

Knowledge processes and learning options in networks: Evidence from telecommunications

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Abstract. This paper articulates a network approach to knowledge processes and information systems in organizations. It proposes that cross-business-unit knowledge processes and the learning role of information systems are embedded within a network of relationships that link business units. Exploratory evidence from a large telecommunications firm shows that relationships have strategic *learning option value*. Learning processes are often informal and emergent thus information systems should provide a flexible infrastructure enabling the evolution of learning processes. The paper identifies important feedback loops that can be leveraged by knowledge managers, who should be seen as *cultivators* of knowledge processes, rather than omnipotent planners and designers.

Keywords: Knowledge management, information systems, organizational learning, networks, telecommunications, strategic learning options, feedback loop, case study, dynamic systems



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1. Introduction

Management thinking has long recognized organizational knowledge as a new form of capital [39,40] and linked it with core-competencies, dynamic capabilities and autopoiesis [9,32,42]. However, the field of

knowledge management (KM) had a slow progress and unimpressive impact [43], and both knowledge and the knowledge creation process are still poorly understood.

Inspired by a systemic view of knowledge management [42–44] and the research promise of Zeleny's KM framework [43], this paper explores knowledge processes in networks and the role of information systems [18]. The main objective is to understand how the network of relationships that link business units affects the learning processes and the learning role of information systems, involving both issues of knowledge coordination and knowledge transfer [33]. The research framework integrates a network perspective with knowledge processes [43].

An exploratory case study of firm T,¹ a large telecommunications firm, is used as the basis for theory development. We explore the learning drivers, factors that facilitate or inhibit learning processes, and the opportunities and threats of learning. We provide evidence that the network of relationships affect both the knowledge processes and the learning role of information systems. Learning processes are often informal and emergent, situated within communities that

¹T is a pseudonym, due to research confidentiality.

span internal and external organizational boundaries. Relationships are strategic *learning options*. The paper identifies important feedback loops [34] that can be leveraged by knowledge managers, who should be seen as *cultivators* of learning processes, rather than omnipotent planners and designers. Information systems should provide a flexible infrastructure that enables the evolution of knowledge processes.

The paper attempts to integrate two emerging aspects of organizing, organizational knowledge management and network organization. The concept of *network organization* is used to describe the relatively messy area of organizing modes between markets and hierarchies [31]. The network organization is ‘an association of distinct business units operating in tandem in both intra-organizational and inter-organizational context’ [36]. Networks demonstrate flexibility and responsiveness [25], self-sustainability and autopoiesis [42,44], features that are well suited for the current discontinuous business environment. IT is an essential design element of these networks [35]. An internal network usually arises to capture market and entrepreneurial benefits, achieve increased innovation and performance, better utilization of resources, and the advantage of being large and small at the same time. Internal networks elucidate a shift from centrally planned hierarchies to a complex network of relationships linking business units. The study of these relationships and their implications for knowledge processes is a major focus of this research.

We first discuss the literature on organizational learning and knowledge. Section 3 outlines the network approach and the framework of the empirical research. Sections 4 and 5 present the exploratory findings. The final chapter discusses concluding remarks and future research.

2. Organizational learning and knowledge

The literature on knowledge and organizational learning is characterized by theoretical fragmentation and draws from a variety of disciplines. Organizational learning is ‘the process of improving actions through better knowledge and its understanding’ [11]. Organizations learn by ‘encoding inferences from the history into routines that guide behaviour’ [21]. Organizational learning is related with cognitive (organizational knowledge) and behavioural (organizational action) organizational development. However, cognitive changes may not result in behavioural changes, while behav-

ioural changes are not always the result of cognitive changes [11]. The outcome of organizational learning can be traced as three overlapping stages: cognitive changes, behavioural changes and performance improvement [14]. Organizational learning is closely related with organizational innovation and change. However, learning does not always increase the learner’s effectiveness.

Traditionally, knowledge in organizations is categorized as tacit or explicit. Explicit knowledge can be articulated and codified, while tacit knowledge cannot. Tacit knowledge has a personal and social quality and is deeply rooted in action, commitment, and involvement in a specific context. It has a cognitive element – mental models, perspectives – and a technical one – know-how, skills [29]. ‘Organizational knowledge creation is a continuous and dynamic interaction between explicit and tacit knowledge’ [30, p. 70].

Nonaka [29] describes knowledge creation as a continuous interaction between tacit and explicit knowledge, which leads to a knowledge spiral of four types of knowledge conversion. The phases of the spiral are externalization/articulation (conversion of tacit to explicit knowledge), combination (conversion of explicit to explicit knowledge), internalization (conversion of explicit to tacit knowledge) and socialization (conversion of individual tacit to organizational tacit knowledge). Socialization is triggered by building a ‘field of interaction’ and externalization by ‘meaningful dialogue or collective reflection’, combination is triggered by ‘networking newly created knowledge and existing knowledge from other sections of the organization’, while ‘learning by doing’ triggers internalization [30, pp. 70–71]. The enabling conditions of organizational knowledge-creation include autonomy, creative chaos, redundancy and requisite variety.

Zeleny [43] argues very persuasively that the distinction between explicit and tacit knowledge is actually misguided and unproductive: “All knowledge is tacit. There is no explicit knowledge, only information” (p. 23). Zeleny builds on Nonaka’s framework [29] to integrate knowledge and information in a unified cycle of transformations: articulation (A), combination (C), internalization (I), socialization (S). The ACIS cycle is a continually repeated, autopoietic cycle. The ACIS cycle is a main component of the research framework (Fig. 1).

Organizational learning is a never-ending process [26] that takes place on numerous levels: individual, team, business unit, organizational and inter-organizational. Organizational learning is a target-

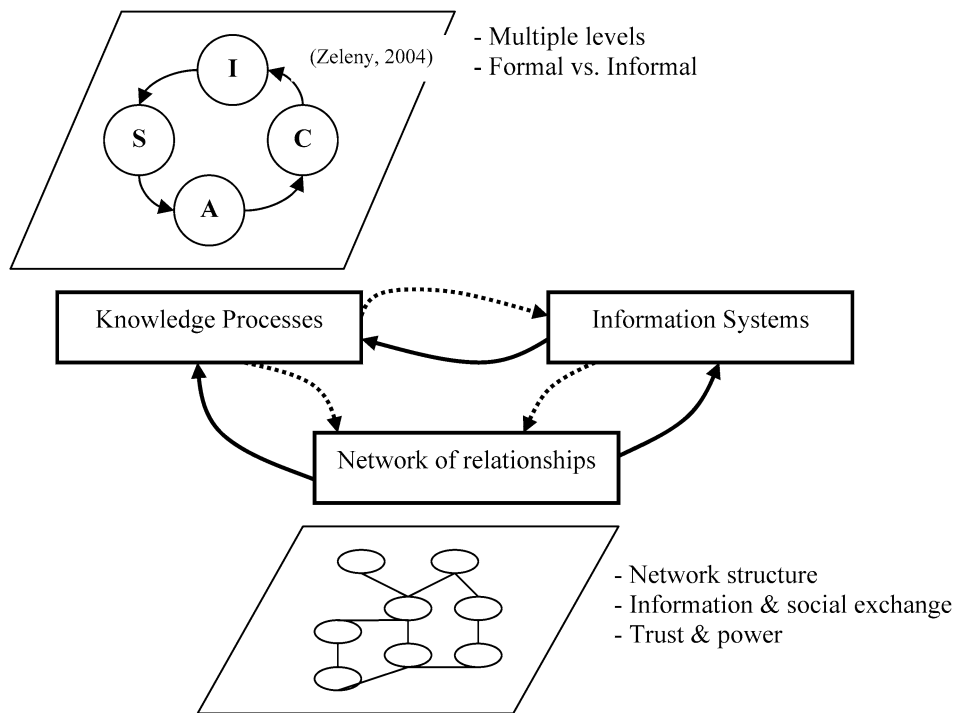


Fig. 1. Research framework.

oriented process [21], while learning need not be conscious or intentional [17]. However, the existence of an intention facilitates learning and drives knowledge-creation to organizational goals [30]. ‘An entity learns if, through processing of information, the range of its potential behaviours is changed’ [17].

When learning appears within an organization (existence), it is important to become collective (breadth) and lead to varied interpretations (elaborateness), but at the same time it is critical that the various units comprehend these varied interpretations (thoroughness) [17].

Organizational learning is a process that does not have a straightforward outcome. An organization can learn incorrect things or be myopic, overvaluing information from the current period, local situation or past success [20]. Moreover, in the presence of substantial noise, very rapid learning can actually be dangerous, as early signals lead to strong and inappropriate outcomes [24]. Organizations can learn either “too early” or “too late” in terms of their environment. The timing of learning affects the outcome of the learning process.

Learning can be achieved by focusing inside the organization, or by focusing on the external environment [23,27]. There is a tendency in organizations to prefer one mode over the other [27]. This research takes an

“external” stance on learning at the business unit level. We emphasize the importance for a business unit to evaluate its learning capacity by looking “outside” to the learning requirements that are posed by its environment. The difficulty of integrating externally acquired information into the existing internal knowledge is a factor that inhibits external oriented learning [23].

3. Research framework

The research framework (Fig. 1) consists of three interdependent components: knowledge processes, information systems and network of relationships. The network perspective views an organization as a social network, a set of relationships (network links) that link network nodes, which in our case are business units. A fundamental idea of the network approach is that the position of each node within the network of relationships constrains its behaviour, while at the same time the node’s behaviour shapes the network [4,13,28].

We propose that the learning of each business unit in the network is affected by its position in the network of relationships. At the same time, the network of relationships is indirectly shaped by the learning of each and every unit, since the learning changes the po-

tential behaviour of the business unit. We propose that the learning role of the information systems that cross business unit boundaries is affected by the position of the use of the system within the network of relationships. At the same time, the use of information systems affects that network of relationships. We view organizational learning as a “natural” organizational process. That means that business units and organizations learn regardless of intentional management intervention.

The network of relationships consists of a multitude of formal and informal relationships. The basis of the network of relationships is dyadic relationships. A dyadic relationship is an interaction process between two parties in the context of an atmosphere within a wider environment. The relationship is built on short-term exchange episodes. The content of the exchange can be resources, information or social. The informational and social contents of the exchange are of particular interest for learning. Exchanges constitute the core of learning processes. The information exchange episodes refer directly to the combination (C) phase of learning processes. The social exchanges refer to the socialization (S) phase of the ACIS model, whereby knowledge is shared [43]. The relationship is constantly adapted, as a result of the changes in short-term exchange episodes, while in the long-term the major changes are institutionalized.

The interaction is embedded in the atmosphere of the relationship. The atmosphere can be conceived as a set of factors that affect, and are affected by, the interaction. Important atmosphere factors are trust and power. The broader context in which the relationship is situated is the environment. The internal environment is related mainly with the culture and the reward system of the internal network organization. The external environment is related with the market and the wider social system, where the internal network organization operates.

The set of all dyadic relationships culminate into the network of relationships. Every relationship potentially affects every other relationship in the network. Therefore, our understanding of learning as a result of the interaction within a relationship should consider the whole network of relationships. Although it seems complex to explicitly identify the dependencies between *distant* relationships, such an explicit description would be particularly useful in understanding how learning at one point of the network is affected by a change at another point, i.e. the diffusion of learning within the network.

A business unit has a centrality value within the network, a concept that grasps the extent to which it holds

a central position regarding the structure of the network. The most important measures of centrality are betweenness and closeness [12]. Betweenness refers to the extent to which a node acts as an intermediary between other nodes in the network, while closeness is the extent to which a node is close to all other network nodes. A node with high betweenness can take advantage of his position to increase others' dependence on it, while the node with high closeness is in a position of decreased dependence on others. Furthermore, one's centrality is increased by virtue of being linked to highly central others [3]. The nodes with relatively high centrality are better positioned for learning because they have access to more information channels and sources. Central nodes can also exploit the other nodes' dependence on them, withholding or distorting information flows they control.

4. Organizational learning in T

The empirical research method is exploratory case study [37]. The case study is a research strategy suitable for novel research topics [37]. The exploratory dimension stems from our attempt to assess phenomena in a new light, and to use these new insights as a basis for future theory building and formalization.

The primary unit of analysis is the business unit. We collected data from firm documents and semi-structured interviews with firm managers, internal consultants and researchers (IA, IB, IC, ID). IA is an internal, executive development consultant, who has participated in several organizational development, management development and knowledge management projects. IB has lead the organizational learning initiatives within T. ID is a researcher with experience in numerous R&D projects around organizational learning, knowledge management and organizational development. IC is a member of the knowledge management group emphasizing the design and use of intelligent agents to support information sharing.

T is a large global telecommunications firm that can be conceptualized as an internal network organization [ID, IB]. The shift toward an internal market was explicitly attempted by the corporate strategy. However, the reorganizations that are made almost annually [ID] keep the internal network in flux. These reorganizations are not explicitly related with learning objectives by the firm's management, but 'if learning means to a considerable degree adaptation to the environment,

then these reorganizations are the outcome of learning' [ID].

Because of the turbulence and strategic uncertainty in the fast-changing, digital-convergence-sensitive telecommunications market, there are increased learning requirements. As a response to those learning requirements, there is increased awareness of organizational learning within the firm. IB observes:

There is a good understanding of the concept within T. So there is a lot of recognition of the term of organizational learning and I can say a degree of consistency but not uniformity about the definition.

However, the turbulent market where T operates may affect the learning processes negatively.

The intrusive, commercial, competitive environment takes away people's luxury to learn together and they just care about survival [IA].

'Within a rapidly changing environment people need more flexibility for learning' [IC]. Witness the knowledge-creation conditions identified by [35] such as autonomy, creative chaos, redundancy and requisite variety.

4.1. The entangled nature of learning levels

While we focus on the business unit learning, the empirical work within T provides strong evidence of dense interconnections of learning at different levels. That implies that learning at one level cannot be understood in depth without considering its relationship with other learning levels. IB notices:

Of course business units learn. The issue with businesses is how fast they learn and what they do with that that they have learned. There is an issue on what this learning occurs . . . There is learning around individuals, around projects, around processes, around teams, around business units. So there are multiple learning processes operating.

Collective learning is more difficult to achieve than individual learning.

I am aware of the difference between individual learning and organizational learning. And I am constantly surprised that organizations confuse the two and they think that if you develop and train your managers you have a learning organization . . . And I see a very little evidence of collective learning [IA].

Fragmentation of learning is an important inhibitor toward the learning organization ideal.

Sometimes there are big words that we must be a learning organization; the practicality and the practice of it are not evident. It is evident in parts but not in the whole organization [IA].

Organizations learn through the agency of their individuals. Business unit learning does not appear to be as strong as individual learning, or learning around projects. IC emphasises that 'reorganizations are mainly project-focused and it is mainly project groups that learn rather than business units'. One main inhibitor is the size of the business units. IC argues that 'there are business units at the size of about 400–500 people. With that kind of size, the learning at the moment is very primitive'. Learning appears to be a decreasing, or likely concave, function of size of the organizational entity.

4.2. The network of relationships

Business units have to learn, can learn and do learn from other business units. The exchanges of explicit and implicit knowledge are at the core of every learning process. Cross-business-unit learning stems from the need to know and understand similar issues, or to resolve similar problems.

Business units have similar problems, so you ask other business units about what they know so you don't have to find out again [IA].

There are a lot of formal techniques involved in the process of knowledge sharing between business units. These are centers of excellence, internal benchmarking, cross-functional projects, project reviews, staff exchanges and seminars. The transfer of employees across business units is one important method to transfer tacit knowledge across business units.

One of the major ways to transfer learning is to transfer learning with the individuals. We manage the transfer of people across business units. There are certain people within the company that we would define as a corporate resource and have a major loyalty to the firm and not to the business unit [IB].

Trust. There is substantial body of research on the role of trust in knowledge sharing within organizations. However, ID takes a critical stance on this issue.

Trust is a recurring theme. Partly I think because people feel that they understand what is meant by trust. It seems to be an accessible concept. In English language it is not a rare word.

Despite this difficulty, research on how a trusting knowledge sharing culture [ID] can be established within T has revealed that

... The sense of expectations and motivations is going to be the key consideration rather than merely give [people] email and groupware. These pieces of software simply give people a tool to share information and knowledge, but does not itself encourage people to use it.

We can argue that trust facilitates effective learning, if the two units mutually look for a long-term relationship. There are probably only short-term learning opportunities in a relationship without trust in an internal network, which results in limited learning benefits. The relationship is a dynamic process and the parties invest in the relationship. That investment has a strategic *learning option value*,² since essentially the units acquire a right to potential future learning benefits. Therefore, learning is not constrained only in the short-term exchanges but emerges from the whole history of these exchanges, as well as from the future expectations from the relationship. Learning is an interaction situated in a history and an anticipated future.

The long process of trust development is parallel to the learning process. Learning opportunities from the relationship are increased and enhanced in quality over time as trust develops. Trust can be seen as *a lever that expands or contracts the spiral of knowledge creation*. That co-evolutionary pattern may also be path-dependent. Path-dependency implies that history matters, and if trust is lost at a point in time point then it becomes more difficult for the parties to regain it, and learning option value is destroyed. IA points to the need for “reciprocity of respect”.

Trust has to be maintained and used as an investment if you want to have shared knowledge [IA].

IC points that the large size of an organizational entity may limit trust development.

And what is the right size of the company so that trust can work? It is said to be a maximum of 250 people. That is the size of a business unit [IC].

Power. IA identifies power as an important learning-mediating factor.

The other is power. If you have some information that may be useful for someone then to share this information is to give something away

Power is the inverse of dependence between two parties [3]. Power derives from control of relevant resources. To acquire power in a network it is necessary to decrease your dependence on others and increase the dependence of others on you. From a structural perspective on the network, the power of one node is closely related with its centrality. The business unit with increased power is better situated for learning within the network.

However, the whole network of relationships constrains the manifestation of power in each relationship, since that power affects, and is affected by, virtually every relationship in the internal network. Environmental factors, such as the culture and the broader social system, can also inhibit the manifestation of power, because such a manifestation would be against the interests of the business unit. It is not straightforward that a business unit that holds a “power-position” in the network will take advantage of this position. If it does the overall learning environment in the organization may be threatened.

One of the key issues is the degree of interdependence between business units, the degree to which these business units compete with each other, the personal agendas of the senior executives [IB].

Strong conflict can be an inhibitor for the operation of the internal network and its learning capacity. Conflict resolution can be a learning process by itself.

Culture. Although a loosely defined and heavily used concept, culture is crucially related with learning. IA argues:

It seems to me that if you are in an environment that is anxious or pressurised for time, or myopic, then the opportunity to use information for learning is more and more limited. Time and limited vision [are crucial].

Individual competition and the reward systems focused on individuals are learning inhibitors. IA notes that ‘there is no reward system for being more generous’.

²The concept of option used here is grounded in Real Option Theory grounded in Finance. For a seminal non-mathematical description of the concept related to IT investment see [2].

IB suggests that the subcultures and the technical language developed within business units operate as learning inhibitors. The differences in learning and leadership styles, as well as the territorial loyalties within business units are factors that affect the inter-business-unit learning processes negatively.

The cost-cutting logic is also an important learning disabler.

Give people time and flexibility to innovate and experiment. Give me time to actually go and find the better way. Cost-cutting logic – everybody does everything in the same way – disables learning and innovation [IC].

Centralization is also a factor that can function as a learning disabler.

Usually everybody is going to the same direction because of the central support. But learning and innovation need different directions [IC].

4.3. The informal nature of learning processes

The strongest aspect of cross-business-unit learning appears to be the informal and emergent nature of learning processes. This is a serendipitous finding from our empirical data. IA sees a clear informal dimension around her business unit's learning.

I think [my business unit, HR] must be learning, otherwise it would have died as an organism. I don't think it has any process of learning except inside the intelligence of the individuals . . . I don't think it has systems that help it learn but I think that we would like to think that it has.

The most important intra-business-unit and cross-business-unit learning process is the individual-level, informal knowledge sharing and co-creation.

I think it is primarily trying to find the right people to talk to. I think that the best way of sharing knowledge is by talking to somebody, because you can ask questions and when you ask the question it prompts new answers. But the issue is to know who are the right people to ask these questions [IC].

Talking to someone else in the organization facilitates the exchange of explicit knowledge and tacit knowledge, and the externalization of tacit knowledge through the use of metaphor and analogy [30]. It facilitates the co-exploration of ideas, beliefs and assumptions, which lead to knowledge co-creation [30]. How-

ever, the problem of finding the right people to talk to is enlarged in the case of cross-business-unit learning. Personal weak ties [16] that span business unit and organizational boundaries are critical learning facilitators.

We can get a really valuable piece of information, a really valuable piece of insight from anyone; randomly. . . It is luck . . . I am persuaded about the notion of the value of weak ties [IC].

IC notes that 'it is the *informal networks of people* that make information propagate around'. Managers often 'invite other people from other BUs for project reviews and develop relationships' [IC], which facilitates cross-business-unit learning and supports the creation and maintenance of informal networks that span business unit boundaries. That evidence supports early research on informal communities-of-practice [6, 39]. People work, learn and innovate in emergent, not designed, informal communities-of-practice. Community knowledge is dominantly socially constructed through narration and collaboration. Therefore, individual learning is inseparable from collective learning. Individual learning is essentially achieved by becoming an insider.

Learners are acquiring not explicit, formal "expert knowledge", but the embodied ability to behave as community members [6, p. 51].

Informal communities-of-practice span internal and external organizational boundaries. However, these communities are discouraged by numerous aspects of current organizations. An informal community inside firm T that shares an interest in "business leadership" is threatened by the existing reward system that does not encourage the emergence of such initiatives and the participation within them [IA].

Most interestingly, any attempt to introduce formality in learning processes may backfire. This is a crucial challenge for knowledge managers.

I think you may inhibit learning by actually saying 'you must go and learn from somebody'. If you put a process to facilitate learning that is almost that if want to switch it off. By making it explicit somebody says 'oh, I have to spend half of the day telling someone else what I have learned'. It is the informality that helps the system work [IC].

These informal learning processes have a strong improvisational element.

For the information that I need I might go and look at the web site or the library, but most of the time it is the serendipitous, the unusual situation. Most of the time the interesting pieces of information come up almost randomly, and I say 'ha, that is useful for me' [IC].

Cross-business-unit learning processes are dominantly informal and emergent, not the outcome of intentional management design. IB notes that 'lots of them are not consciously designed within organizations'. Learning processes are also evolving.

But it's accidental that you find a way connecting across. It is not systematised . . . I don't think it is [IA].

5. The learning role of information systems

The use of information systems is embedded within a network of relationships linking business units. This network mediates the learning role of information systems. At the same time, the use of information systems affects the network of relationships, affecting that way indirectly the learning processes.

The role of information systems in learning processes is 'absolutely central' [IA]. Information systems support the information exchanges that are in the core of cross-business-unit learning processes. E-mail enables the sharing of explicit knowledge, but drawbacks include information overload and junk email. The corporate intranet enables information publishing, and pulling of information when needed. Information is hyperlinked, but 'so much information is published in our Intranet that people just give up instead of searching. You have to know where you can find something in order to search for it' [IC] and the quality of information might not be the highest. Systems that support cross-business-unit processes capture and integrate knowledge into processes, but they are not designed to support learning. Their primary objective is efficiency.

Firms have a variety of information systems to facilitate the acquisition of information about their environment (e.g. Internet). IS can be used to enhance the environmental scanning and absorptive capacity through the use of Internet, or the development of learning relationships with actual and potential customers, supported by Customer Relationships Management (CRM) systems. Information systems enable new organizational forms or designs with better learning capacity, decreasing the risk for learning failure [22].

Information systems support organizational memory, either in the form of databases that store codified information, or by supporting the operational processes of the organization that are repositories of knowledge [7]. Knowledge is costly to produce, maintain and use, and IT infrastructure is a means to lower such costs by allowing its efficient processing, transfer and accumulation. The support of organizational memory is important, since organizational memory is positively related with the ability to learn [8].

The external and internal integration of information systems and the ubiquitous information infrastructure facilitate organizational learning. Redundancy of information access facilitates learning [30].

IB emphasises the need for information to be delivered when it is required and not just to be pushed. Learning is a feedback loop and at the moment a lot of information is being presented only, due to limitations concerning feedback and updating.

Information systems in the way that they are designed can be learning disablers. We've got legacy systems, multiple systems that cannot share information, multiple protocols, information formats etc. That is why Internet technologies succeed: because organizations are crying out for a common platform [IB].

T, as any large firm, has legacy systems that act as change inhibitors [ID]. The lack of IS flexibility reveals that systems are not designed for learning.

There is also the issue of flexibility in information systems. The lack of flexibility in information systems leads to an approach 'given the system what problems can we solve?' instead of 'what are the real problems to address?' [IC].

Is the recordable data in a form that can be recycled and reused in different ways? . . . But systems are not designed for learning . . . How can we configure learning systems that will help us for the future that we don't yet know about. I guess organizational learning is limited to when the system is formulated [IA].

Tacit knowledge poses the strongest challenge for IS design.

When the data can be recorded then the relationship between IS and OL is phenomenal. But my brain holds an incredible amount of information about people and interactions, none of which could be recorded [IA].

Half of the knowledge that we have in businesses is within people's heads and it is not codified. It exists with the individual or exists with the organizational function in a tacit form. You cannot transfer it by systems. And if I ask you to write down what you know, it will take you from here to eternity to write down what it is that you know. Because you don't know what you know until you need to apply it. Knowledge is associated with specific activities, and associating the knowledge with these activities it becomes visible. But it does not become visible until that time. That is why learning, my knowledge is very difficult to transfer . . . Not in a form transmittable by information systems [IB].

One challenge is the support of socialization [29]. Another challenge is to capture tacit knowledge, e.g. systems in the form of automated tools that monitor and make inferences about the 'way I work', which is a type of implicit knowledge.

Presently you are obliged to use a keyboard to make your tacit knowledge explicit and inevitably you limit the exchange of information . . . Increasingly as we develop virtual shared spaces . . . simulate face-to-face contact . . . [IS may help] achieve the same kind of sharing of confidence . . . [ID].

Trust. The atmosphere of the network of relationships, with emphasis on trust, mediates the use and the learning role of information systems. IA describes the role of trust and power, leading to the failure of a knowledge-sharing tool.

We built a knowledge-sharing tool last year between everybody in a business unit. And the idea was to put in information about things that were going on inside the organization so that collectively we would be more intelligent and informed. We wanted to be fully informed about an internal customer so people started to put information in, but they couldn't find anything. The categorization of the data was not as my brain works, so I couldn't find anything. Second, I was putting a question but nobody was replying to me – cooperation. Then the senior manager got into the system and made an observation about the way that the system was used – power. And instead of encouraging people to use the system, everybody stopped to use it, because they realized they would have been watched rather than appreciated. When we started the use of the system, we started with a joke: we made a prize for the funniest poem, just to get people in the

system. But the culture connected it unconsciously that it was too light, too silly, too funny. Nobody took the system seriously. And we stopped using it. It died.

Trust development is difficult between business units, because of the large number of people involved. Information systems can mitigate the negative effects of large organizational size, by aiding cross-business-unit contact and memory.

And what is the right size of the company so that trust can work? It is said to be a maximum of 250 people, that is the size of a unit. The issue then is how does this unit relate with other units? I can identify here a role for information systems aiding contact and memory [IC].

ID points to the corporate firewall, as an example of how trust affects the use and the learning role of information systems.

The firewall is an extreme example of that. I suppose that corporately we cannot trust people outside it.

The incentives for individuals to use information systems to share knowledge may be related either with the corporate culture, or with the reward system. Although information systems provide more opportunities for information sharing, employee's attitudes about information sharing affect the use of these systems [10].

Internally, because everything has costs – creating Intranet pages is not an exception – I may have an experience but not publish it without some particular incentive. I need this particular incentive [ID].

These findings extend related research in information systems. As [15] argues, knowledge exchanges have costs for both parties, the organizational context influences these costs and therefore, although information systems decrease the exchange costs, their role is moderated by the organizational context. [19] studies knowledge transfer between consultants and clients in ERP projects, and they show that knowledge transfer is affected by a multitude of knowledge-related, motivational and communication-related factors. [1] takes also a process view on learning and knowledge.

5.1. Information systems affect the network of relationships

The use of information systems also affects the network of relationships, which mediates learning

processes. The latter is essentially an indirect, though critical, effect of information systems on learning processes. The effects of information systems use on trust are particularly important. IC emphasises:

Another issue is how information systems may affect a culture of trust that facilitates learning. The use of information systems to “monitor” people working within the organization breaks that trust.

IS should make these relationships more transparent [25]. That can result to external (visible) and explicit (voluntary) relationships between units, facilitating the operation and the self-renewal capacity of network organizations [42].

5.2. Information systems and the informal nature of learning processes

The strong evidence for an informal and emergent nature of learning processes has clear implications for the learning role of information systems. Current information systems already support informal processes in a variety of ways, but this area is relatively unexplored design direction.

IS should support informal networks within organizations irrespective of formal structures. That support includes collaborative working environments such as Wikis,³ platforms for open source software development,⁴ and support for finding people and keeping in contact with people.

The relationships between groups are more or less temporary and it drives you to rely on fostering individual relationships irrespective of organizational structure . . . Although there are reorganizations we can find and keep in contact with individuals within the organization through the network. Information systems enable us to act as a network of individuals independent of the formal information channels [ID].

Every business unit created and maintains its presence in the corporate Intranet, which is accessible throughout the firm. The Intranet can be seen as a platform of resources that support mutual awareness within the organization and potentially trigger informal learning processes.

First is the issue that we advertise our existence through the Intranet. We have our web site, which is accessible through the Intranet within the whole organization. ‘We are process engineering group, these people, these tasks, part of . . .’ So we position ourselves within the T so the rest of T in using the Intranet is at least aware of what we are doing and who we are . . . That is a potential channel of learning . . . I see as the most useful learning mechanism the informal contacts. Regarding these contacts, studies have shown that the access to an email infrastructure is not related with the creation of more informal contacts. However, it is related with the exploitation of these contacts, overcoming geographical boundaries. Building informal contacts is more useful than regular monthly meetings to share ideas for example. However, my view is probably biased by the non-repetitive type of my work as a researcher [IC].

Much of learning develops around social activities. Information systems to create communities of interest [IB].

Information systems can facilitate the creation and support the communities of interest. This role is particular well suited for the corporate Intranet. T’s corporate Intranet facilitates the creation and the operation of virtual communities-of-practice that span business unit boundaries within T.

The role of information systems can be seen as disseminating of learning. People find new things but they cannot know to whom else within the organization these might be useful. They can tell to their colleagues but to extend this concept to a wider audience there is a need for information systems. A role to notify people [IC].

Information systems support the serendipitous and improvisational nature of informal learning processes across business unit boundaries.

Anybody within the organization can have a new idea and information systems may facilitate the access to it [IC].

That evidence supports the development of IS that facilitate informal structures and emergent learning processes rather than formal procedures (see also [5]).

6. Concluding remarks

This paper developed a network-approach framework to explore cross-business-unit learning processes

³See e.g. Wikipedia.com.

⁴See e.g. Sourceforge.net.

and the learning role of information systems within network organizations. Learning processes and the learning role of information systems are embedded within, and mediated by, the network of relationships between business units. Empirical data from T, a large telecommunications firm, confirm that mediating role of the network of relationships and offer evidence of a strategic learning option value of the relationships.

Spanning the boundaries of our conceptual framework, our exploratory case study supports a dominantly informal, community-based nature of learning processes that span internal and external, formal organizational boundaries. Knowledge management should cultivate these processes, besides trying to plan and design formal systems. IS that support informal organizational structures is a key systems design direction for the future. Internet technologies are a suitable technological platform toward that direction facilitating the evolution of learning processes through an open and flexible infrastructure.

There is a self-reinforcing mechanism, or positive-feedback loop, between IS use and the network of relationships. IS may affect positively the learning processes both directly, and indirectly (through the atmosphere of the relationships), while improved learning processes improve the value of IS. This virtuous cycle takes place for example when the information systems make the relationships more transparent, strengthening trust. Knowledge management should be aware of, and leverage such feedback loops⁵ in the use of information systems.

Future research should formalize and analyze in-depth the issues raised in this research. A series of intriguing research questions remain to be further explored. How knowledge processes in networks are different than knowledge processes in hierarchies? What is the right balance between formal and informal knowledge processes? Organizations may be in a perpetual struggle to comprehend and reconcile the *fittest* balance between their interdependent formal and informal dimensions, and ultimately reap the value from the synergy of the two. Knowledge management, founded on a clear understanding of the organizational and technological issues, should have a leading role in the cultivation of that synergy.

⁵They should also be aware that *autopoietic* cycles can very easily operate as *autocatastrophic* cycles.

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