine the way a technology is used onto an individual or group level.

On the other hand, Sarbaugh-Thompson and Feldman (1998) showed how Information Technology can turn out to have the opposite effect for the communication between

individuals in a social context. In particular the authors analyzed the overall negative impact of the increasing use of electronic mail at the expenses of face-to-face communication. In the study presented by the authors, as the electronic mail usage increased within the community, overall communication between individuals started to decline. While the use of electronic mail increased, the use of face-to-face communication and all the other media decreased. The authors reported that the whole community perceived a decline in the perception of community and connectedness. According to Sarbaugh-Thompson and Feldman (1998), information technology does not engage individuals into developing their social dimension, leading to a detrimental effect regarding the sense of connectedness with other individuals.

This is supported also by Sproull and Kiesler (1996), whose found evidence that electronic mail has a negative impact on social context cues by reducing them. Specifically, as Sarbaugh and Feldman (1998), they observed a detrimental effect regarding communication within member of the organization, and detachment by individuals from the usual social dynamics.

On the other hand, according to Salomon and Gardner (1986), the effects of information technologies based on computer mediation should have limited effects on communication. This consideration would imply that communication technologies cannot have major impact on interpersonal relations.

Some considerations should be kept in mind. As Salomon and Gardner (1986) pointed out, when considering computer-based media and their effects on relationships and social dynamics, each of those computer-based medium should not be treated as the others, since they present different characteristics and uses. And, as mentioned before, we should also consider the context within where communication happens.

Also, with regards to interorganizational relationships, information technology posed a revolution for interorganizational communication as well, by enabling the establishment of more linkages between firms (T. Scott 2015). Given the improved number of linkages, organizations can share valuable knowledge more easily.

Furthermore, as pointed out before, information technologies can enable the emergence of weak ties among members from different organizations (Sarbaugh-Thompson e Feldman 1998), and specifically, communication systems enable a better support for the development of interorganizational relationships (Fulk e DeSanctis 1995).

Improved efficiency

Information technology impact transaction costs and communication costs by decreasing them, improving efficiency. Specifically, IT can generate costs savings and time savings due to the improved ability to gather and analyze data. For example, Pickering and King, (1995), found out that interorganizational electronic mail use by individuals enable savings on information costs. On the other hand, Dewett and Jones (2001) found out how IT usage can lead to performance gains, stemming from the fact that it gives the possibility to individuals to pool their resources and overcome boundaries by cooperating across their role. Individuals can communicate more easily and faster, allowing individuals and groups facing a problem to discuss in real-time with other individuals to solve the problem that are facing or that experienced the same problem.

As mentioned before, information technology has an indirect impact on organizations by moderating the effects of organizational characteristics on outcomes rather than the outcomes themselves Dewett & Jones (2001). That happens through the ability of IT to generate what Dewett and Jones (2001) identified as Information efficiencies (INE) and Information synergies (INS): respectively the cost and time savings given by the possibility from employees to expand their role due to an improved ability to gather and analyze data and performance gains. That is possible because information technologies give the chance to individuals (or subunits) to pool their resources and cooperate across their role (boundaries).

1.2 Sharing of culture

Behavior is determined by the specific situation and context in which the individuals is located. Every individual holds a mental program, which causes the individual to display more or less the same behavior in similar situations (Hofstede, 1980). Mental programs

are in part unique and in part shared with others, with the collective. A mental program can also be shared by everybody at a universal level.

The two major constructs pointed out by Hofstede (1980) in its work are *values* and *culture*. He defines values as a "*broad tendency to prefer certain states of affairs over others*". Values are a characteristic of both individuals and collectivities. On the other hand, we have the culture, which encloses shared values, behaviors and beliefs from the collectivity. Values must be shared by most of the members of the organization to achieve benefits. The same concept will be recalled when we will talk about organizational memory, as the success of organizational memory development depends also on the ability of the organization to make most of the organization participate in its development. There are various definitions for the concept of culture. Kroeber and Parsons (1958, p. 583) defined culture as "*transmitted and created content and pattern of values, ideas, and other symbolic-meaningful systems as factors in the shaping of human behavior and the artifacts produced through behavior*". This definition resonates with the broader definition provided by Trice and Beyer (1993) since they define culture as a pattern of beliefs, expectation, ideas, values, attitudes, and behaviors shared by the members of the organization. Hofstede (1980) considers culture as a systems where common values are held; he defines culture as the collective programming of the human mind that distinguishes the members of one human group from those of another. In our case, the word group should be intended in a broader sense as organization.

In a later work, Hofstede G. (2001) went deeper and provided a specific definition for Organizational Culture, defined as "*the differences in collective mental programming found among people from different organizations, or parts thereof, within the same national context*".

Culture permeates each dimension of the organization, for both example organizational behavior choices and organizational action are influenced by that. Hofstede (1980) recognizes that culture plays a big role in organizations. Specifically, the author recognized four determinant issues that organizations have to address when shaping their culture.

First, culture influences the **distribution of power** among the organization. Culture can determine whether decision-making power can only be in the hand of the management, or it can be more diffused within the organization.

Second, culture **influences values** of the group that is dominant. In an organization the group that detains more knowledge is the group that will in turn exert the most influence on other individuals (Hofstede, 1980). The dominant group defines goals and objectives in the organization, it influences decision-making processes regarding the allocation of resources, and it shapes the organizational structure. Furthermore, it influences reward systems.

Third, with regards to the non-dominant part of the organization, which represent the majority, they have a major impact on the organization as well: they represent the body of the organization, they determine the reasons for fulfilling the organizational requirements or they determine the control processes to guarantee the desired behavior.

Fourth, the culture is affected by the values established in the **environment**. Values of competing organizations, partners, or government affect and determine the behavior of the organization.

In their work, Claver et al. (2001) studied the relationship between IT, IS and organizational culture. They defined organizational culture as "*a set of values, symbols and rituals shared by the members of a specific firm, which describes the way things are done in an organization in order to solve both internal management problems and those related to customers, suppliers and environment*." Often, organizations are used to be supported by IT to face internal management problems, for example by using decision support systems (DSS). A DSS can support the analysis of a specific problem, as well as supporting operations and evaluate strategic opportunities to find a solution. Furthermore, IT supports problems with customers by using for example a Customer Relationship Management System (CRM), which is the term used to refer to the methodologies and tools used to leverage customer data.

When considering the relationship between information technology and organizational culture, literature is divided into two streams of thought. Many authors have supported the view according to which organizational culture establishes the path and guidelines for

the acquisition of information technology (Allard, 1998; Katz & Townsend, 2000; Tolsby, 1998). On the other hand, others believe that IT determines the shape and the character of an organizational culture (Daily et al.1996; Gainey et al., 1999)

However, both findings show both that culture has a direct influence on IT, and IT has a direct influence on culture According to (Claver et al., 2001). In fact, information technology influences culture by influencing the socialization of individuals. Also, since IT implementation and utilization impacts the way members behave, communicate, and socialize it is considered a social phenomenon (Orlikowski e Robey 1991)

The vision of IT as a social phenomenon is proposed by Orlikowski & Robey (1991), which also proposed a new perspective about how IT impacts organizational culture (Markus & Robey, 1988; Orlikowski, 1996). This perspective considers both IT and culture non-fixed, but changeable over time. This approach is referred to as **structurational** (Orlikowski e Robey 1991) and consider changes as unpredictable: for example, the adoption of a groupware technology, does not mean that the organization will become more collaborative over time, neither the contrary. As noted by Karsten (1999), individuals may change and modify over time how they use technology within the organization, and sometimes cultural changes may occur, but these are not at all predictable, quite the opposite. Designer and managers can build a structure around the use of technology, and they can set goals, however technology must be flexible. Each individual can interpret technology in their own way and give a different meaning and purpose to it. Technology will be interpreted differently by individuals based on their culture, so according to their beliefs, values, and behaviour. Furthermore, different patterns of IT usage can be observed at a group level, given the different social context within which the group is (Zack & McKenney, 1995).

As a social phenomenon, IT implementation and use depends on the social setting in which it is embedded. So, context mediates and influences the impact of information technology on culture. In fact, IT facilitates the sharing of culture within the organization and moderate the effects of culture on outcomes depending on social circumstances (Dewett and Jones, 2001; Zack and McKenney,1995).

Moreover, information technology not only has a material weight and existence, but its use and existence resonate also in the social dimension of the organization. So, any

change in the goal and meanings of the IT is mediated through the organizational culture (Coombs, Knights e Willmott 1992).

Information technology is based on information, how it flows, how it is exchanged, the different types and so on. Organizational culture plays a major role in channeling the information (Coombs, Knights e Willmott 1992), consistently with the stream of literature which support the guiding role of organizational culture in shaping information technology. Culture not only is a channel for information, but it works also as a mediator both for information and communication. The medium function of culture does not deplete in the information sphere, but it extends also in competition and in control.

1.3 Promotion of Learning

Literature sustains the idea which sees information technology as a support for the process of implementing new ways of learning and behaving. This because it provides individuals easier access to information and promotes **learning** (Dewett & Jones, 2001; Huber, 1991; (Ruiz-Mercader et al., 2006)).

Learning is defined as the process that increases knowledge of the organization and its members through interpretation, comprehension and assimilation of *tacit* and *explicit* information (Ruiz-Mercader et al., 2006). The purpose of learning is to generate knowledge that can be **codified** and institutionalized in norms of behavior. We can differentiate between **individual learning**, namely the conscious and unconscious process where tacit or explicit knowledge is created by a person through interpretation of information (Bontis et al., 2002), and **organizational learning**, namely the process where knowledge is created by socialization, externalization, and combination (Nonaka e Takeuchi, The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation 1995). Nonaka and Konno (1998), pointed out how mechanisms

such as socialization between individuals, externalization of ideas and combination of information, all enable overall organizational knowledge to increase.

However, the positive effect of Information Technology on organizational learning stem from the existence of a proper supportive culture (Ruiz-Mercader et al., 2006). To develop *learning capacity*, a social-cultural climate for learning must exists with appropriate structures and procedures. In the proper learning context, the positive effect of Information Technology has much more resonance.

The structures need to be ready to capture and elaborate new knowledge, from the inside and the outside as well. In the stream of literature focused on learning, the concept of *absorptive capacity* found a lot of room and attention. Cohen & Levinthal (1990) define it as the firm's ability to recognize the value of new external information, digest it, and apply it in a commercial context. Organizational efficiency and innovation can stem from the promotion of learning derived from absorptive capacity. (Cohen e Levinthal 1990) differentiate between two dimensions when considering absorptive capacity. On one hand *knowledge assimilation*, supported by the collection of different sources of information, both internal and external. The role of Information Technology shapes around the provision of boundary spanning capabilities to gather relevant information and around the codification of new knowledge to make it more accessible. On the other hand, regarding the dimension of *knowledge integration*, several information technologies provide the right infrastructure to integrate knowledge and to make it circulate within the organization to pursue knowledge optimization.

1.4 Knowledge and the knowledge creation process

Nonaka et al. (1996) defined knowledge as "*a meaningful set of information that constitutes a justified true belief and/or an embodied technical skill*". Knowledge is a set of information that combined emerges as valuable and can also be represented by the experience gained by practicing a technical skill.

Knowledge is often addressed according to different dimensions. Literature mainly addresses knowledge based on how it is stored, its specificity, on how it is possessed and communicated.

Based on its specificity, knowledge can be *specific knowledge*, and *general knowledge* (Hitt & Brynjolfsson, 1997). Specific knowledge is difficult to convey in others, it is costly to transfer, and is possessed by limited number of individuals. On the other hand, general knowledge is less costly to transfer. Individuals possess more knowledge that they can state, also because communicating and processing information could be expensive. Generally, individuals that hold specific knowledge, also hold decision rights, and complementary general knowledge is made available to them.

Knowledge is possessed, transmitted, and communicated in different ways. Generally, the distinction is made between *tacit knowledge* and *explicit knowledge* (Dewett and Jones, 2001; Ruiz-Mercader et al., 2006). Tacit knowledge is considered the personal, context specific, subjective knowledge. It is based on experiences, expertise, behavior, and intuition. It is supported by technologies such as collaborative software, portals, expert systems, and intranets. On the other hand, explicit knowledge is codified, formal, systematic, and so turns out to be easier to transfer and communicate within the organization. It is based on objective data, models, and best practices. Explicit knowledge is supported by databases, data warehouses, and digital libraries, other than a proper information architecture. Keep in mind that knowledge not only is stored in documents and repositories, but it is embedded also in practices, processes, and routines (Davenport, De Long e Beers, Successful knowledge management projects 1998).

To support the transfer of knowledge, organizations are supported by information technologies. IT lowers the *transmission costs* of knowledge, enabling the reallocation of specific knowledge within the organization (Hitt & Brynjolfsson, 1997).

Information technology also have a major impact on the process of knowledge creation. Wagner et al. (2014) bringed together knowledge creation theory and social media theory with the purpose of understanding better how information technologies may support knowledge creation in an organization. Wagner et al. (2014) adopted the structure used by Nonaka et al. (1996) to better describe technologies and the properties that define their use. The work from the authors gives particular importance on the process of knowledge

creation, in fact he provides a description of organizational spaces for knowledge creation and the relevance of internet as a collaborative space. Knowledge must be activated in a shared space to be a source of innovation. This shared space is referred to as *ba* by Nonaka (1996) and Nonaka and Konno (1998), the word "ba" can be translated with the English world "place". The concept of *ba* describes a shared space where individuals and groups can meet and interact. This space, which can be physical, virtual, or mental, is the playground for knowledge creation and sharing and it requires the development of a shared understanding.

Information technology may support knowledge creation not directly, but by enabling new behaviours (Nonaka and Konno, 1998). In fact, new behaviors allow individuals to cross their boundaries and face new stimuli fostering the discovery of new solutions.

However, technology advanced over the years and the work from Nonaka et al. (1996) failed in explaining why and in which ways IT may support knowledge creation processes. Therefore, several steps forward need to be done regarding the SECI framework developed from Nonaka et al. (1996). The SECI model introduced by Nonaka et al. (1996) aims at conceptualizing the interaction between explicit and tacit knowledge that leads to the creation of knowledge.

Wagner et al. (2014) went further with regards to the SECI processes explained by Nonaka et al. (1996). To fill in the gaps they extended the framework by gathering the already established theory on knowledge creation and the social media research. The specific consideration of social media goes further our goal of understanding the impact of IT on organizational learning dynamics. However, research by Wagner et al. can let us understand better how information technology can support knowledge creation.

The SECI processes are 4: Socialization, Externalization, Combination, Internalization.

First, the concept of **socialization** is tightly linked with interpersonal experience, sharing and observation. This process aims to build interaction to facilitate sharing of experiences among models. According to Nonaka et al. (1996) information technology turns out to be unhelpful in this process. Instead, according to the study from Wagner et al. (2014), the support given from IT to the externalization process occurs through two so-called affordances, namely benefits or qualities that are enabled from the use of information technology. These affordances are found in all four processes, in the socialization process specifically we can find two of them: *association*, IT foster the establishment of relations

between individuals; *reviewability*, in fact IT supports the progressive establishment of a knowledge base and allows a sustained level of organizational knowledge over time.

Second, **externalization** is the process involving the articulation of tacit knowledge into explicit knowledge through concepts, or diagrams or analogies. The process of externalization aims to elaborate information to build concepts from tacit knowledge. According to Nonaka et al. (1996) information technologies such as groupware systems, can support the externalization process. The affordances enabled in the externalization process are two: *authoring*, which allows members of the organization to articulate their thoughts and make the articulations available for the other members; *editability*, namely the ability to craft and re-craft a communicative act, which allow the members to improve the quality of the information.

Third, the **combination** process involves the exchange and transfer of explicit knowledge exchanged by individuals through various medias and channels of communication. The concepts that were articulated in explicit knowledge are here integrated and combined into the knowledge system. Furthermore, the process may involve the emergence of new knowledge. The affordances recognized by Wagner et al. in this process are: *editability*, namely the ability to modify previously generated content and make it easy to adapt to a different setting; *recombinability*, which relates to action enabled by IT, where each individual contributions builds up on other individual contributions. Editability can be considered as on of the most important affordances because it meets the need of IT to change and adapt to new environments and new needs. Information needs to adapt to the environment and its needs to be valuable. Information that cannot be applied to the specific setting cannot be used to solve problems. We will see other implications when we will discuss about organizational memory.

Fourth, the last process involved in the knowledge conversion cycle is the **internalization** one. In this process, explicit knowledge turns into tacit knowledge. The experiences gathered from individuals are internalized as tacit knowledge after the processes of socialization, externalization, and combination (Nonaka and Takeuchi, 1995). These models that are now shared by a significant part of organizational members, build up the organizational culture (Schein 1990). The affordances that play an important role in the process of internalization are *reviewability*, which allow individuals to review past

knowledge for problems that they are facing now. Then *experimentation*, which pushes organizational members to find new ways to solve a problem and try new ideas.

Once that the internalization process occurs, the cycle does not end. On the contrary, the cycle starts by going through all the phases again. This because the new tacit knowledge internalized needs to go through socialization with other individuals to turn it into explicit knowledge. So, the cycle goes on and repeats itself.

The affordances studied by Wagner et al. (2014) and presented above show how information technology support knowledge creation in an organization.

Meanwhile herein is the right place to discuss how literature addressed the effects of IT on knowledge and in particular knowledge creation, it is appropriate for now to not go deeper into the discussion about knowledge processes. In the next section we will discuss the other knowledge processes and more.

1.5 Organizational memory

As happened for learning, the definitions given from the literature about memory are several and different and the matter was assessed in diverse ways through the years.

In his work, Atwood (2002) refers to organizational memory as a "*combination of experiences and skills about projects, products and decisions that is more often embedded in the minds of the workers, or entrenched in the organization's culture as tacit knowledge, rather than stored in formal documents, reports and manuals as explicit knowledge*". This definition highlights the fact that memory is based on knowledge and experience that is stored in the minds of the members of the organization rather than information merely stored in documents. Moreover, this definition keeps in consideration two elements: the experience in the minds of the individuals, and the knowledge embedded in the organizational culture. We also must keep in mind that when considering organizational memory, we are contemplating that the experience stored in the memory will be reused.

Organizational memory can be approached in two different ways, according to a categorization of it based on knowledge or shared values (Sandoe e Olfman 1992). These two main approaches are referred to as *representational,* and *interpretational*.

The representational approach categorizes the organizational memory purely as a representation of knowledge. On the other hand, the interpretational approach assesses shared values and understandings developed among the individuals in an organization. Organizational memory stores knowledge from the individuals and works as a repository to make the knowledge available for them. In this way it represents knowledge to organizational members. Moreover, organizational memory also stores beliefs and shared values from the members, in the measure in which knowledge stored was interpreted according to a particular individual or group interpretation. Also, since the knowledge stored in the organizational memory comes from the past, contextual factors should be addressed. In fact, the knowledge brought from the organizational memory was applied in a context that could have been significantly diverse from the current one. It is extremely important to highlight that knowledge from the past is brought back to being applied in the current context to undertake current actions. This is consistent with the definition of *organizational memory* given from Stein and Zwass (1995, p.89) whom examined the role of information technology in actualizing organizational memory in. They referred to organizational memory as "*The means by which knowledge from the past is brought to bear present activities, thus resulting in higher or lower levels of organizational effectiveness*". In this definition three elements are highlighted which are important: the retrieval process of knowledge from the past, the application of that knowledge for present actions, and the resulting organizational effectiveness.

The cultivation of organizational memory is extremely important for organizations and among all the benefits stemming from it, we can find an improvement in organizational learning (Hedberg 1981). The information created and stored in the organization is mostly produced through the communication and coordination of the members of the organization. Members participate in the activities of the organization by being part of a community, referred to as *community of practice*. These communities have common practices and common languages. By participating in these communities, members of the organization learn.

Some considers organizational learning as a side effect of learning and learning as a direct consequence of the participation in a community (Stein and Zwass, 1995). The participation as a community in the development of an organizational memory is a fundamental element for learning.

Knowledge workers plays an important role in the development of an organizational memory, and there are several matters that are recognized as significant when considering the successful development of an organizational memory. These topics are topics that should be addressed from organization. These topics deal with the workers who develop and use the knowledge. Atwood (2002), recognized six of those:

- **Work vs. benefit.** The organization must assure that the people that work on designing and developing the tool is the one that will benefit the most. The organization must deal with the disparity that subsists between users who make an effort to maintain a groupware tool for organizational memory, and the individuals who actually benefit from the utilization of that tool.

- **Information capture difficulties.** The information must be captured implying as less effort as possible. Also, new information must be consistent with the old one. The information captured may conflict with the information already in possession, namely when the old information cannot be applied to the current context anymore. The importance of the match between information and context is highlighted.

- **Disruption of social process.** By implementing a new groupware system into a functioning organization may disrupt work practices and jeopardize the optimal use of organizational memory.

- **Adoption process.** The process of implementation of a groupware system for the organizational memory is delicate. Future users must participate in the design and development process to shape the system for their needs. It is important to involve as most individuals as possible because organizational memory must be used by a good mass of individuals to work at its best. So, it could be a good practice to raise awareness and encourage users to use it, because the more they use it, the more they contribute to it, and the better the knowledge stored will be in terms of applicability.

- **Resource constraints.** Resources are limited, but organizational memory requires that the management commit to it. It could be difficult to allocate the right people needed to develop and maintain the right organizational memory system.

- **Individual work and group work.** Organizations tend to encourage individual work rather than group work. According to Orlikowski (1991), three factors hinder the development of a groupware tool. First, the reward system is based on rewards for the traditional work and do not offer any reward or incentive for adopting the new system into the work practices. Then, rewards are a driver only for individual and individual performances.

Organizational memory is also related to organizational effectiveness. Effectiveness can be seen in different ways, Stein and Zwass (1995) identify four different groups to identify it: the first one look at effectiveness as regards to the coordination and management of the information across the organization (*integrative function)*; the second group consider effectiveness in terms of the adaptability of the organization, the ability to adapt to changing environment (*adaptive function*); the third group refer to effectiveness in terms of the ability in setting goals and evaluating their accomplishments (*goal attainment function*); the fourth group views effectiveness in terms of maintaining cohesion in the workforce (*pattern maintenance function*). Organizational memory impacts organizational effectiveness by directly impacting each of these functions. So, the tight link between memory and effectiveness brought to the possibility to frame information technology's support for organizational memory in terms of effectiveness.

We believe that by defining effectiveness as a product of the integrative, adaptive, and goal attainment dimensions, it would be easier to understand the influence of information technology on organizational memory.

A threat to adaptability is posed by personnel turnover, which can turn out to be the biggest threat for organizational memory (March, 1991). In the previous pages was mentioned how information technology use by individuals or organization can change over time to adapt to new needs and environments. This matter turns out to be more complicated by the fact that one of the dangers of retrieval from organizational memory

is the retrieve of automatic responses that are not adapted to the environment and do not meet environmental demands (Stein & Zwass, 1995).

Information technology supports the creation of organizational memory (Atwood, 2002). The enhancing function of information technology in terms of effectiveness is also supported by studies from Sainfort et al. (1990). The researchers shown that communication media and decision support system technologies improved effectiveness in terms of decision-making quality and problem-solving outcomes. Information technology allow an easier and diffused access to organizational memory, so more organizational members can have the right information where it is needed. Combined with the horizontal structure and the decentralization of decision making, the latter is faster and increased in quality. Decision can be taken from the people who are facing the problem, without any mediation with upper management.

However, the horizontal structure can hinder the development of an organizational memory. In a horizontal structure, organizational memory is more difficult to develop because this type of structure is based on interdisciplinary and on the development of a shared set of interpretations and a common technical grammar (Stein and Zwass, 1995). Information technology usage change across the organization and among individuals and groups, as well as information technology support for organizational memory (Stein and Zwass, 1995).

2 Organizational Learning, a Conceptual Framework

In this chapter the concept of Organizational learning will be defined. After a clarification on the main clusters adopted from the literature to define organizational learning, its main characteristics will be described. Some of them were already introduced in the previous chapter, like culture and organizational structure. Here will be described how knowledge is created, retained, transferred, and retrieved. Below will be made clear that organizational learning is the product of experience, context, learning processes and organizational memory. The value of knowledge depends however on contextual factors. This will be useful to discuss about organizational action and the relationship between exploration and exploitation.

2.1 Organizational Learning, definition of the concept

The concept of Organizational learning has had a keen success in literature, many studies were and currently are undertaken. However, since the argument has had various and several applications, a common definition for organizational learning has not been already developed.

A part of literature considers organizational learning as a change in the **knowledge** of the organization that occurs as a function of **experience** (Argote, 2011, Argote & Miron-Spektor, 2011). Argote and Miron-Spektor (2011) defined organizational learning as a

change in the organization that occurs when the organizations acquire experience. Knowledge and experience are two of the main elements addressed when approaching the development of learning. Knowledge is developed by single individuals in the first stages, but for organizational learning to occur, this knowledge must be accessible by other individuals. To be accessible by others, it must be embedded in repositories such as databases, memory systems, or even routines (Argote, 2011). Organizational memory, as explained in the previous section, help organizational members to have access to knowledge.

Knowledge is defined both by explicit and tacit components, and it can be defined by changes in behaviors or cognition. In fact, Robey, Boudreau, and Rose (2000) define organizational learning "*as an organizational process, both intentional and unintentional, enabling the acquisition of, access to, and revision of organizational memory, thereby providing direction to organizational action*". This definition highlights several characteristics. First, organizational learning is viewed as an organizational process, so differentiating it from learning that occurs for individual, groups, and relationships. Moreover, organizational learning is both intentional and unintentional, so accounting for learning that occurs from planned processes such as formal training as well as for learning that stems from unplanned ways.

Furthermore, this definition determines a pivotal role for the *organizational memory* and so for the *experience*. The role of experience in defining organizational learning is recognized by researchers. For example, Argote and Miron-Spektor (2011) defined organizational learning as a change in the organization that occurs when the organizations acquire experience. The organization faced a problem or a change and it gained experience about it, in the effort to face that problem of adapt to changes it changed itself. Organizational learning process has the goal of guiding *organizational action* (Fiol and Lyles, 1985). Since the organization is in a constantly changing environment, the need to adapt is fundamental, so the organization needs to take action to adapt and survive. The tight link between organizational learning and organizational action is supported and evidenced by part of the literature, which defines learning as "*the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions*" (Fiol and Lyles, 1985). Organizational learning is seen by that part of literature as a change in the knowledge of the organization, which ultimately depends on

experience. The more knowledge an organization develops, the more the portfolio of practicable actions adapt to the environment improves.

Another way to address organizational learning is by focusing on behavior and changes in it (Huber, 1991). Indeed, Huber defines learning as a change in the range of potential behaviors due to information processing. This definition is not limited to organizational learning, but it is applicable for all entities in general, from individuals to organizations. When the entity in consideration is an organization, the processes involved to transform information can be *social* and *interpersonal*. This last point of view recalls the view of learning as a revision of past actions and experiences to determine which possible direction the organization can take in the present. In considering the organizational learning as a change in the range of behaviors, we leave considerations about organizational effectiveness behind, since the behavior chosen may or may not increase effectiveness. So, the organization can acquire the knowledge needed to improve its effectiveness, but without showing those improvements.

2.2 How To Measure Organizational Learning?

In their work Robey et al. (2000) question themselves how organizational learning should be measured. Following their definition of organizational learning as a process with consequences that can be observed, they suggest two different approaches. The first is focused on measuring the *outcomes* of organizational action and determine learning from outcomes variations over time. This approach leads to a deduction of learning curves, which unfortunately do not observe the learning process directly. Based on the outcomes following decisions from the organizations, it can be possible to say whether the organization learned from its past.

The second approach, on the other hand, focuses on measurement of the organizational *learning process*. The measurement can occur through the development of ad-hoc

questionnaire, even though they can be focused on the outcomes as well rather than on the actual activities that determine learning.

According to Robey et al. (2000) these two processes could be combined, and the method that may combine appropriately the measurement of outcomes and processes is the *simulation*.

2.3 Types of learning

Organizations are made of individuals that are located within procedures, processes, groups, culture, socialization and so on. These individuals learn from interactions, experience, and solving problems, creating experience, and ultimately learning. However organizational learning goes beyond the sum of the individual learning of the members of the organization. As individuals develop their beliefs and behaviors during time, the organization develop a memory that preserve those behaviors, mental programs and values (Hedberg, 1981).

According to Brown and Duguid (1991) individual learning is inseparable from collective learning. Learning can occur at different levels in the same organization, Fiol and Lyles (1985) defined a hierarchy based on two levels of learning: *lower-level learning* and *higher-level learning*. **Lower-level learning** refers to the learning that occurs within a given structure and a given set of rules and is based on routines and repetition of past behaviors to ultimately impact organization activities. This type of learning is characterized by a short-term horizon and takes place within a given set of rules. Members of the organization learn to recognize deviations from standards and to solve the problem, thereby reducing the variance between operation variables and norms. On the other hand, **higher-level learning** takes place within members questioning underlying assumptions and values, trying then to substitute old paradigms with new ones. This type of learning refers instead to the learning that occurs to modify rules and norms in order to develop new ones and is based on skill development and insights. This type of learning has a

bigger magnitude compared to the lower level, in fact this type of learning affects the organization in its entirety.

March (1991) analyzed the contrast between those two types of learning when he talked about the exploitation of old certainties versus the exploration of new possibilities. Both of those rely heavily on *organizational memory*, so on experience, the relationship is shown to be closer with lower-level learning (Stein & Zwass, 1995). Lower-level learning mostly desires for standards of performance to being a part of the organizational memory so that members of the organization can recognize variances and correct them (Stein & Zwass, 1995).

On the other hand, higher-level learning can happen only if social processes are introduced from the same members of the organizations that question assumptions and challenge standards. Higher-level learning is shown to be exploratory by March's analysis. Higher level learning is improved by modest personnel turnover through the acquisition of new knowledge (March, 1991).

2.4 Experience, context and learning process

In analyzing organizational learning, will be useful to go through the main determinants that have an impact on it. Argote (2011) recognized the main characteristics from several streams of research. The characteristics below are the main research themes kept in consideration when studying learning. These characteristics are:

- Experience
- Context
- Organizational learning process (creating, retaining, and transferring knowledge)

The influence of experience

Studies of organizational learning look at organizations as cognitive entities, capable of observing their actions, experimenting new alternatives and modify their actions to improve performance (Fiol and Lyles, 1985; Robey et al., 2000). Improvement must stem from a revision of **past knowledge** and **experiences**, which are stored in repositories and that influence the whole organization. So, organizational memory needs to be revised for the organization to learn from past actions, take other directions and improve. We must be careful however, because past knowledge stored in the memory is not substituted when new knowledge is added. In fact, it would be particularly difficult for the organization to unlearn something that they already know.

Learning is strictly linked to **experience**, and it can be enhanced through *formal activities* as well as *informal activities* (Fiol and Lyles, 1985). Formal activities include all those tasks that happens to be planned and part of the daily job of the worker. While informal activities can be considered as those tasks, actions and operations that do not make part of the normal routine of the worker. Members can experiment and develop new ideas by undertaking these activities, therefore informal activities eventually can turn out to be more effective than the formal ones in promoting learning.

Older experience provides valuable foundations in terms of knowledge, it is extremely useful for implementing new technologies, other than providing a path for current actions. In other contingencies, however, experience contributes to the development of competency traps that preclude the formation of new knowledge.

Evidence shows how experience provides a base of knowledge to guide current action. For example, the company CIGNA, a provider of insurance and related financial services, used past experiences to develop a plan of reengineering that makes the example of learning from past experiences, both successful and unsuccessful (Caron, Sirkka e Stoddard 1994). CIGNA with its CIGNA Technology Services (CTS), provided datacenter and communication network services to its customers. CIGNA reengineered unit's processes for a new organizational structure. Reengineered focused on three processes: processing, communication services, and the customer service hotline. Furthermore, the company focused also on the creation of an **environment** which

encouraged the members to come up with innovative ideas. The company determined this as a priority for the reengineering (Caron, Sirkka e Stoddard 1994). The environment needed a change in the mindset of organizational members, so the company introduced a new set of **values** for the members employed in the utilization if the information system. This was the most difficult challenge in the reengineering process. The newly introduced values included a change from focus on technology to focus on business processes and results, so allowing for a broader spectrum of usage for the technology, resulting then in exploration. The reengineering was possible because CIGNA applied the knowledge gained form previous projects in the newer ones. The company facilitated the sharing of experience gained from one project to another. Whether the experience came from a successful or an unsuccessful project, it was valuable.

Experience can be acquired when dealing with a task as well as by solving problems, members will then gain knowledge about them. Individuals gain knowledge both when the task ends successfully and unsuccessfully. Individuals may need to address tasks for which they are familiar with because they have been already performed in the past repeatedly, otherwise they may have to address novel tasks that were not performed in the past.

However, for novel tasks it is possible to apply knowledge developed from the performance of diverse tasks or even knowledge developed in another location in the organization. Levitt and March (1988) make a distinction between experience that is gathered directly by the focal organizational unit and the experience acquired from other units. Argote and Ingram (2000) referred to the learning coming from the latter type of experience as *knowledge transfer*, this process is crucial. The transfer from a unit to another one, or from an individual to another one, implies that the knowledge transferred is applied for different purposes form the original and processed from a diverse individual or group. This contributes to promote learning.

Experience may be *heterogenous*, individuals can encounter different types of experience characterized by various properties. Experiences may be interpreted and elaborated in different ways from different individuals depending also on the context. Different types of experience will in turn have different impact on learning outcomes. Findings show how

different types of experience contribute to increase learning outcomes more than homogeneous experience (Haunschild e Sullivan 2002).

The way organizations learn from past experiences was studied from Haunschild and Sullivan (2002). The authors studied accidents and incidents that faced by U.S. commercial airlines occurred in the span of time of almost a decade and a half. By considering multiple causes they found out that experiences developed from heterogenous causes produces generally more learning than experience developed from homogeneous causes.

According to Haunschild and Sullivan (2002), benefits of learning from heterogeneity apply mostly to specialist organizations, while generalists learn from industry's experience, consistently with findings from Ingram and Baum (1998). Apparently, generalists learn more from the experience of the industry than the specialists (Haunschild and Sullivan, 2002).

So, since industry's experience is a major source of learning for generalist organizations, the context starts to gain a bigger role in this type of organization, as well as culture. These shape the industry, in turn experience and finally learning will be influenced by these two dimensions.

Other than homogeneous and heterogenous experience, researchers identified different types of experience, for example *direct* and *indirect* (*vicarious*) experience (Argote and Ingram, 2000). There exist mixed considerations about the relationship between these two types of experience. In fact, according to some, direct and indirect experience are negatively related since one type of experience substitute the other, on the contrary, according to others the two types are positively related (Schwab 2007).

A topic that is important to address is the utility and validity of experience as a teacher for the organization, so when experience turns out to be a good teacher and when not. Experience is difficult to interpret from organizations and individuals. It may have negative effects on learning outcomes, in fact organizations can be mislead by experience and learn things that are not valuable in that particular context and in those circumstances. Or even, they can persist in undertaking actions that in the past turned out to be successful but in the present are not adapted to new needs and context.

So far the discussion was based on organizations' own experience. However, researchers went deeper in analyzing not only organizations' own experience, but they also discussed the effects of industry's experience (Ingram and Baum, 1997), since it is capable to determine and influence organization's outcomes.

Among the effects of the organizational learning stemming from own experience studies pointed out an improved efficiency (Yelle 1979). However, other studies show how learning stemming from organizations' own experience can lead the organization into competency traps. This is due to the focus dedicated on refining old routines that do not suit the changed environment anymore (March, 1991; Levinthal & March, 1993). In this way, organizational efficiency is negatively affected because the organization is not adapting to the new needs.

Own experience appears to improve efficiency in the short term, playing a major role especially in specialized organizations. Moreover, organizations appear to benefit from industry's operating and competitive experience. Ingram and Baum (1997) found out that different types of experience allow the development of different capabilities for the organization. So, experience covers a strategic role in the organization, which must figure out which kind of experience to integrate to develop the desired path for learning.

Context and environment

Another major determinant for organizational learning is represented by the context in which learning occurs. Fiol and Lyles (1985) identified four contextual factors that affect learning occurrence, some of those factors were introduced above, such as the **culture**, the **organizational structure**, and the **environment**. Another one is the **strategy**, which must guarantee flexibility. According to some theorists, culture is tightly linked to strategy so it could be used as an indicator to predict actions and to guide organizational actions and change (Miles e Snow 1978).

The **organizational structure** determines how learning processes are undertaken in an organization. For example, a structure characterized by centralized decision-making will tend to be more reluctant to change and reinforce past behaviors, making the organization less flexible to environmental changes (Fiol and Lyles, 1985). On the other hand, since

information would be more diffused, decentralized structures would promote changes in actions as well as beliefs, promoting learning (Duncan e Weiss 1979). Greater diffusion of information would enable different interpretations of the same piece of information, which would be applied to different contexts. The application occurs from individuals with different beliefs and competences. This would turn into the development of new ideas and into the increased capability of capturing signals of change in the environment., allowing for greater levels of flexibility.

Both internal and external **environment** play a big role in determining the dynamics of learning (Fiol and Lyles, 1985). An overly dynamic environment may not favor learning since the greater complexity would not allow the organization to keep up with the fast-changing environment. But on the other hand, an overly stilled environment may not provide enough stimuli for learning and improving, leaving the organization in a stagnant condition, and increasing the inertia, fossilizing existing procedure and ideas.

Findings from the study of (Caron, Sirkka e Stoddard 1994) pointed out the attention given to environment from managers of CIGNA. A successful practice from CIGNA was to address the environment to better define the dimensions of reengineering. They started the process of reengineering by changing the internal environment. They developed an environment that encouraged organizational members to develop new innovative ideas. Furthermore, CIGNA's managers concluded that the reengineering that they planned would not have worked in another environment. Their experience and knowledge would have turn out to be exploited successfully probably only in the environment in which they were situated. Fundamental to their successful reengineering was the knowledge suitable for that specific context.

The alignment between the organization and the environment is fundamental to guarantee innovation, growth and so improvement (Lawrence & Dyer, 1983). According to some authors (Katz and Kahn, 1966) the alignment between environment and organization is a condition that guarantees a healthy organization in the long term, in terms of increasing performance. The alignment implies that the organization must learn and adapt to changes in the environment and overlook prior experience if it is not appliable in the new circumstances, to ultimately learn new knowledge. In this sense we talk about Organizational adaptation, seen as the ability to deal with environmental changes (Thompson, 1967).

As CIGNA experience pointed out, organizations and individuals are influenced by the *external context* and the *internal context*. The **internal context** of the organization is the narrower level of analysis, and it is determined by characteristics such as the organizational structure, culture, technology, memory, goals, incentives, and strategy (Argote and Miron-Spektor, 2011).

Inside of the internal context, a distinction is made also between an *active context*, characterized by elements such as members and tools interacting with tasks (here is where organizational learning occurs); and a *latent context* which influences the active context by determining which member is part of the organization, which tool they use, and which task they undertake (Argote and Miron-Spektor, 2011; McGrath & Argote, 2001). The main difference between these two sub-levels is that the active context is characterized by the fact that action envisaged. By being characterized by action, it is in the *active context* that the individual and the organization can gain experience which will turn into learning. Since action is envisaged, decisions about actions need to be taken, so experience determine the choice between possible actions. Then, experience indirectly affects active context. The elements that characterize the active context, namely members and tools are the main media through which knowledge is created, retained, and transferred. The elements are also the mechanisms through which organizational learning is created.

Individuals participate in the knowledge processes. Furthermore, they work also as knowledge repositories. As evidence, above was mentioned the interpretation of organizational memory as a combination of experiences about decisions that are embedded in the minds of the members as a tacit knowledge. The knowledge acquired become part of the organization and is embedded both in the active context of members, tools, and tasks and in the latent context of the culture.

The cycle that was presented above can be applied for different levels of analysis, from an individual level to a group level (Argote et al. 2001), then organizational (Schulz 2002) and interorganizational (Ingram, 2002).

Learning from own experiences and from history, is one of the skills that learning organizations are likely to develop. Other valuable skills that the organization must

develop are learning from others experiences and practices, rely on environmental memory, and transfer knowledge quickly and efficiently. The former skill is one of the most important. It is built on experience and is developed on the enactment of the process of organizational memory, which is a major component of the organizational learning.

2.5 Organizational Learning Process

Knowledge in the organization

Argote and Miron-Spektor (2011) pointed out several interpretations and approaches to explain knowledge in the literature of organizational leaning. Researchers measure knowledge by measuring cognitions of organizational members (McGrath, 2001). Other researchers focus on knowledge embedded in routines and practices. According to them, changes in routines and practices are a consequence of changes in knowledge. The occurrence of organizational learning is then explained through those changes in knowledge (Levitt and March 1988). According to other researchers such as Huber (1991), knowledge can be acquired from the organization without any changes in the behavior, so organizational learning is defined in the range of potential behaviors. All these approaches define knowledge in terms of changes, whether it is a change in knowledge or a change in the behavior. Despite the popularity of approaches that defined knowledge by assessing changes in cognition, currently this kind of method is being complemented by practice-based approaches (Argote and Miron-Spektor, 2011).

Often organizational learning process is approached as a **cycle**, which starts from the experience following the task performance. This experience is then converted into knowledge, and ultimately affects the context of the organization and future experiences (Argote and Miron-Spektor, 2011). Indeed, the whole process occurs into a context, the internal context of the organization and the environment. Organizational learning occurs within this context since knowledge emerges from the interaction between **experience**

and the **context**. The modified context will determine how the organization will approach future experiences.

Knowledge processes, how knowledge is developed and maintained in the organization

The occurrence of organizational learning goes through the creation of knowledge through experience, and the storage of those knowledge in repositories, which can be represented by the minds of individuals or proper artifacts created to stock knowledge. Then, knowledge can be retrieved from individuals where it is needed, and finally transferred to other individuals within and outside the organization. Following this path, we can determine a framework based on four distinct processes that can describe the fundamental knowledge processes for the development of organizational learning. Three of the processes were identified by literature, namely **creating knowledge**, **retaining knowledge**, and **transferring knowledge** (Argote, 2011). Other then these three processes, it can be recognized one other process: **retrieving knowledge**. An accessible supra-individual repository is fundamental for the organizational learning to occur and for the successful diffusion of an organizational memory. So, since the organizational memory must be an artifact separated from individuals' minds, by limiting the analysis on the transfer of knowledge between individuals, the analysis could be exposed to the danger of not considering a fundamental determinant for organizational learning occurrence.

Through experience, the organization creates knowledge, which is retained in repositories and can be transferred between units or retrieved by individuals. Argote and Miron-Spektor (2011) differentiated between three processes. The first process is referred to as *knowledge creation*, where individuals or groups perform a task, gain direct experience, and develop new knowledge. When an individual or a group develop knowledge from the experience gained from another unit, this is referred to as *knowledge transfer* process. The process aiming at retaining the knowledge in the organization is referred to as

knowledge retention. Depending on how they are faced and the mindfulness by which they are undertaken, learning processes can be differentiated also in *mindful* (attentive) or *less mindful* (routine) (Argote and Miron-Spektor, 2011). The first type involves a bigger effort in terms of communication and reasoning, this type of practices involves the analysis and comparison of circumstances and their elaboration to develop principles and in turn valuable knowledge appliable for other needs and conditions. On the other hand, learning for less mindful processes comes from a simpler input and response process. However, literature highlights how higher level of learning is related with effort from the entity that is learning (Argote and Miron-Spektor, 2011; McGrath and Argote, 2001). Research concerning mindful processes focused mainly on the subprocess of *knowledge creation*, but even the subprocesses of *knowledge transfer* and *knowledge retention* can vary in mindfulness. The definition of mindful learning process along with the determination of the active context, highlights how a proactive participation in organizational dynamics (both form the social and operative perspective) guarantees for an improvement in learning. By acting, undertaking tasks, communicating with members and generally proactively socialize with the social context and the operativity of the organizations, the individual would confront his ideas and beliefs with different ideas and different conceptions. The individual will confront himself with the diverse (and with variability) and will learn about it. This is socialization.

So far, knowledge development was considered consequent to the performance of a task. The development of knowledge though, is not limited to the consequence of tasks performance. Knowledge can be acquired or produced in various ways. According to Huber (1991) the organization acquire information through five subprocesses: *congenital learning, experiential learning, vicarious learning, grafting, and searching*.
Congenital learning refers to the primal knowledge concerning processes and present in the starting environment. Founders make this information available to the new members of the organization. By doing so, the founders exert huge influence on the culture and the context of the organization.
Experiential learning refers to the process based on acquiring knowledge through direct experience, by undertaking tasks and facing problems. Experience can show a great number of facets, it can be direct or undirect, it can be intentional or unintentional, it can

be homogeneous or heterogeneous. Experience is fundamental in developing knowledge, both for individuals and for the organization.

Then, *Vicarious learning* refers to the process focused on acquiring knowledge that is not present within the boundaries of the organization but is possessed by other organizations. Organizations are used to look in the neighbor's garden. They look for knowledge outside of their boundaries mostly when the information needed is highly specific or not easily acquirable without spend too many resources. Organizations look on the outside to acquire knowledge about technologies, practices, and strategies. Then, the external environment highly influences the actions of the organizations which operates within it, by setting standards both for procedures and technologies.

Furthermore, organizations gain knowledge from the outside also by *grafting*, namely by acquiring new members that possess new knowledge. By incorporating new members, the organization add variety to the knowledge that is already possessed. Grafting may happen for example through the acquisition of another organization finalized to the incorporation of expertise know-how. Acquisition may happen for a multitude of reason, like strategic purposes, but here we will leave strategic implications outside the discussion.

Moreover, organizations acquire information through *search*. Organizations may search for signals in the environment by scanning it and obtaining information about potential changes (Fahey, King e Narayanan 1981). It is a useful process to keep the organization able to consistently fit the environment and meet its needs.

Understanding knowledge acquisition is fundamental because it determines how experience and then knowledge are developed within the organization. But alone, knowledge acquisition cannot lead to organizational learning. To gain knowledge is not enough. It is necessary to distribute the information and make it accessible for all the members of the organization. Distributed information within an organization is extremely valuable. Different pieces of information stored in different organizational units can be put together to form new knowledge. So, Information distribution can then lead to broader organizational learning (Huber, 1991). Often organization do not know the knowledge that they detain, so individuals are not able to find where and in which unit a piece of information is located (Huber, 1991). More successful retrieval happens when

information is optimally distributed, so that the organization's members can draw from different sources and find what they are looking for. Individuals and groups are more likely to be able to learn (Huber, 1991).

Several determinants influence whether an individual or a unit will distribute information to another individual or unit. Some of these are the information's relevance perception, membership power, status, costs of information distribution, and the rewards as a result from distribution (Huber, 1991).

The entities that exchange information should be careful to the quality of distribution as well, in order to prevent information distortion.

When information is stored in a repository, is accessible from individuals and groups. Diffused distribution allows the access by the whole organization, so from a huge variety of entities. Individuals and groups take the information needed and interpret it by filtering with their own perspective, values, culture and yardsticks. This enables a different interpretation of the same information among the organization.

Interpretation is the process where information is analyzed and elaborated. Daft and Weick (1984) defined it as the process through which information is given meaning and the process of translating events and developing shared understandings. Generally, more learning occurs when different interpretations have been developed. Different interpretations enable changes in the range of potential behaviors. Also, more learning occurs when more units comprehend the nature of the different interpretations given by other units.

The type of learning that are addressed in this paper are two. The *bottom-up* one, so the one based mainly on experience and the *top-down* one, based on social interactions, other than goals and task demands.

2.6 Organizational Memory as a determinant component for learning

Experience, discoveries, inventions, and evaluations all must be embedded in the organizational memory for organizational learning to occur (Schon e Argyris 1997). Organizational memory is an important component of organizational learning. The latter indeed can be also defined in terms of the former: "*Organizations are seen as learning by encoding inferences from history into routines that guide behavior*" (Levitt and March, 1988, p. 320).

Huber (1991) identified four dimensions that affects the effectiveness of organizational memory: *membership attrition*; *information distribution and organizational interpretation of information*; *the norms and methods for storing information*; the *methods for locate and retrieve stored information*.

Charles Ungson and Brian Walsh (1991) recognized the organizational memory as a concept that includes a variety of forms of knowledge. They described five types of storage for storing this information: *individuals, culture, structures, and ecology*.

A problem that organizations may face is that often they do not know what they know. Especially for more specialized organizations, they lose potential due to this unexploited knowledge. Huber (1991) pointed out a couple of important considerations to keep in mind when considering the role of organizational memory in the development of organizational learning. First, knowledge created must be stored in memory and then brought out from it, so the usability of learning depends on the effectiveness of the organization's memory. In fact, Huber (1991) links demonstrability, namely the capacity to store what has been learned in the memory and bring it out, on the effectiveness of organizational memory. The same applies for usability of learning.

Then, organizational memory builds the foundations for the basic processes that shape development and depth of organizational learning.

At the beginning of this section, was mentioned how organizational learning cannot be merely considered simply as the sum of the learning coming from each individual. The

occurrence of individual learning is in fact not enough to guarantee the development of learning at higher levels. In fact, even if individual learning is necessary to develop group and organizational learning, it is not sufficient for organizational learning to occur (Argote and Miron-Spektor, 2011). The presence of a supra-individual repository that works as a stock for knowledge and that is accessible from each member if fundamental. Without a repository in which store knowledge, the latter will remain in the mind of the worker and isolated from the organization, which will not be able to access to knowledge and use it to solve problems and create new knowledge. So, an efficient organizational memory is distributed to allow all the individuals to access, store and retrieve the knowledge. However, the widely diffused organizational memory may pose several problems for the organization. It may imply an increase in locating and exchanging problems, since individuals do not know where to find the specific knowledge and who detains it.

By not anticipating future needs for specific information, great amounts of information are not stored or are stored in ways that make it difficult to retrieve. Often members of the organization do not know if the information needed exists and where it is stored and by whom.

2.7 March's Model on Exploration and Exploitation

Knowledge development leads to learning, which is finalized to determine a guiding path for organizational action. In a changing environment organization needs to adapt constantly to new needs and circumstances, so it is fundamental for the organization to take action to adjust to those changes. Learning is finalized to provide the foundation for taking thoughtful, insightful, and evidence-based decisions.

March (1991) grouped and synthesized the possible organizational action into two paths: the exploration of new possibilities, by taking risks, discovering new things, innovate itself and the environment; or the exploitation of old certainties by focusing on efficiency on processes.

March's works determine the foundation for most of the following studies about both organizational learning and information technology implications. In its work, March (1991) considers the relation between the exploration of new possibilities and the exploitation of old certainties. The development of those two models enabled the elaboration of the relations between exploration and exploitation. Learning is finalized to guide the organization in undertaking actions. However, organizations' resources are limited, and these two paths compete for scarce resources, so organizations need to decide where to allocate them

Regarding the ways experience and knowledge may be developed, March proposed a model that includes two situations involving the development of knowledge. The first situation modeled is the case of mutual learning between members of an organization. The second one instead, is the case of learning in competition for primacy.

According to the author, adaptive processes are likely to become effective in the short run but self-destructive in the long run. This is because adaptive processes refine exploitation more rapidly that exploration.

Balance is key, and organizations should find a balance between exploration and exploitation in allocating the resources, to guarantee the health and the survival of the system. Organizations that engage in exploration and exclude exploitation are more prone to invest and spend resources without gaining many of the benefits. Organizational setups that mainly target exploration, create the conditions for the organization to develop a lot of innovative ideas, to the detriment of developing specific competences. On the other hand, setups that targets exploitation to the detriment of exploration are more likely to not grasp all of the possibilities that the environment offers and settle for a condition that can be improved, especially in terms of knowledge levels.

Exploration and exploitation

In terms of organizational learning, the distinction between the implementation of a new technology and the refinement of an existing one is a manifestation of the solution found to the problem of reaching a balance exploration and exploitation (Levinthal and March, 1981)

Exploration of new alternatives reduces the speed of improvement for the already existing skills. On the other hand, improvements in already existing skills and competences make experimentation less attractive for the organization (Levitt and March, 1988). These issues are not limited to an individual level but are present also at an organizational level. Exploration can be considered as more vulnerable with regards to exploitation. Returns from explorations are less certain, more remote both in terms of time and locus of action. Benefits are not immediate but are characterized by a long-term horizon. Since the environment is constantly changing, what is good at a particular moment, with specific circumstances may not be good at another time when those circumstances changed. Overall returns are uncertain with regards to exploitation. On the other hand, **exploitation** shows results more quickly, more clearly, and more precisely (March, 1991). The acquisition and implementation of new information technology has longer time horizons, less certain outcomes on processes and procedures, and more diffused effects than the further development of already existing technologies.

Since exploitation is linked to outcomes more quickly and more precisely, *adaptive processes* improve exploitation more rapidly then what they do with exploration.

Rewards play an important role in determining the likelihood of engaging in an educational activity (action that increase competence). Improvement in competences stemming from exploitation, increase the likelihood of receiving rewards for engaging in educational activities. Benefits cumulate because the more the individuals engage in such activities, the more they are rewarded and the more they develop competences. This phenomenon is referred to as **path dependance**. The system of reward may facilitate exploitation or hinder it. On the other hand, individuals may develop a sort of addiction to an activity that becomes so predominant that obscure or even exclude superior activities in which the organization has little experience.

This tendency to continuously increase exploitation and reduce exploration may backfire in the long run. Balance is key, and exploitation's path dependance may not allow the presence of optimal levels of exploration in the organization.

Social context features

A differentiation can be made between two features of the social context. The first is the *mutual learning* of an organization and the individuals in it. Organizations store knowledge in repositories as well as on procedures, norms, and rules. The organization gathers the knowledge by learning from its members. In the same context, individuals are socialized to organizational culture, beliefs and norms. Therefore, they learn from them and they socialized to what March called the *organizational code* (March, 1991). The code adapts simultaneously to beliefs and culture of the individuals. The individuals and the organization both detains and develops beliefs about the environment within they operate. Beliefs converge into an equilibrium in the long run depending on learning parameters. March showed how slow socialization accounts for diversity, meaning more exploration which in turns leads to knowledge improvement. Also, heterogenous speeds of learning accounts for a higher knowledge equilibrium. In fact, fast learners contribute from slow learners with low levels of socialization to the code. Slow learners contribute for variability in the knowledge developed, they are indeed fundamental to maintain optimal levels of variability. However, is extremely difficult to reach an optimal fraction of slow learners in the organization since there is no incentive in being a slow learner. Although, the organization can undertake alternative routes to induce variability. First, the organization can increase variability by introducing **personnel turnover**, which affects both individual knowledge and code knowledge. Turnover lowers individuals knowledge, this effects appears to be very strong.. On the other hand, it increases diversity in the system by introducing new individuals which are not familiar with the code. By bringing new individuals into the organization, new pieces of knowledge are beringed in as well. Then, with high levels of socialization, turnover can improve code knowledge. Given these conflicting effects, trade-off between learning and turnover rate must be addressed from organizations.

The new knowledge brought from new members, contributes to the variability and to produce exploration. However, personnel turnover will lower the individuals' average knowledge because new members did not have had already the occasion to develop their competencies within the organizational context. Moreover, on average they show less knowledgeability. So, turnover levels should not be kept high, but a moderate level of

turnover could bring the right amount of variability to improve the knowledge of the organization, increasing exploration.

Furthermore, environmental turbulence is the other cause of variability envisaged by March (1991). Turbulence make mutual learning degenerate, resulting in lower knowledge levels. Once the knowledge equilibrium is reached, it remains identical. Passed this stage however, reality and the environment keep changing and the knowledge developed in the system cannot adapt to the changing environment and needs. Adaptability is in fact one of the most important abilities that organizations can develop. However, a continuously changing environment make learning from experience extremely difficult. External environment keeps changing, in the worst scenario leaving the organization behind with knowledge that is no more appliable in the new context, or with knowledge not as much as valuable as before. These consequences may be overcome by introducing turnover, but the effects depend on the rules planned for recruiting. In fact, the new members should not be familiar with the code and bring diverse knowledge.

The other feature of the social context is *competition for primacy* from organizations that compete with each other. Knowledge affects the development of a competitive advantage in mixed ways, so its difficult to determine a balance between exploration and exploitation. Competitive processes described in the model are both internal and external. The former includes the competition of organizational members for primacy, while the latter is the competition of organizations for supremacy in the environment. In a context of competition, new technology adoption improve performance. Increased variability indeed affects relative position if the newly adopted technology is superior to the previous one. Information technology has a great impact on mean, which improves due to the increased reliability, while variance is reduced, since variability is reduced. However, in environments characterized by high levels of competition, mean turns out to be irrelevant.

Mutual learning – Brief insight

In mutual learning circumstances, trade-offs between short-run and long-run gains and between individual knowledge and collective knowledge gains determine choices between exploration and exploitation. The ability of learning faster both from individuals and the organization, on average leads quickly to a condition in which individuals and the organization share the same knowledge. On the other hand, when socialization with beliefs is slower, the organization reaches greater level of knowledge, and the condition of knowledge equilibrium is reached later. March (1991) found out that the highest level of knowledge occurs when the organizational code learns fast from individuals, while individuals are slow to socialize with the code. Slower learning for individuals allows them to foster exploration of alternatives and to develop a more balanced set of competences. The organization can learn and improve only from individuals who bring different information, knowledge, and beliefs from the organizational code.

The presence of exclusively fast learning or slow learning individuals represent an extreme. More likely, the organization will show a mix of individuals that socialize fast and others that learn slower. By having a mix of those two types of individuals, the organization will gain more knowledge than by having only fast learners or slow learners. In fact, fast learners benefit from the presence of slow learners.

3 The Relationship Between Organizational Learning and Information Technology

Topics addressed in the previous chapter will be now put together to explain the relationship between the implementation of information technology and organizational learning dynamics. Below it will be shown how information technology generally enables organizational learning by linking employees, increasing communication, and improving access to the organizational memory. It will follow an in-depth analysis on experience role in determining both the foundations for organizational action and the success of new technologies, accounting for various downsides. The chapter ends with showing the conditions which may turn information technology into a disabler of organizational learning.

Several outcomes can be identified regarding the impact of information technologies on organizational learning. First, value is produced through the production of conceptual designs for organizational memory information systems (Robey et al., 2000). Conceptual designs determine the role of applications in contributing to develop organizational memory and organizational learning, providing then a guide for contribution (Atwood, 2002).

Furthermore, information technologies can enhance organizational learning by increasing the communication and discourse among members (Sarbaugh and Feldman, 1998). They enable an improved access to organizational memory, facilitating the contribution to it. Moreover, information technologies may enable organizational learning as well as disable it (Gill, 1995 ; Orlikowski, 1992).

Two main streams of research cluster the literature on the relationship between Information Technology and Organizational Learning (Robey et al., 2000). The two streams are closely linked to each other, but they address the issue in opposite ways.

The first one is focused on the part of literature where *Organizational Learning* concepts are applied to the **process of implementation** of information technology. Organizational learning is considered here as a mean to explain the problems stemming from the implementation of new information technologies in the organization. Many considerations stem from this stream of research, mainly about **learning** in organizations. In this stream is reiterated the linkage between learning and experience, which plays a huge role in determining organizational learning dynamics (Robey et al., 2000).

The second stream of research, on the other hand, is focused on the design of information technology's applications to **support organizational learning**. This stream is consistent with the direction that suggests the use of advanced technologies to enhance organizational memory and facilitate communication, collaboration, and discourse among individuals. For example, several technologies contribute to enhance organizational memory by providing valuable material to it (Stein & Zwass, 1995). Some of these can be identified as data warehousing, best practices databases and expert systems. Furthermore, Group support systems and collaborative tools may support organizational learning by creating communication links and promote discourse among individuals and by storing past decisions (Stein & Zwass, 1995). As in a cycle, as individuals gain access to more knowledge, more usable organizational memory is created. All the interactions among individuals, create the foundation for knowledge creation within the organization.

The first stream attributes a major role to experience in determining whether an implementation of information technology is successful or not. As mentioned along the paper, learning is enabled by formal training, but also through the informal activities and participation in practice, where the individual can address tasks and related problems hands-on.

3.1 Information technology and experience

According to what was said above, experience plays an extremely important role in enabling organizational learning. Experience still covers a major role when considering dynamics of information technology implementation in the organization (Robey et al. (2000). Experience constitutes the foundation to determine organizational action. The knowledge developed through experience leads the organization by providing a path for action. Furthermore, past experiences appear to be powerful, in fact if an action undertaken in the past appeared to be unsuccessful, the organization will prevent to undertake a similar action in the future (Denrell and March, 2001). This type of behavior could backfire in the future because the context may change, and it will not let the organization adapt to the changed environment. In fact, actions that turned out to be unsuccessful or detrimental in the past, may fit a new context. Experience stemming from unsuccessful action is as important as experience stemming from successful one.

Studies show also how prior experience with a particular set of information technologies determine the success of new technologies (Robey et al., 2000). In fact, positive experiences influence the interpretation of new technologies for individuals. In fact. New technologies may be viewed by them as opportunities, so they are viewed in a positive way. Prior experience with a technology may then affect the implementation of new information technology.

Keeping in mind what have been said before about the power of past experiences, when a specific information technology has been successful in the past, its use will be persistent in the future even when the context has changed, and technology's effectiveness has decreased. This is referred to as **competency trap**, it occurs when the positive performance of a technology leads to a fossilization on the same technology to develop more knowledge with it (Levitt and March, 1988). This at the expenses of other technologies that could be more suitable and effective. This is consistent with exploitation's path dependance pointed out by March (1991). Individuals which obtained a reward for the utilization of a specific information technology, will be encouraged to further utilize the same technology in the same way, increasing competence and related skills. However, this behavior would turn out to be detrimental in the long run because it

would hinder a useful exploration of alternative ideas and ways to utilize the technology. This will finally lead to lower knowledge level balance in the organization.

Positive effects of learning from experience are several. However, studies show how sometimes organizations have troubles in learning from experience (Robey e Newman 1996). Companies may ignore past experiences and protract flawed patterns of action. Also, organizations may not learn from experience because of the so-called **knowledge barriers** (Robey et al. 2000). In fact, older knowledge may be not suitable to current needs and assumptions, creating a barrier to the acquisition of new relevant knowledge based on recent experience.

Evidence shows how experience with technologies that present similar characteristics to the ones currently adopted, is extremely valuable. In fact, as previously pointed out, members which developed a favorable experience with information technology are more prone to interpret new information technologies as opportunities.

3.2 Knowledge barriers and how to overcome them

Companies may ignore past experiences and protract flawed patterns of action. Organizations may not learn from experience because of the so-called **knowledge barriers** (Robey et al. 2000), as mentioned above. In fact, older knowledge may be not suitable to current needs, creating a barrier to the acquisition of new relevant knowledge based on recent experience. There exist barriers that do not permit the acquisition of knowledge. Some activities can be undertaken from organizations in order to overcome those barriers. Those activities may comprehend **formal training** from the organization. This approach is directly related to learning. Communication from the organization can be very important, because it is able to transmit high quality and valuable knowledge. But on the other hand, studies shown that structures created to support and promote

organizational learning such as formal training, may inhibit deeper learning (Argyris and Schon, 1996), leading to lower levels of individual knowledge.

Furthermore, know how and organizational learning may be potential barriers to the adoption of innovations, so barriers to exploration. Evidence shows how firms tend to delay in-house adoption of complex technology until they obtain sufficient technical know-how to implement it successfully (Attewell 1992). Before this moment they use intermediaries to gain know-how or obtaining technology vicariously. Evidence shows how knowledge barriers influence technology diffusion (Attewell, 1992). Is really important for organizations to recognize and address knowledge barriers. In fact, as knowledge barriers are lowered, technology diffusion speeds up and organizations shifts from technology as a service to in-house provision of technology.

Finally, *vicarious learning* may occur through the exploitation of the experience gathered from other organizations regarding the use of a specific information technology. Best practices can be benchmarked and imitated. Although, the transfer of vicarious knowledge is very delicate, because environment and context change from the original source of knowledge.

As pointed out before, knowledge barriers can be overcome by receiving support from the external environment, in fact external sources of knowledge may determine the development of new knowledge in the organization, and the storage of vicarious experience.

3.3 Information technologies for facilitated communication and enhanced organizational memory

On the other hand, the other stream of research pointed out form Robey et al. (2000) leads to different considerations. The second stream focuses on the design of information technologies applications to support organizational learning. This stream went towards the confirmation of the conventional approach which suggests the use of advanced

technologies to enhance organizational memory and facilitate communication and discourse. On the other hand, it reveals the potential disabler role of information technologies. Information technologies have the potential to turn out both as an enabler and a disabler for organizational learning (Robey et al., 2000).

The stream of research focused on information technology design to support learning, define a big role for **organizational memory**. The stream of research enhances the consideration of the design of organizational learning based on the implementation of information technologies. Which enhance organizational memory and enable communication and discourse among organizational members. Information technology's support for organizational learning goes through the enhanced access to organizational memory. Above was emphasized how important the development of a proper and diffused organizational memory is, this second stream supports this vision.

Organizations can enhance organizational memory through supporting information technologies. Moreover, information technology's support goes beyond the mere enhancement of organizational memory. Information technology has a great potential to support organizational learning through the provided ability of capturing, representing, storing and retrieving structured data, models et cetera in electronic databases (Davenport & Prusak 1998).

Applications of information technologies can be used to support organizational memory's conceptual design, which is formed by linkages between functions and their relationship with repositories. Stein and Zwass (1995) showed specific applications designed to support processes, such as hypertext and hypermedia technologies, other than expert systems.

By defining the conceptual design of organizational memory, the organization can also define an appropriate role and setting for specific applications. An appropriate design also depends on how the organizational knowledge is represented. Furthermore, the design should focus also on facilitating the retrieve and use of information.

The enhancement stemming from supportive information technology, goes also through an improvement of communication and discourse among the organizational members. The improvement occurs because the specific applications may facilitate linkages among members, which store experiences of past actions. When more members gain access to

knowledge stored in repositories, they can create more valuable organizational memory. Hence, the organization should commit itself to make as most members as possible to contribute to the use of information technologies such as Organizational Memory Information Systems, and to the creation of a more valuable memory. Individuals and groups that communicate between them, contribute to share information stored in different locations, the share by communicating. Specific information technologies which are design to support communication and discourse include applications such as collaborative tools and group support systems.

The advantage of contributing to organizational memory by using information technology is represented also by the clearance of space and time gaps. Individuals can then contribute to the organizational memory even from remote locations.

A diversification can be made between systems that support group process and systems that support organizational learning (Hine e Goul 1998). Group support systems are designed to support distributed cognition and shared understandings to enable organizational learning. These systems are a great enabler for the development of the suitable culture (Hine & Goul, 1998).

However, findings show how individuals give different interpretations to the technology even if they are in the same context, so the use of this type of technology is unlikely to lead to a homogeneous shared organizational memory. The great aspect of these technologies is that they promote communication and discussion. By using them, organizations can look at themselves to find ways of improvement, other than evaluate the best actions. Doing so, these technologies can improve organizational learning.

Moreover, information technology can come in help to overcome the problem of not knowing what the organization knows by facilitating retrieval, completeness, and precision of the information.

Three conclusions can be drawn. First and foremost, learning is closely related to **experience**, and experience gained from the use of information technologies is a starter point from which the organization can learn by improving future implementation. However, in some cases experience is ignored, and detrimental practices are carried out

over time. It results very difficult to value past experiences, because it could be useful as well as determine competency traps.

Second, consistently with previous analyses, the development of learning can occur both from formal training and from informal activities that are situated in the social context. Formal training may help the organization to overcome knowledge barriers, but studies show how learning enhanced by informal activities can turn out to be more effective than the one stemming from the formal ones.

Third, **knowledge barriers** can be overcome by exploiting interorganizational relationships. The organization can learn from partners and from intermediaries that detain the know-how. When considering information technologies, organizations show a peculiar behavior: in-house implementation of a specific information technology can be delayed until the organization develops the sufficient know-how to successfully implement the technology and use it. So, intermediaries can be extremely valuable because they detained a vast amount of knowledge about the specific technology and procedures. Over time, the organization lose dependence on the intermediaries and develop own capabilities with the specific information technology.

In addition, can be concluded that a **window of opportunity** in which organizations can adapt to the technologies exists. This because organizations can implement new information technology during a range of time in which the context and the environment are optimal for IT's successful implementation. Once those windows are closed, the organization is likely to stop learning since the currently-dated new routines are now well established.

In the case of CIGNA's reengineering for example, speed was crucial. In fact, the company was able to implement it in a proper window of opportunity since weak financial results from the division required for changes in 24 months (Caron, Sirkka e Stoddard 1994). Findings from literature points out that learning a new technology is a dynamic process that shows a narrow window of opportunity to turn out to be successful (Tyre e Orlikowski 1994). This window of opportunity shows how the successful implementation and utilization of IT depends on contextual factors that must be optimal to show optimal outcomes. These findings should not be underestimated. The existence of a window of opportunity highlights the fact that the successful implementation of a new technology

highly depends on contextual factors. Inside the window, the environment may show optimal conditions, for example in terms of competitiveness. By increasing flexibility and explorative actions, to search for new valuable stimuli to ultimately detect changes in the environment, it would be possible to enlarge the window of opportunity.

3.4 Facilitation of interorganizational learning

Information technology facilitates organizational learning and interorganizational learning (Scott, 2000). Specifically, technology impacts lower and higher levels of interorganizational learning. Electronic links facilitate both lower and higher levels of learning (Scott, 2000). What happens at the lower level is that the electronic adaptive systems adjust to inputs and provide fast feedback to stimulate greater efficiency by using explicit knowledge. On the other hand, at the higher level, interorganizational collaboration foster a revaluation of practices currently employed (Scott, 2000).

Information technology facilitates lower level interorganizational learning by enabling further monitoring abilities. For example, uses decision support systems to monitor performance. Also, the usage of email, videoconferencing and fax leads to higher frequency of face-to-face meetings to give feedback and to solve problems involving explicit knowledge. On the other hand, higher-level interorganizational learning has a more innovative footprint, as it establishes new routines by importing and institutionalizing new learning processes (Scott, 2000).

In fact, collaboration at an interorganizational level usually has a positive effect, since it enhances organizational learning. Through the introduction of diverse knowledge, collaboration speeds the learning process up.

According to Scott (2000), information technology facilitates interorganizational learning in different ways, two direct and two indirect. First, IT facilitates lower-level learning directly with a mechanism based on feedback, which uses explicit knowledge codified in information systems. Feedbacks give the possibility to partners to modify and adjust their behavior. The other way information technology directly facilitates learning, mostly higher-level interorganizational learning, is by using modeling technologies.

Furthermore, information technologies support directly lower-level learning by helping users to find solutions based on the memory of monitor variables, solutions that worked before, and decision-making processes. IT is expected to improve and enhance lower-level learning, so is expected to enhance exploitation of old certainties. Consistent with findings from (Carley 1992), it is expected that IT's benefits on lower-level learning turn out to be more pronounced in organizations characterized by malleable structured teams. Moreover, information technology facilitates interorganizational learning in two other indirect ways. On one side, it enables the organization to monitor partners, allowing the creation of trust in the partnership, which encourages more collaboration and so interorganizational learning. On the other hand, it facilitates interorganizational learning by improving collaboration (Scott, 2000).

One of the highlighted benefits of information technology is enabling of more communication and collaboration between individuals. However, when considering an open system, this benefit is extended even further, across and outside organization's boundaries and barriers. For example, email and videoconferencing allow partners to discuss and confront about issues and problems, despite all the barriers. This leads to a flow of diverse knowledge between boundaries that may enable changes in routines (Scott, 2000). The knowledge that is exchanged may be explicit as well as tacit.

3.5 Enable or hinder learning, dual nature of information technology

Enable organizational learning

The role of IT as enabling factor for learning was emphasized by Scott (2000) in her works. Using the appropriate technology is a big part for reaching positive outcomes with the implementation of IT. However, the successful implementation of the technology

depends also on the capacity of the organization to learn. Therefore, culture and social context heavily influence the capacity of the organization to learn. Hence an organization that is already experimenting and learning practices should be facilitated to learn because the members of the organization are already familiar with experimenting new technologies. On the other hand, organizations that first needs to develop learning practices will have a harder way to introduce the necessary technologies (Robey et al. 2000).

Furthermore, IT increase communication and provide support for discourse, also promoting a greater access to organizational memory. The right information technology is able to connect organizational members far away from each other in terms both of space and time. Technology can link them and support communication and discourse to share information. Communication and discourse would ultimately produce knowledge. Systems that support communication and discourse provide a link also between individual and organizational learning. They indeed support distributed cognition and shared understanding. However, such technologies must fit organizational norms to lead to more collaboration.

Hinder organizational learning

On the other hand, the stream focused on the design of information technology pointed out the potential disabler role of information technologies towards organizational learning (Robey et al., 2000). Even if the enabler role of information technology for organizational learning is vastly supported, researchers study the other side of the coin: information technology may hinder organizational learning (Gill, 1995 ; Orlikowski, 1992; Orlikowski and Robey, 1991)

Information technologies may both turn out to enable learning or hinder it. The dual nature of information technology was highlighted by the structurational model developed by Orlikowski and Robey (1991), whom in their works, highlight both enabling and restricting implications related to its use. The structurational approach highlights the dual nature of technology, which "*can facilitate as well as constrain social action*" (Orlikowski and Robey, 1991).

To be effective, technologies must be able to adapt to changes in assumptions, so in environment, goals, and purpose. Technology is not fixed, but rather users and system developers may exercise considerable influence over the nature of it, consistently shaping and reshaping its applications (Orlikowski and Robey, 1991).

Moreover, information technology could become overly dependent on formal systems and disable organizational learning by supporting rigid systems which are not flexible to adapt to changing conditions. Doing so, the organization would lose the potential stemming from the less formal depiction of organizational memory that reside in the minds of those individuals that gained experience (and so knowledge). The routines developed from the knowledge workers will not be revised, because they are strictly embedded in the computer systems. Thus, information technology may support non-flexible systems that are too rigid for adapt to changes in the context and in turn disable organizational learning.

Findings from empirical studies highlight the potential disabler role for learning of information technology (Gill, 1995). Gill explained how a decline in performance was due to the fact that the information systems implemented by the organization replaced the individuals. By replacing them, the organization lose the capacity to scan changes in the environment and so opportunities. The systems were not able to interpret signals and unstructured information and so the organization was not able to adapt its practices to the new environment.

A failure in detecting occurring changes in the environment from organizations that adopted new information technologies was shown also by a study from Orlikowski (1992). Even in this case the organization was not able to capture the unstructured information needed to understand the obsolete. Those practices needed to be changed to meet new needs.

Future research

In terms of future research, one avenue is to develop a statistic model. A simulation though computational modeling can increase the potential of building theory. A type of simulation model that particularly suits studies of organizational systems is *agent-based* modeling (Chang & Harrington, 2006) A development of a model based on the NK landscape methodology would turn out to be very useful to build further theory (Kauffman and Levin 1987). NK methodology has been used extensively in organizational modeling and human systems (Levinthal, 1997; Chang and Harrington, 2005; Rivkin and Siggelkow, 2003). By using an NK model, we can model systems composed of different interacting components. Each component can be in one of several different states. The objective of the model is to maximize a measure of performance of the system based on contributions from each component, depending on the state of the component and its interaction with its neighbors. The contribution of a determinate component to the fitness (the measure of performance) of the system depends both on the state of the component itself, and on the states of the components with which it interacts with. In the case of organizational learning, the system is represented by the organization. It would be interested to develop the model to compare landscape from a system in which information technology is not already implemented to a more complex landscape that simulate the system after the introduction of information technology. The system without information technology would be mainly formed by groups and few interactions outside the group. After the introduction of information technology, the patterns of contributions will be more complex, accounting for more interactions outside the groups. The landscape simulated for the system where IT is implemented is expected to be more complex and rugged due to the bigger number of contributions to the performance, that in this case could be represented by the knowledge level.

The options available with the NK landscape methodology are numerous.

Conclusions

In conclusion, this work was useful to bring to light the role in promoting organizational learning of experience, knowledge processes, organizational memory, and context. Furthermore, the organizational learning is finalized in guide the organization in undertaking organizational actions. The spectrum of actions was synthesized from March (1991) into explorative and exploitative actions. Information technology heavily impact each of these macro components and it can turn out to be fundamental in determining the future and the survival of organizations. The main benefit enabled from the implementation and use of information technology, namely the ability to link employees, is at the root of the impact of IT on organizational learning. The ability to link employees leads to an improved communication between members and groups of the organizations. Furthermore, information technology highly improves information distribution within the organization.

The diffusion of information technology enables a decentralization in decision making, so the possibility to take actions autonomously. Information technology enables also for a greater ability to store valuable information in a qualitative way, participating in the development of a valuable organizational memory. In turn, a valuable organizational memory is full of knowledge stemming from experience, this knowledge is extremely useful for the organization because it creates a path, filled with landmarks, to undertake organizational action.

Such as individuals, organizations develop experience, which is elaborated according to values and beliefs of the individual, and then stored in the organizational memory. Knowledge is then retrieved and mixed with the interpretation according to beliefs and values of the individual who retrieved it. These process of elaboration and re-elaboration contribute to create learning in the organization. Information technology enables individuals to access to memory repositories, promoting in turn learning within the whole organization.

Learning is ultimately used to determine organizational action in a context that itself determines the value of knowledge. Knowledge is valuable when it can be applied to address the environment and its assumptions, and ultimately undertake action and adapt to changes.

Organizational actions are synthetized from March (1991) into exploration and exploitation activities. Information technology impacts the equilibrium between exploration and exploitation. From one side, information technologies enable enhanced communication, support transfer of knowledge, support processes for the implementation of new ways of learning and overall, it promotes the emergence of innovative and alternative ideas, improving variability and so exploration. On the other side, the increased socialization and diffusion of information lead the members of the organization to rapid achievement of the knowledge equilibrium. This involves the achievement of an suboptimal equilibrium. Organizations should then address the rapid homogenization and path dependance bias which lead to a disproportion of exploitative activities to the detriment of a proper number of explorative ones.

Finally, it was shown that information technology's enabling role in promoting learning is not undisputed. It depends on several conditions, such as an appropriate use from the organization, culture, context, familiarity with experiencing new technologies from organizational members and more. But when implemented technologies do not adapt to changing assumptions, information technology may hinder organizational learning.

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Summary

In the paper are analyzed the effects of the implementation and use of information technology on organizational learning dynamics. The discussion goes through several topics. Some of these topics are organizational memory, organizational action, learning processes, knowledge creation, social context, socialization and more.

The goal of the paper is to understand the effects of information technology use and implementation on organizational learning dynamics. To do so, it is necessary to understand first what the impact of IT implementation on the organization is. Then, is important to understand how organizational learning occurs in the organization. Then, by bringing together these two topics, the type of effects of IT on organizational learning will be clear.

The first chapter discuss the role of information technology in the organization. There, are recognized the main benefits enabled by the implementation of information technology, namely the ability to link employees, the promotion of learning, the facilitation of culture sharing, and the facilitation of organizational memory by helping codification of knowledge base. The ability to link employees is the main benefit stemming from the use of IT. Because of this ability, information is more diffused within the organization, raising the average level of knowledge. Furthermore, thanks to IT communication is easier and faster, leading to the emergence of weak ties and to the development of technical grammar. The ability to link employees have a major impact on most organizational dimensions. Main dimensions addressed are structure, size, learning, and culture.

Regarding impact on structures, IT's use leads to a more horizontal structure where decision making is decentralized. The horizontal footprint is related also with lateral communication from members. Findings also show how IT is related with smaller organizations in terms of staff size. The structures enabled from IT's use are open to external collaboration and to the development of interorganizational relationships.

Regarding interorganizational relationships, increased information availability mixed with electronic communication and easier access to information lead to the emergence of virtual organizations. Information technology impacts interorganizational relationships

by reducing coordination costs, transaction risks and by enabling an easier flow of information. IT may also facilitate synergies to support innovative streams.

Furthermore, information technology facilitates sharing of culture. IT moderate culture and ultimately impact outcome depending on social circumstances and context, and IT's implementation depends on social setting. IT and culture both change over time, however it is extremely important that IT matches culture and context, and that culture supports IT's use.

Information technology's positive effect on learning depends also on a proper supportive culture. Information technology promote learning within the organization by providing easier access to information, supporting process of implementation of alternative ways of learning. Also, IT impact knowledge creation by enabling new behaviors, which in turn enable members of the organization to cross their boundaries and face new stimuli. Information technology also impacts several knowledge-related processes. For example, it impacts socialization process, externalization process, combination process, internalization process.

Knowledge developed is then stored in the organizational memory. Information technology supports the creation of organizational memory.

In the second chapter the concept of organizational learning is defined. After a clarification on the main clusters adopted from the literature to define organizational learning, its main characteristics are described. It is described how knowledge is created, retained, transferred, and retrieved. During the chapter it is highlighted that organizational learning is the product of experience, context, learning processes and organizational memory. The value of knowledge depends however on contextual factors. This chapter contributes to the discussion about organizational action and the relationship between exploration and exploitation.

The goal of the second chapter is to discuss and give a conceptual framework about organizational learning. Three streams can be recognized to define organizational learning: organizational learning can be defined in terms of change in knowledge as a function of experience, in terms of organizational memory and experience, in terms of changes of behavior. Two types of learning for organizational members can be recognized: learning based on repetition of past behavior and learning from members that challenge assumptions to develop new paradigms.

One of the main topics addressed in the second chapter is experience. Learning and experience are strictly linked, since improvements stem from the elaboration and revision of past experiences, which are stored in repositories. Experience is fundamental also because it provides a base of knowledge to guide current action. A topic that is highlighted throughout the paper is the relationship between organizational learning and organizational action. Learning that is fundamental to develop landmarks that will help the organization and its members to make decisions and take action to address changes in the environment and adapt. However, experience may involve negative outcomes, such as the persistence in undertaking actions that in the past turned out to be successful but that are not adapted and useful in the present context. Another important dimension is the context, which can be diversified in two main types: internal context and the external context. The internal context is subdivided into latent context and active context. The active context is where organizational learning occurs. The characterization of the context as active, highlights how action is fundamental for learning.

Furthermore, are discussed processes of knowledge creation, retention, transfer, and retrieval. To develop learning is fundamental to acquire knowledge and then distribute it with repositories. Knowledge acquisition is important to addressed because it determines how experience, and then knowledge, are developed within the organization. However, it is highlighted that for organizational learning it is necessary to distribute the information and make it accessible for all the members of the organization. In fact, experience, discoveries, and innovations must be embedded in the organizational memory for organizational learning to occur.

In the second chapter, a section is dedicated to the discussion of dynamics of exploration and exploitation. The discussion uses the studies conducted by March in 1991 as a starter point. Important considerations are made about path dependance. Exploitation is linked to outcomes more quickly and more precisely, so adaptive processes improve exploitation faster then exploration. In this dynamic, rewards play an important role. In fact, improvement in competences stemming from exploitation, increase the likelihood of receiving rewards for engaging in educational activities. Benefits cumulate because the more the individuals engage in such activities, the more they are rewarded and the more they develop competences.

In the third chapter the relationship between information technology and organizational learning is discussed. Topics addressed in the previous chapter are here put together to explain the relationship between the implementation of information technology and organizational learning dynamics. It is addressed how information technology generally enables organizational learning by linking employees, increasing communication, and improving access to the organizational memory. It follows an in-depth analysis on experience role in determining both the foundations for organizational action and the success of new technologies, accounting for various downsides. The chapter ends with showing the conditions which may turn information technology into a disabler of organizational learning.

In this chapter is highlighted how experience builds the foundation of organizational action. It can determine the success or the failure of the implementation of new technologies. It is mentioned the phenomenon of competency trap, which occurs when the positive performance of a technology leads to a fossilization on the same technology to develop more knowledge with it. In fact, when a specific information technology has been successful in the past, its use will be persistent in the future even when the context has changed, and technology's effectiveness has decreased. It is also mentioned how sometimes organizations show how organizations have troubles in learning from experience. organizations may not learn from experience because of knowledge barriers. To lower knowledge barriers is fundamental to enable technology diffusion.

Furthermore, important implications are pointed out about the enabling and disabling role of information technology for organizational learning. Overall, information technology enables and promotes learning, evidence shows how IT can hinder organizational learning. To be effective, technologies must be able to adapt to changes in assumptions, so in environment, goals, and purpose. Information technology could become overly dependent on formal systems and disable organizational learning by supporting rigid systems which are not flexible to adapt to changing conditions.

Finally, in the paper are made some suggestion about future research followed by the conclusions. Specifically, for future researches it is addressed the possibility to develop a statistic model based on the NK landscape methodology.