Tacit Knowledge Generation and Inter-Organizational Memory Development in a Supply Chain Context

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ABSTRACT

In recent years, particular attention has been paid to knowledge management and organizational learning in general and tacit knowledge management and organizational memory in particular. This interest is driven by saturation of various markets, innovation speed and increasingly uncertain environments that have led companies to organize and structure themselves as parts of supply chains, by focusing on their core competencies and outsourcing non value-added and less strategic activities. Developing distinctive competencies under such circumstances comes from tacit knowledge learning, creation and memorization. In this paper, we first analyze tacit knowledge from different perspectives; we show how individuals and organizations can learn from tacit knowledge and how they also create new relational and collaborative tacit knowledge from individual, organizational and inter-organizational learning. We then explore how this knowledge can be capitalized into inter-organizational memory which is independent of individuals and organizations within the supply chain.

Keywords: Tacit knowledge, supply chain management, inter-organizational memory, learning.

1. INTRODUCTION

Most organizations evolve today in a complex environment in which competition is becoming increasingly intense, pushing companies to develop distinctive competencies by mastering knowledge and technology, and outsourcing non value-added and non strategic activities. Hence, they form reticular organizational configurations characterized mainly by supply chains. The critical and distinctive knowledge developed by a company does not particularly rely on structured information, or on explicit business rules. In fact, over time it becomes increasingly tacit. Keeping and developing this knowledge is not an easy task, however, owing to loss of skills and capabilities due to impending retirement or accelerated specialist and expert turnover.

Neglected for years by academics and professionals, tacit knowledge development and use is emerging as a source of value for most businesses. Many authors have raised this issue in terms of organizational knowledge transfer, proposing complex information management systems relying on information technology and communications. However, given the proliferation of knowledge in today's environment, it is not a question of managing all knowledge, but rather, of knowing how to locate and identify key knowledge related to strategic objectives of an organization. This work focuses on this key knowledge, and especially on how to enable its development and exchange through more open and collective working practices, as well as teaching methods and scalable and responsive training.

Analysis of organizations from a systemic point of view requires adopting complex thinking, allowing us to address the supply chain as a whole, whereby individual learning leads to organizational, and then to inter-organizational learning. Inter-organizational learning results in supply chain knowledge, which is different from organizational or individual knowledge. Therefore, in this paper, the fundamental question being addressed concerns acquisition by learning, the creation and development, and capture of inter-organizational tacit knowledge so that it can be disseminated throughout companies and to individuals.

To address this issue, our paper is divided into four sections. In the first section we present a critical overview and classification of the tacit knowledge concept. In the second section, we highlight the relationship between supply chain management, inter-organizational collaboration and learning organizations to better understand the role of collaboration in this approach. Then, in the third section we show how a company generates tacit knowledge from individual and inter-organizational learning. The last section focuses on inter-organizational memory formation via organizational tacit knowledge, to show that an organization is made up of embedded organizational knowledge which belongs not to individuals or the organizations, but to the supply chain.

2. TAWARD TACIT KNOWLEDGE DEFINITION AND CLASSIFICATIONS: A CRITICAL APPROACH

Polanyi [41] says that we can know more than we can tell. His works have significantly influenced a set of contemporary works on the nature of organizational knowledge. The idea of tacit knowledge is very important for those trying to understand sources of competitive advantage. This advantage comes partially from knowledge that cannot be expressed and also from the organization's experiences that provide specific skills and capabilities that cannot be imitated by competitors [9].

While tacit knowledge can generate a unique competitive advantage for the company, it cannot easily be capitalized upon and disseminated in different parts of the same organization [50].

The notion of tacit knowledge was introduced by Polanyi [41], a philosopher who has become well known because he was cited in the writings of Kuhn [28] and since then has had a renaissance with the writings of Nonaka and Takeuchi [36]. As noted by Polanyi [41], "we can know more than they say" means that ineffable knowledge exists in individuals and organizations but they cannot easily identify it. Nonaka and Takeuchi [36] used the notion somewhat differently from how Polanyi himself used it. Because of the influence of Nonaka and Takeuchi's [36] works in the knowledge management field, however, the idea of something being "relatively ambiguous" has been widely adopted. While Polanyi [41] speaks about tacit knowledge as a backdrop from which all actions are understood Nonaka and Takeuchi [36] use the term to denote particular knowledge that is difficult to express.

Thus, in contemporary literature, the meaning of tacit knowledge has little in common with Polanyi's [40] conception. More oriented towards the vision proposed by Nonaka and Takeuchi [36], tacit knowledge is defined as knowledge that is not yet articulated. That is to say, it represents a set of rules embodied in the activity in which the individual is involved, that can later, (and it's just a matter of time) be transmitted in a certain learning process. Today, Nonaka and Krogh [37] stipulate that ""tacit knowledge" is a cornerstone in organizational knowledge creation theory and covers knowledge that is unarticulated and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb".

In his critique of rationalism, Oakeshott [38], in the same vein as Polanyi [40], distinguishes between two types of knowledge, namely technical knowledge and practical knowledge. Technical knowledge is the knowledge of rules, while practical knowledge represents skills and capabilities. For this author, it is clear that skills and the know-how, or in other words, competency cannot be transmitted from one person to another, nor acquired easily by simply following rules. The knowledge can be acquired only through "learning by doing" under the watchful eye of the master (teacher). The value of this analysis lies in its usefulness when applied toward understanding scientific knowledge (which is often confused with explicit knowledge).

Scientific knowledge is neither mechanistic nor explicit. It is developed by people who are deeply involved and have learned their profession over many years by teaching others. Scientific knowledge is often seen as purely representative of technical knowledge or a set of facts. However, the work behind this knowledge and these facts, intuitions, beliefs, and multitude of hours of interaction with other scientists is the real driving force behind progress in science. Thus, the metaphor of a "pipe line" that underpins many discussions on communication (argues Tsoukas [57]) emphasizes that Nonaka and Takeuchi [36] consider ideas as objects that can be transmitted between individuals via their behaviors, thus reducing practical knowledge to technical knowledge [15]. Process practical knowledge, which is tacit in nature, and therefore initially cognitive, has content that can be easily set and then translated into explicit knowledge [36]. It is the reduction of "what is known" into "what can be articulated", hence the concept of tacit or "practical" knowledge is impoverished [55].

Weick [60] explains practical knowledge by highlighting the fact that it redefines the specific differences in all activities to attract the attention of those who are involved, to distinguish certain hitherto unnoticed aspects, and also to see the connections between various items previously imagined as disconnected. This systems approach to practical (tacit) knowledge formation is supported by Katz and Shotter [24]. Guzman [22] also reported from Thompson and Walsham [53] that practical knowledge is located, given that it focuses on current actions developing in a precise framework that can be temporal, emergent and social. In that, tacit knowledge is acquired by engaging in practical activity through participation in social practices, under the supervision of people who are generally more experienced [52], who, by paying attention to certain actions or operations, can see the interconnections [61].

Table1. Tacit knowledge definitions

Authors	Definitions
Polanyi [41]	***Ineffable*** knowledge that exists in individuals and organizations but which cannot easily be identified
Nonaka and Takeuchi [36]	Knowledge ***not yet articulated*** or knowledge ***waiting to be translated*** or converted into explicit knowledge.
Weick [60]	Knowledge that redefines the ***specific differences***… in order to distinguish certain aspects hitherto unnoticed, and also to see the ***connections*** between the various items imagined disconnected before.
Tsoukas [56]	A ***set of particulars*** of which we are subsidiarily aware as we focus on something else.
Nonaka and Krogh [37]	Knowledge that is ***unarticulated*** and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb.

To recapitulate, we can say that tacit knowledge has a multitude of definitions and interpretations. Nonaka and Takeuchi [36] consider tacit knowledge as knowledge not yet articulated or knowledge waiting to be translated or converted into explicit knowledge. This interpretation has been widely adopted in management, yet is flawed in that it ignores the ineffable nature of tacit knowledge [55]. But if we refer to Nonaka and Krogh's [37] definition, we find that instead of being *knowledge that is not yet articulated*, tacit knowledge becomes *knowledge that is unarticulated*. Its ineffable nature does not mean that we cannot discuss the possibilities of learning. However, insistence on the fact that tacit knowledge must be converted into explicit knowledge should be limited, and instead attention should focus on the creation of tacit knowledge, taking into consideration that it cannot be captured, translated or converted, but only displayed and manifested in activities [54]. So for a learning organization, the goal is not to transform knowledge from tacit to explicit, but rather to

promote the emergence of new knowledge from the interaction between the tacit and explicit knowledge of all those individuals involved in the performance of its activities. The ultimate objective of the organization that is learning for the creation of a specific "intangible capital" is to generate by this act, a sustainable, competitive advantage.

Collins [13], based on Polanyi's [41] approach, came up with new classifications of tacit knowledge, namely "Relational tacit knowledge", "Somatic tacit knowledge" and "Collective tacit knowledge". For Collins [13], relational tacit knowledge is knowledge that can easily be turned into explicit knowledge by social interaction with the knower. This is the type of knowledge which was studied by Nonaka and Takeuchi [36]. Somatic tacit knowledge is knowledge that is emblazoned in the substance of body and brain. Collective or strong tacit knowledge, as discussed by Collins [13], is knowledge that can be attained by individuals only if they are embedded in a group or society. For this type of knowledge, Collins [11] stipulates that the unique capacities of body and brain allow one to acquire this knowledge from the collectivity, or what he called in his previous work [12] the "social collectivity".

In our paper, we principally make reference to relational tacit knowledge generated by dyadic interactions between individuals, groups or organizations within the supply chain. We also refer to the third type of tacit knowledge, collective knowledge, that is generated by supply chain system dynamics and that is acquired by individuals, groups and organizations only if they are embedded in the supply chain.

3. SUPPLY CHAIN MANAGEMENT, INTER-ORGANISATIONAL COLLABORATION AND LEARNING ORGANIZATIONS

Supply chains can be presented as inevitable phenomena that arise from a need for coordination between companies whether they are managed or not [33]. They can be defined as a process oriented set of autonomous companies (from the first supplier to the end customer), linked by upstream and downstream flows (physical, informational, financial and knowledge), established to satisfy the customers through better coordination and integration, but also possessing great flexibility and responsiveness.

Managing a supply chain requires coordination and synchronization of material and financial end information flows by developing cooperation and collaboration from the first supplier to the end customer. As reported by Lambert [29, p.2], the *Supply Chain Forum* defines supply chain management as "the integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders".

For Mentzer et al. [33, p.18], "Supply chain management is defined as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole". Cooper et al. [14] define it as an integrative philosophy to manage the total flow of a distribution channel from supplier to end user. The main purpose of SCM is to make the most of the value created, for both the company and the total supply chain. Also worthy of mention are the bipolar strategies of supply chain partners that can simultaneously include cooperation and competition [62]. In this work, however, the game aspect is not included to permit focusing on collaborative aspect of relationships.

Inter-organizational collaboration is a key element of SCM. In fact, Horvath [30] insists on the fact that collaboration represents the driving force of SCM. SCM promotes inter-organizational collaboration because it facilitates process integration, information and knowledge transfer and exchange, organizational coordination and strategic cooperation. When analyzing collaboration between supply chain partners, whether cross-functional or inter-organizational, it is striking the extent to which SCM effectiveness depends on individuals. When interacting with one another, individuals develop knowledge networks that allow producing, sharing, disseminating and applying strategic knowledge to improve operational and strategic performance [59].

Inter-organizational knowledge transfer and learning are more efficient when enacted between learning organizations. Skule [44] states that lack of knowledge transfer can be associated with a lack of development in the various models that govern all practices. As learning organizations encourage knowledge transfer, they necessarily help achieve the processes and structures for double-loop learning. As a result, organizational routines will suggest what the organization needs, and will automatically determine the solutions to problems [43].

The concept of a learning organization recently appeared in the literature. Although Garvin [19] stipulates that a clear definition of this concept has not yet been established, there are several propositions. Senge [42, p.1], one of the first to study this concept, defined a learning organization as an "organization where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together". For Pedler et al. [39, p.3], "The Learning Company is a vision of what might be possible. It is not brought about simply by training individuals; it can only happen as a result of learning at the whole organization level. A Learning Company is an organization that facilitates the learning of all its members and continuously transforms itself."

Kim [25] observed in her studies that organizations learn only if they consciously choose to do so. She concluded that, in strategic terms, the most important thing for a company is not the speed of learning, the things learned or the people who learn, but how the information is used, processed and transferred as knowledge within the company. Furthermore, the fact that some companies continue to advance even in times of economic uncertainty, while others decline, is proof that businesses depend on their ability to learn and adapt [45].

Senge [42] believes that in rapidly changing situations, only organizations that are flexible, adaptive and productive

will succeed. To this end, these organizations need to discover how to harness the commitment and learning capabilities of all their employees. For Senge [42], even if all individuals have an ability to learn, the structures in which they operate may not provide adequate incentive for thought and commitment, especially if tools and ideas to enable them to make sense of the situations they face are lacking. Organizations that consistently invest in creating their future require a fundamental change in the attitudes of their members. He adds that real learning delves into what it means to be human and it is from this place that individuals and organizations somehow become able to recreate and rebuild themselves. Thus, for a learning organization, learning is not just about survival. "Learning to survive" or what is commonly called "adaptive learning" is certainly important, but needs to be supported by "generative learning", learning that enhances the ability of individuals to create new things.

In his work on the fifth discipline, Senge [42] states that Systems Thinking is presented as the cornerstone of all the other disciplines because it integrates them into a coherent set of theories and practices. Systems thinking helps one understand an organization as a whole and the interrelations between all its parts. It allows individuals to see beyond the immediate context and incorporate the impact of their actions on others, and the effect others have on them. Additionally, since the construction component of systems thinking is relatively simple, it allows people to develop models that are comparatively complex and sophisticated, which runs contrary to what organizations typically do today. Senge [42] states that for complex systems, use of simplistic models may blur analysis of the real situation. Finally, systems thinking can make sense of action and reaction mechanisms within an organization, and thus enhance learning how to identify tacit knowledge and allowing its transfer and capitalization.

In the same vein as Spender and Grinyer [46], we can say that the firm is conceptualized as a whole, as a community of practice with institutional dimensions that gives meaning to these practices, rather than as a system of market resources under explicit control of managers. The resulting model is an organization designed as a dynamic system, autonomous from its elements and which is partially responsive to managerial influences.

This systemic vision leads us to an interesting observation. Since:

- The environment in which organizations evolve is complex, and thus requires a complex vision,
- All parts within a system are necessarily interdependent,
- The interactions between these parts are as important as the parts themselves,
- The organization is more than the sum of its parts,
- There is a very close relationship between what emerges and those who make it emerge,
- Tacit knowledge is the strategic knowledge in an organization,
- Tacit knowledge results from an individual's emerging internal mental schema.

Consequently, we can say that an organization can have tacit knowledge that emerges from the interaction between the tacit and explicit knowledge of individuals. These outcomes are not necessarily formalized or known in an overt way. Consequently, we cannot talk about a concept of capitalization because, in our opinion, to capitalize on knowledge it needs to be articulated and simplified. Based on the above, the goal of a learning organization is not that of knowledge articulation nor of simplification, it is, rather, of processing knowledge in its complexity. As a result, the best suited concept is that of memorization, which unlike capitalization is dynamic, in the sense that it allows intelligence and complexity. It also allows introducing the concept of intelligence, toward the end of creating tacit organizational knowledge by using organizational memory. Before exploring how organizational memory is constituted, however, let us try to understand how tacit knowledge is generated through individual, organizational and inter-organizational learning.

4. TACIT KNOWLEDGE GENERATION: FROM INDIVIDUAL TO INTER-ORGANIZATIONAL LEARNING

Organizations can only learn via the individuals who constitute them. However, not all organizations promote individual learning and occasionally, seeking to understand has been considered an act of disobedience. Additionally, few organizations really try to capitalize upon knowledge developed by their members. It must also be noted that not all forms of learning are necessarily geared towards formulation, oral verbalization or codification. Overall, researchers have tended to focus on learning that manifests in simple forms with clear and apparent processes.

Historically, companies have felt relatively little pressure to learn. Over time, however, knowledge capitalization has become a more or less pressing preoccupation, depending upon the company's context. Today, it appears that new approaches to learning are different from traditional professional approaches (how do we learn?) or theoretical/academic approaches (why do we learn?). These two approaches respond to particular goals and are the outgrowth of limited worldviews that are gradually changing. Current market realities require companies quickly mobilize distinctive or specific knowledge in environments that are increasingly volatile.

Additionally, tacit knowledge is mainly personal, stemming from each individual's experience. The fact that knowledge is inseparable from its owner also implies that an employee's departure causes loss of this individual tacit knowledge. A consequence of high turnover within the company is knowledge loss. Conversely, hiring workers with previous experience in the industry, from a competitor, a supplier or customer, contributes to knowledge within an organization [18].

Organizational learning can be defined as an organization's ability to organize and enhance the effectiveness of its collective action over time. Nevis et al. [35] defines it as the capacity or processes within the organization that can improve performance based on experience. It should be emphasized again that there is no organizational learning without individual

learning, yet the organizational learning process is much more complex because it must be understood from a systems approach. In this sense, individuals' mental models play a central role because, according to Argyris and Schön [6], organizational learning is based on "shared mental models".

The work of Argyris and Schön [6] on organizational learning that distinguishes between single loop and double loop learning has gained general acceptance. Single loop learning is a process of behavioral adaptation/response or correction of errors in established organizational patterns that are not challenged. Double-loop learning is a cognitive process of challenging mental models which leads to adoption and production of new patterns of knowledge, thoughts and actions.

For Argyris [3], tacit knowledge is the basis for efficient and effective management, but can also be the cause of its undoing. The main objective of effective management is the definition and transformation of required behavior into action-based routines to achieve organizational objectives [3, 5, 34]. These routines are implemented through skillful actions that are necessarily based on tacit knowledge. To better understand this, Argyris and Schön [5] focus on action strategies, which leads them to develop two action theories: Espoused theory (what we say) and Theory-in-use (what we do). Although they detect many different behaviors, the authors have noticed that there are really only two theories-in-use, Model I and Model II.

For nearly two decades Argyris and Schön have pursued analysis of conscious and unconscious individual reasoning processes within organizations [17]. They assume that people are designers of their actions, who perform actions to achieve their goals and learn when they perform actions that seem effective. In other words, Argyris and Schön [6] argue that all individuals have within themselves cognitive maps with which they plan, implement and correct their actions.

These authors also assert that few individuals are aware that the cognitive maps on which they rely intellectually are not the same as those they use when they take action [7]. Argyris and Schön [5] suggest that there is a theory that corresponds to what people say and another one that corresponds with what they do. Thus, the distinction is not made between theory and action, but between two different "theories of action" [8], hence the concept of "espoused theory" and of "theory-in-use".

Espoused theory represents values and commonly held views upon which people believe their behaviors are based. Theory-in-use, on the other hand, is theory in which individual behaviors, or maps they use, involve their views and values. In other words, we can say that people are unaware that theories-in-use are not the same thing as espoused theories, and they are even unaware of their use of theories, implying that much of their knowledge is tacit.

Argyris and Schön [5] argue that these theories of action determine the totality of purposeful behavior of individuals. Argyris [2] suggests that one of the reasons that led him to insist that the actions of individuals are the result of a theory, is the claim that what is done by these individuals is not fortuitous. People design their actions and are therefore responsible for this design. Argyris [2] also states that in designing their actions, people are generally unaware of this design and its divergence with what they say. This raises a question: if individuals are unaware of the theories that guide their actions (theories-in-use), how can they effectively manage their behavior? Argyris [7] suggests that effectiveness results from an individual developing congruence or fit between their espoused theory and their theory-in-use.

Models developed by Argyris and Schön [5] are designed to help people become aware of the tacit aspect of their knowledge and then to chose actions they design and implement. In this context, they develop models (namely single and double loop learning models) that attempt to explain processes that create and maintain the theory-in-use of individuals. Thus, interaction between these theories-in-use stimulates organizational learning.

Organizational learning thus represents an emerging interaction between all cognitive maps of all individuals. According to a systems approach, the organization is not the sum of its parts, but represents a whole with a specific behavior. It is a system of norms and meanings shared by actors, or cognitive maps, called by Argyris [2], theories-in-use [51].

Beesley [31] believes that individual learning, group learning, organizational learning and inter-organizational learning are closely interrelated and interdependent (see Figure1). He stipulates that the individual learning level is embedded in the group level, which is embedded in the organizational level which is ultimately embedded in the inter-organizational level. He adds that this dynamic is not linear but symbiotic in nature. Therefore, it is interesting to see how this knowledge is memorized through the accumulation of tacit organizational knowledge.

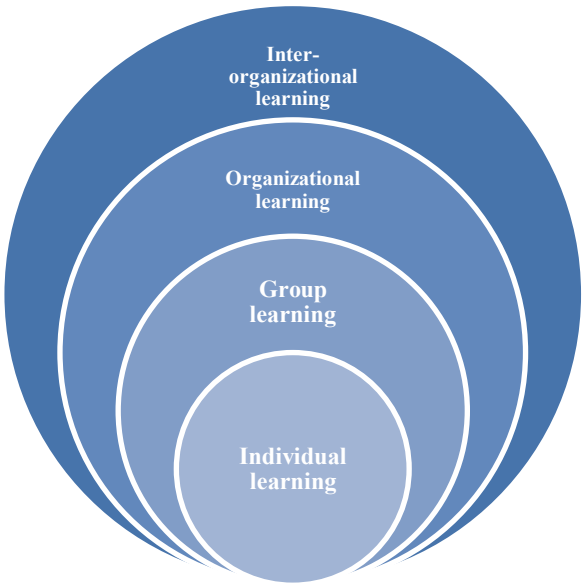

Figure1. The interrelated levels of learning [31]

5. INTER-ORGANIZATIONAL MEMORY FORMATION VIA TACIT ORGANIZATIONAL KNOWLEDGE

Organizational knowledge is a concept that has become widely used in the literature because it is a significant and very expressive instrument for explaining the nature of organizations and their behavior [27]. The company can be described as a "knowledge warehouse" that is embedded in assets, rules, routines, standard operating procedures and dominant logics [32]. In addition, several studies claim that to have a sustainable competitive advantage, a company must have fundamentally organizational knowledge, and at the same time, be able to create new knowledge suited to its context [26].

Grant [21] goes further by saying that the primary role of companies, and the essence of their capabilities, is the integration of knowledge. He adds that companies exist because they can integrate and coordinate specific knowledge held by individuals in a more efficient manner than do markets, and because they can transform individual knowledge into collective knowledge, otherwise known as organizational knowledge. This knowledge is difficult to reproduce and enables companies to be autonomous from their competitors and partners, and to maintain a sustainable competitive advantage, provided of course, that they are able to produce more knowledge, and depending upon the speed of change in their particular competitive environment.

It is recognized in the literature that organizational knowledge is embedded in a kind of organizational memory that does not disappear with the loss of an individual [32]. Organizational knowledge does not belong to individuals, but is rather a separate property from the organization, a social actor [20]. Thus, organizational memory is presented as a fundamental organizational system that requires storage; or rather a memorization of knowledge produced by the organizational learning process. In simpler terms, learning can be seen as the development of organizational memory [16]. For Stein [48], all current conceptualizations of organizational memory are mainly based on the work of Walsh and Ungson [58] and define organizational memory as the set of information stored from the history of the organization so that it can be used in ongoing decisions. Organizational memory consists of decision stimulus series kept in a kind of "memory box" and has behavioral consequences when used [58].

In general, studies on organizational memory have tended to theorize on a large scale, yet they are not based on empirical works, making it difficult to identify measuring variables [1]. Huber [23] states that the support of a corporate memory analysis is certainly useful, but all works do not clearly distinguish what constitutes corporate memory. Stein and Zwass [48] recognize the need for empirical studies in this field.

For Ackerman and Halverson [1], most studies on organizational memory have largely focused on a set of technological systems designed to replace physical and human factors. These studies were very limited due to overly reductionist definitions of memory and organizational tasks, mirroring the current trend toward standardization. It would be interesting to examine the human side of this issue by studying how to transform standardized knowledge into personal knowledge and then into idiosyncratic (specific) memory.

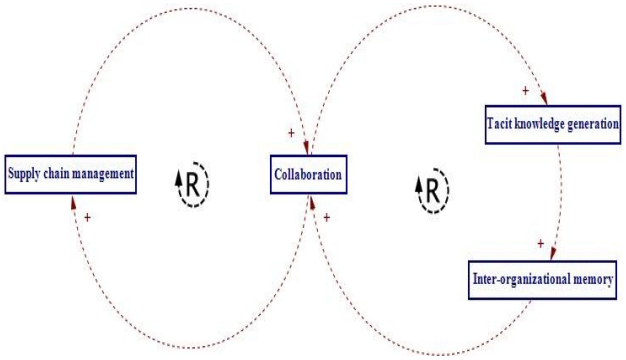

Figure2. A CLD representation of the dynamics of tacit knowledge generation and inter-organizational memory constitution in a supply chain context

We can consolidate our analysis by a CLD (Closed Loop Diagram) representation (Figure2) to show the mutually reinforcing systemic dynamics between tacit knowledge generation, inter-organizational memory development, collaboration and supply chain management. From this perspective, supply chain management adoption reinforces inter-organizational collaboration that tends to reinforce and stimulate tacit knowledge generation. This develops inter-organizational memory, also translating into organizational and individual memory. This inter-organizational memory reinforces collaboration between organizations that further reinforces the supply chain management approach.

6. CONCLUSION

In conclusion, we can say that there is growing interest in the concepts discussed in this paper, namely tacit knowledge, learning organizations and inter-organizational memory. To better apprehend this, we presented a critical overview of the tacit knowledge concept and we classified it according to Collins [13] to illustrate the types of tacit knowledge we need to mobilize. We then highlighted the link between inter-organizational collaboration, supply chain management and learning organizations to better identify the important role of inter-organizational collaboration. We showed how a company generates tacit knowledge from individual, organizational and inter-organizational learning, and then explored how inter-organizational memory is formed from relational and collaborative tacit knowledge. This allowed us to state that an organization is made up of embedded organizational knowledge belonging not to individuals or organizations, but to the supply chain.

In other words, we show that an organization as an entity interacts with its environment, its partners, its competitors, and with the individuals that constitute it. These interactions permit individuals and organizations to develop relational and collaborative tacit knowledge and to generate inter-organizational tacit knowledge that can be capitalized in inter-organizational memory.

This inter-organizational memory allows organizations to develop distinctive competencies that are the outgrowth of or reaction to market saturation, increasing innovation frequency, increasingly demanding customers and highly uncertain environments. These circumstances compel companies to organize themselves into supply chains, reticular organizations that reinforce collaboration and in turn tend to improve organizational and inter-organizational learning. This leads to increased collaborative and relational tacit knowledge that further develops inter-organizational memory. We thus enter a virtuous circle leading to a process of continuous improvement.

But, as with all research, our work has limitations. One of these limitations is that we do not integrate learning barriers, which could enrich our approach. As pointed out by Barson et al. [10], multiple types of barriers can exist between supply chain partners. We can briefly mention technology barriers (available technology and legacy system), organizational barriers (poor targeting of knowledge, cost of managing knowledge transfer, protection of proprietary knowledge and geographical distance), people or human resource barriers (internal resistance, self interest, lack of trust, risk, fear of exploitation, fear of contamination) or cross-category barriers (existing resources, the need for reward and culture). However, McLaughlin et al. [49] find that barrier impact cannot be assumed to be uniform across the core processes of an organization. Thus, barrier identification and management have to take place at a process, rather than at an organizational level.

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