Organizational Learning Revisited

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Abstract

Organizational learning is a nebulous concept which needs to be articulated in order to be of concrete use. In this paper we will recapitulate and criticise some of the prevailing ideas concerning organizational learning. An alternative definition is suggested which is tightly coupled to the purpose and goals of the organization, which for Ericsson is to develop and sell telecommunication systems. Thus our definition of organizational learning is of immediate practical value. We examine some problems at Ericsson which are related to organizational learning and discuss an application at Ericsson of the alternative definition: the coordination of the integration of software increments in the UMTS releases. We also discuss organizational learning from a theoretical and philosophical point of view.

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1 Introduction

> "Download knowledge directly to the brain! Today the actual learning process takes too long. In future we will download knowledge directly to the brain. Connect in to something which contains specific know how and transfer it over." (Framed statement hanging on the wall at Corporate IT, Ericsson, July 2000)

Organizational learning is an important issue that has attracted considerable interest for a number of years. This interest has increased with the advent of the so called 'information' era where the knowledge of employees is regarded as one, if not the most, important company asset. From being a somewhat overlooked topic, organizational learning has surfaced to become a major concern in many organizations. For example, Ray Stata, Chairman of the Board and President of Analog Devices, Inc. stated this in the following way:

> "In fact, I would argue that the rate at which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries." (Stata, 1989)

Another statement comes from Ikujiro Nonaka who wrote "The knowledge creating company":

> In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge... Successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products (Nonaka, 1991).

This interest in organizations and learning has made *knowledge management* an important task in organizations. Knowledge management considers knowledge as an asset which can be captured by technology, shared and migrated into organisations.

The main issue in organizational learning appears to be how to accelerate organizational learning and make the organization adapt to changing circumstances. However, the essence of organizational learning is not easy to pin down. In spite of many years of research and discussion there seem to be no consensus about the core substance of organisational learning and how to achieve it (see for example Keating et al., 1994). Although the need for organizational learning is evident, it is not clear how to funnel this learning into an asset which can be controlled and evaluated.

In this paper we suggest a definition of organizational learning which is tightly coupled to the purpose and goals of the organization, which for Ericsson is to develop and sell telecommunication systems. Thus our definition of organizational learning is of immediate practical value. We start by recapitulating and criticising some traditional thoughts about organizational learning in the literature. Next we discuss some impacts on Ericsson which are related to organizational learning. The following section presents a theoretical background for an alternative definition of organizational learning. After that we discuss an application of the alternative definition at Ericsson: the coordination of the integration of software increments in the UMTS releases. We conclude by a short discussion of the results achieved and point out some potential applications.

2 Organizational learning - a review

It is evident that learning and knowledge are tightly related to each other: “Learning is the process whereby knowledge is created through the transformation of experience.” (Kolb, 1984). In this paper we simply assume that knowledge at any particular moment in time is a state. Learning is a change of that state for better or worse. Thus, learning affects knowledge and vice versa.

In the literature a number of attempts to define organizational learning can be found, none of which seems to be very satisfactory. We are not going review this literature here[1]. Rather we will pick one recent article as a representative example of the prevailing conception about organizational learning and knowledge: “Technology is Not Enough: Improving Performance by Building Organizational Memory” written by Cross & Baird (2001).

In this paper a number of concepts related to organizational knowledge are discussed. Under the heading of *organizational memory* we find items like individual memory, relationships, databases, work processes & support systems and products & services. Another concept is *learning organizations* which is defined by Senge as “Organizations 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 to learn together” (Senge, 1990). Here you will find issues like learning curves, learning from unique events or small sample, innovation efforts, strategic alliances, migration of expert knowledge to organizational level, routine stored as procedural memory etc.

Here are some quotations from Cross and Baird:

> “Companies need to maximise individual learning and then make that learning available to other organizational members. (...) Once individual learning occurs, lessons can be aggregated, validated and synthesised to produce organizational learning” (Cross & Baird, 2001:11)

1. In Braf (2000) a thorough discussion about knowledge and its relation to organizations can be found.

> "We learned that organizations remember lessons from that past in a variety of ways. An organizations memory resides in the minds of its employees and in the relationships that employees tap on an ongoing basis to accomplish work. Memory is also stored in repositories such as computer databases and file cabinets. Memory can also be embedded in work processes and in product or service offerings that have evolved over time and reflect lessons learned from an organization's past experiences." (ibid., p 8)

> "...knowledge repositories play an important part in preserving organizational memory" (ibid., p 10)

> "Many organizations are combating the problem with programs to capture tacit knowledge. For example, one approach is to video-tape interviews with experts and make these tapes available to all employees." (ibid., p 9)

> "Two important features are useful for building organizational memory. First, time spent interacting on work tasks establishes a sense of reciprocity and trust among colleagues. (...) Second, by working closely together, colleagues build an understanding of each person's particular knowledge and skills." (ibid., p 9)

> "Products or service offerings also tend to shape which skills and organizational capabilities a company will develop." (ibid., p 10)

From these quotations a number of observations concerning the conceived nature of organizational knowledge and learning can be made:

- The origin of knowledge lies in the individual. First, an individual acquires a particular piece of knowledge, for example, somebody becomes an expert in a certain area. Then this knowledge is passed on to other actors in the organization who learns from the expert. Individual knowledge migrates to organizational (see Figure 1).

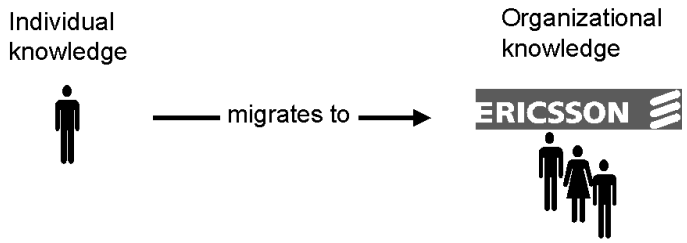

Figure 1. Prevailing epistemology of organizational knowledge

- Organizations can remember things; they have memories. This memory is a container into which knowledge can be stored. The memory resides partly inside the head of the actors in the organization and partly outside actors as artefacts in the organization. Thus, organizations are conceived as having an independent existence. An organization is a being that is equipped with cognitive capabilities such as memory.
- Knowledge is an asset which can be managed like any other asset. It is the job of knowledge workers to pull out the knowledge from individuals and provide it to other individuals through repositories etc.
- Tacit knowledge can be made explicit[1]. An example of tacit knowledge is the knowledge needed to ride a bicycle. It is possible to describe some of this knowledge but not all of it.
- Interaction plays an important part in building organizational memory from individual skills.
- Organizational capabilities are closely related to the products and services provided by the organization.

The conception about organizational learning and knowledge outlined above can be questioned on several points. For example:

1. The concept of tacit knowledge was coined by Polyani (1966)

- There is no clear idea of the nature of phenomena and how knowledge about these phenomena can be achieved[1]. For example, does knowledge emerge from the heads of individuals? If so, how did it get there in the first place?
- Do organizations have memories? Do they have an existence of its own which is independent of humans? Can an organization act?
- Is knowledge something that can be managed like a product or a document? Can it be assigned a label and put into a storage? Can it be downloaded from the net directly to the brain? Is data in a repository equivalent to knowledge?
- Can tacit knowledge possessed by an expert be pulled out and made explicit? Can all capabilities be articulated and written down?
- What is organizational knowledge about? Which is the object of organizational learning?

In our opinion, all these points are valid criticism of the traditional perspective of organizational learning and knowledge. In Section 4 we suggest an alternative perspective which is based on *interaction* as the genesis of all capabilities and knowledge. We claim that this perspective overcomes the many problems in the traditional perspective.

3 How does organizational learning impact Ericsson?

From the previous section it is clear that organizational learning is somehow related to individuals, concerted actions of groups of individuals and artefacts in the organization. With this in mind a number of circumstances in the environment of organizations today will affect the learning of the organization. Among these circumstances are the dynamics of the market, increased competition, outsourcing of operations and acquisition of companies. These will above all impact the individuals in the organizations in terms of staff reduction, blending of cultures and traditions etc. The even more close cooperation between vendors, customers and suppliers makes this aspect even more complicated.

These circumstances are indeed valid for Ericsson. In addition to that the situation for Ericsson is complicated by the nature of the products developed. The ensemble of telecommunication systems has been called the worlds largest machine. As such it exposes a unrivalled complexity. It consists of a networks of interacting nodes and contains many different technologies such as radio-, software-, hardware-, optical- and mechanical technology.

These networks are in a state of constant evolution. New nodes are added and obsolete ones removed. New types of services are implemented. The capacity of the networks are increased. All the time, the networks have to be monitored and reconfigured if for example a node stops working or a cable is cut off somewhere. In addition to this there is a legacy of existing equipments and networks which must be considered when making changes or upgrades.

The development of telecommunication systems is a complex task as well. The sheer size of the task is enormous. A project developing a 3:rd generation mobile systems may take more than a year to complete and it will involve several thousand people all over the world. Furthermore, since there are a number of different technologies involved, very heterogeneous skills are needed. For example, the task of designing a mobile telephone antenna is very different from writing a software program to control an exchange.

Since the projects are distributed to development organizations all over the world, the manner in which development is carried out differs from site to site. Local traditions and cultures have evolved over time. This applies to processes, tools, different ways of thinking, local markets conditions etc. Still, there has to be some commonality in the project in order to put all the pieces together.

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1. These issues are studied in philosophy under the headings of *ontology* (i.e. what reality is or "what there is") and *epistemology* (what knowledge is and how we achieve reliable, well grounded knowledge).

It goes without saying that learning is a vital factor in this scenario. In particular we conjecture that two aspects are important. The first one comes from the observation that different kinds of knowledge are not equally impacted by the circumstances discussed above. For example, the ability to write and debug a particular piece of software code is fairly stable over product generations as long as the particular programming language or development process is not changed. Although we have not made any thorough analysis we claim that the knowledge which is most heavily impacted by changes is the knowledge associated with the *coordination* of the development task.

The other aspect concerns the achievement of *shared understanding*. Again, without any valid justification we claim that the effort to achieve shared understanding in a turbulent environment is by far the heaviest aspect of organizational learning and also the most costly.

4 An alternative understanding of organizational learning

In this section we will discuss an alternative understanding of organizational knowledge and learning. In order to do so we must ground our discussion in a coherent perspective about what knowledge is and how it is acquired. In Taxén (2002) a perspective based on the *praxis* concept is chosen (Kosík, 1976). In this perspective *interaction* is taken as the genesis of all knowledge and capabilities. Thus, knowledge does not originate in the heads of individuals but in the interaction between them. Without interaction with other individuals, society, artefacts or nature, no individual knowledge can emerge. The interaction is mediated by *signs* which are perceived physical objects signifying something outside themselves. For example, in the Ericsson practice, the number combination '1095', which is called the signifier aspect of sign, signifies a 'Requirement Specification'. Outside Ericsson this combination most likely does not signify anything particular.

4.1 Activity Domains

A detailed analysis of the interaction based approach reveals a number of *fundamental constituents* of human activity (Taxén, 2002). The fundamental nature of these constituents implies that they are found in every organized human activity, including the development of telecommunication systems. In order to structure human activity based on the these fundamental constituents Taxén suggests the notion of *Activity Domains*. An Activity Domains (ADs) exhibits the following features:

- *Human activity*: In an AD *Actors* are working together on an *object* to produce a certain *outcome*. The actors have a *motive* for coming together, which is the reason why the AD exists[1]. The object is the main driver for organising the AD.
- *Intersubjectivity*: In order to achieve the outcome, intersubjectivity is necessary. Intersubjectivity arises in the interaction between humans and is a prerequisite for the emergence of various sign systems, above all language.
- *Signification*: The actions in the AD are mediated by *signs* which signifies which phenomena are perceived as relevant in the AD. The 'reality' perceived is always dependent on human interpretation. Understanding is possible only through signs.
- *Experimental learning*: The capabilities and knowledge of actors in the AD are achieved in an ongoing iteration between reflection and action.
- *Stabilizing Core:* The actors in an AD share a common ideology, by which we understand any wide-ranging systems of beliefs or ways of thought. This ideology stabilizes the activities in the AD and provides a mechanism to balance between order and disorder in the AD.
- *Contextuality*: In an AD actions are focused and situated.
- *Context translation*: Different ADs interact with each other. When doing so, a translation between the ideologies as manifested in the stabilizing cores may be necessary.

1. These concepts are taken from *Activity Theory* (see for example Engeström, 1999).

- *Spatiality*: There is a spatial / static structure in the AD. This structure signifies what phenomena actors are perceiving in the AD and how these phenomena are related to each other. This means that the spatial / static view of the AD defines the context of the same domain.
- *Temporality*: There is a temporal / dynamic structure in the AD. This structure signifies how actions in the AD are coordinated. The spatial- and temporal structures interact with and influence each other.
- *Tool usage*: In an AD tools are used to support the activities.

In figure 2 the structure of an Activity Domain is illustrated. As an example of an AD we may take

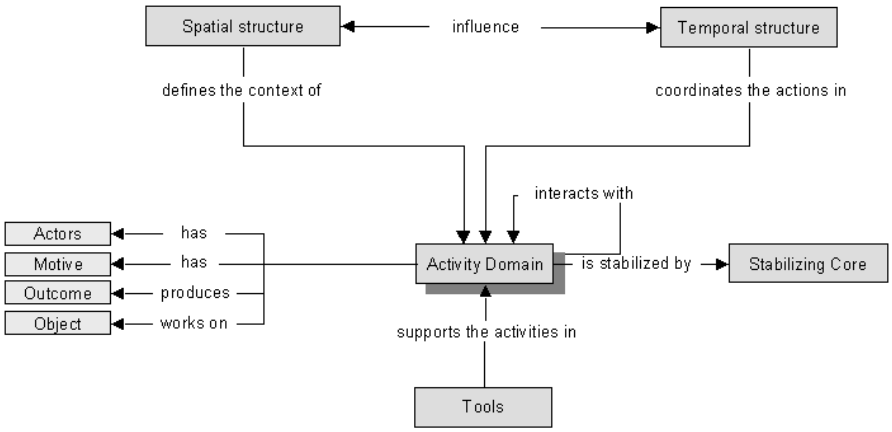

Figure 2. The structure of an Activity Domain

the Ericsson system development practice. Software development is often done evolutionary as in daily builds or iterative development as in the Rational Unified Process (experimental learning).

The development is divided into contexts, each with a particular focus such as software- and hardware development. Each of these contexts has their own outcome and motives. Thus they may be regarded as Activity Domains. These domains also interact, for example between software- and hardware design were there must be an agreed transition between analog signals in the HW domain and digital ones and zeros in the SW domain (contextuality and context translation).

In each context there is some kind of structure of the information being manipulated, for example in the form of product structures, Universal Modeling Language models or entity-relationship models (spatiality). The activities are coordinated by for example process models, interaction diagrams, protocols etc. (temporality).

There are rules and norms which must be followed, for example corporate basic standards for identifying products or telecom standards for telecom systems (stabilizing core). The activities are supported by tools such as information systems, CAD tools etc. (tools usage).

The only fundamental constituent which is not apparent in system development activities is intersubjectivity. Little attention is paid how to achieve intersubjectivity is in a reflected way. However, this might well be one of the largest cost drains in system development, something which anyone having spent endless hours discussing the meaning of a concept can confirm.

4.2 Organizational knowledge apprehended as Activity Domains

We may now suggest an alternative definition of organizational knowledge. An organization may be apprehended as a formalized Activity Domain. As such it may interact with other Activity Domains inside or outside its jurisdiction. In the former case we find units within the organization with certain functions like sales, development, production etc. In the latter case we find, for example, partners and suppliers. Thus the so called ‘extended enterprise’ is included in our definition of organization.

Since organizations are conceived as Activity Domains, organizational knowledge may be defined as such knowledge which is related to the fundamental constituents of an Activity Domain. These constituents may be regarded as attraction points around which various aspects of organizational knowledge is revolves.

For example, like Virkkunen & Kuutti (2000) we claim that organizational knowledge must be closely related to the products and services the organization provides (the object in the Activity Domain):

> "Organizations are not basically knowledge systems, but systems that produce something of value to the society. The knowledge-process framework does not explicate and explain the relation of knowledge processes to the productive processes in the organization; why and what kind of knowledge is needed in the productive processes and their management, and how the knowledge is created and used in these processes." (Virkkunen & Kuutti, 2000:297)

Another constituent is the 'stabilizing core'. An example of this is a recently proposed governance mechanism for managing distributed innovation called a "community of creation". The purpose of this mechanism is to blend the benefits of hierarchies and markets by offering a compromise between too much structure and complete chaos (Sawhney & Prandelli, 2001). Thus, knowledge related to the 'stabilizing core' can be considered as organizational knowledge concerning the balance between central control and autonomy. This kind of knowledge is of outmost importance to cope with flexibility and change. Too much control *and* too much autonomy will both result in stagnation.

In the same way, different types of knowledge can be associated with the other constituents. For example, process models are artefacts related to the constituent 'temporality'. Information model[1] are artefacts related to the constituent 'spatiality' etc. The constituent 'intersubjectivity' is associated with the shared knowledge among actors in the organisation. Thus, like the traditional definition our definition of organizational knowledge also includes individual, intersubjective as well as objectified aspects. However the difference is that our definition is grounded in a coherent theoretical perspective on what knowledge is and how it is achieved.

5 Coordination of complex systems' development

The turbulent conditions facing the development of telecommunication systems impact above all the *coordination* of the development. Coordination can be apprehended as "... managing dependencies between activities" (Malone & Crowstone, 1994:90). First of all, coordination is affected by the inherent complexity of the development task. Furthermore, due to changing requirement and other circumstances, a more or less constant re-planning must be done which also affects coordination. If the coordination fails for some reason it is a threat to the entire project and business opportunities may be lost. The product may be delayed or perhaps not delivered at all to the customer. The delivery may contain erroneous or missing parts etc.

Coordination can be seen as an Activity Domain (AD) where actors are working together to achieve the outcome 'coordination'. The items which are coordinated are called *managed items* (the objects in the AD). Examples of these items from the Ericsson practice are:

- Products and their describing documents.
- Requirements on the system as stated by the customer.
- Trouble reports describing various types of errors.
- Engineering change orders calling for controlled changes of the system.
- Baselines which describes a certain achieved configuration of the system which cannot be changed without specific, control procedures.

1. These are sometimes called 'information architecture', 'business models', 'data models' and the like.

- Incremental deliveries during the project where parts of the complete specification are fulfilled.
- Test cases which are used to test that the system fulfils its specification.
- Milestones controlling the progress of the project.

In a concrete coordination situation the organizational knowledge associated with the coordination AD has to be articulated. This includes individual and intersubjective knowledge as well as objectified artefacts like processes, information architectures and tool support for coordination. In order to support this articulation a *framework* has been developed and deployed in the Ericsson development practice (Taxén, 2002).

The framework consists of three *models*, an *information system (IS)* and a *strategy* for articulating the coordination AD. The models capture the spatial and temporal constituent of the AD as well as the border of the coordination AD towards other ADs such as for example software- or hardware design. To achieve intersubjectivity about the coordination AD, the models and their implementation in the IS are constantly being modified by alternating between reflections over the models and trying them out in real development projects. Thus, the articulation strategy emphasizes the experimental learning and the intersubjectivity constituents of the coordination AD. In order for this strategy to work, the IS must be very easy to modify[1]. In fact, there is no specification of the IS other that on a contextual level, for example that requirement management should be included in the coordination context. This means that an evolutionary development strategy for the IS is applied.

The Framework has been gradually implemented in the development practice in the Ericsson company over several years. Currently the Framework is used to coordinate the software integration in some of the largest and most advanced development projects at Ericsson, including the 3:rd generation mobile systems. To illustrate the complexity of this task, in Figure 3 the dependencies between development increments are illustrated. Every white box indicate a certain increment and each line a dependency. The results indicate that the framework contributes positively to the coordi-

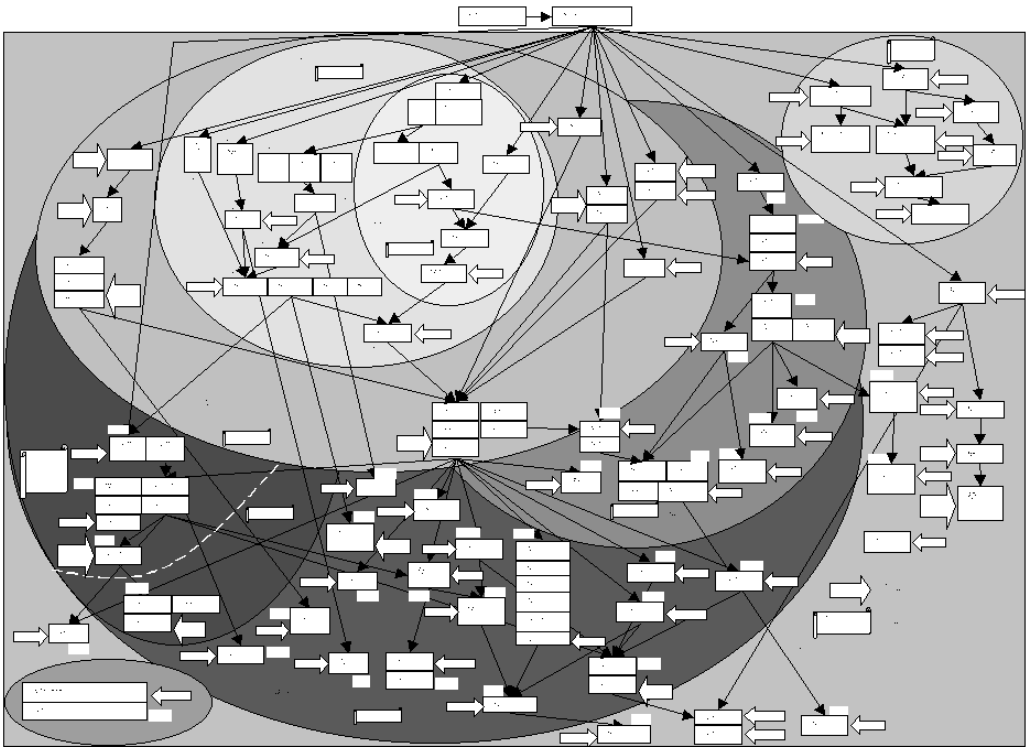

Figure 3. Dependencies between development tasks

nation task. For example, a project manager in one of the first projects made this statement after the

1. In the framework the information system from eMatrix from Matrix-One Inc. is used.

framework had been in use for about a year:

> "Well, the positive effects that we have, that is that we have an integrated project support system where we have tremendous possibilities to improve, continuously improve our operations. We have a good support for configuration management, our engineering change requests are in order, our baselines are in order etc. In addition I think that we have the possibilities to manage requirements in a good way and make them obvious and we can achieve a very clear traceability all the way from customer requirements one might say."

During this year several hundred changes was done in the IS implementation in the project. These changes were due to new insights, new coordination requirements, an improved shared understanding, plain errors in the implementation etc. In this process, the coordination activity was gradually structured both spatially and temporally to suit the needs of the project. A detailed account of the impacts of the framework is given in Taxén (2002).

In figure 4 an example of the information model for the coordination AD is given. The model shows what managed items are coordinated and how they are related to each other. Thus the model constitutes 'spatiality' in the coordination AD at a particular instant in time. The model has emerged in an ongoing discourse among the actors about the content and form of the model. Thus the model can be apprehended as a sign which signifies the spatial structure of the coordination AD for the actors. The signifier (the physical aspect of the sign) has two forms: the media in which the model is manifested (document, overhead-films and the like) and the implementation in the information system. Thus, the model / sign functions as an instrument to achieve individual and intersubjective understanding and to objectify this understanding as artefacts in the coordination AD. The result will be an organizational learning concerning the spatial structure of the coordination AD. A similar analysis can be made for the other constituents of the AD.

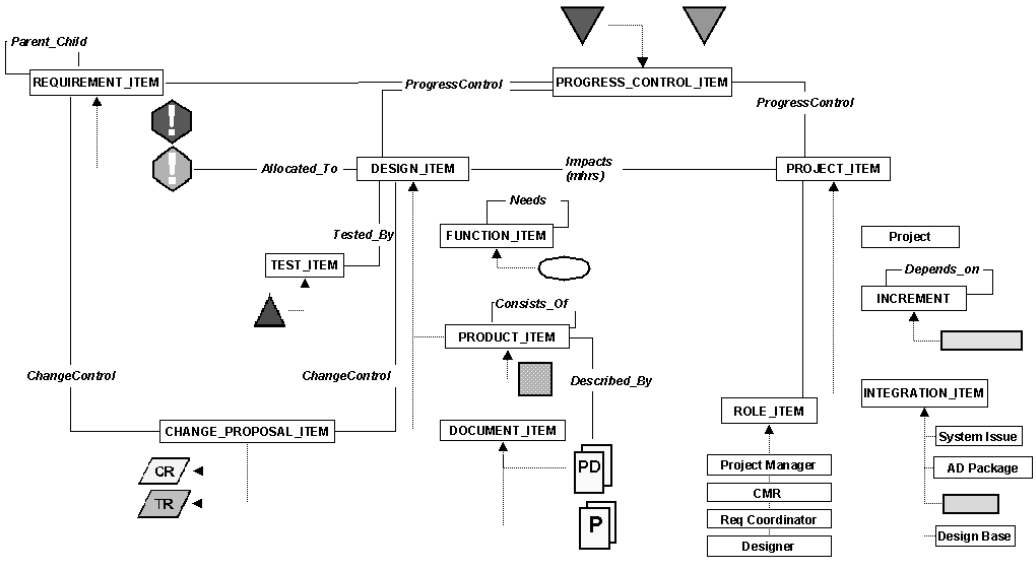

Figure 4. Spatial structure for a coordination context

6 Conclusion

An alternative approach to organizational learning has been proposed in this paper. The approach has been applied in the coordination of the development of complex systems such as the 3:rd generation mobile telecommunication systems. This indicates that the approach is capable of structuring the notoriously nebulous concepts of organizational knowledge and learning into a form which is of practical use.

One consequence of this approach is that large and distributed organizations like Ericsson should be conceived as a number of interacting Activity Domains. This may include the 'extended enterprise' where customers, vendors, suppliers and partners are contributing to the goals of the company. This shift in basic thinking about the nature of the organization has in fact already begun at Ericsson. A corporate initiative has been launched to restructure product related information. In this project[1] the whole of Ericsson is regarded as an Activity Domain which need to interact with four basic Activity Domains: Market & Sales, Supply & Implementation, Research & Development and In Service Support. So far this way of apprehending the organization is promising and have already delivered useful results. For example an analysis revealed an appalling lack of shared understanding about basic information management concepts in the different Activity Domain. Another result is the need for a stabilizing core which makes it possible to balance central control with local autonomy.

The prime advantage of the proposed approach seem to be that it brings intersubjectivity in focus for organizational learning. Although not visible in balance sheets and business cases, the effort to achieve a necessary intersubjectivity may well be the largest cost item of all in the organization. However, negligence of this cost item might lead to erroneous and eventually disastrous decisions.

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1. This project is called the "PDM Core definition" project.