An inquiry into ERP systems from an”activity” perspective

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Original Publication:

Lars Taxén , An inquiry into ERP systems from an”activity” perspective, 2009, Akademin för svensk affärssystemforskning: Utveckling och användning av affärssystem i privat och offentlig sektor, Linköpings universitet, 26-27 november.

Postprint available at: Linköping University Electronic Press
http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-111351

An inquiry into ERP systems from an"activity" perspective

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Abstract

The development, acquisition, adaptation, and diffusion of ERP systems in organizations pose immense challenges. In order to meet these challenges, there is a need for a theoretical framework by which informed actions can be taken concerning ERP implementations. The purpose of this contribution is to investigate what insights can be achieved from basing such a framework on the construct of "activity" in Activity Theory. Activity is the social context framing meaningful actions directed to a work object. Since many different kinds of work objects appear in an organization, the organization can be regarded as a constellation of activities that need to be coordinated. This perspective provides an alternative way to investigate what kind of impacts ERP systems will have in organizations. In particular, the contradiction inherent in the meeting between the standardization aspirations of the ERP system and the idiosyncratic worldviews of activities can be analyzed.

INTRODUCTION

The development, acquisition, adaptation, and diffusion of ERP systems in organisations pose immense challenges. Most of these challenges can be traced back to the contradiction between drive for commonality inherent in ERP systems and the unique needs of the organization. For example, concerns have been raised about the ability of ERP systems to evolve with changing organizational needs if too much commonality is imposed on organizational functions. One view is expressed by the opinion that "implementing SAP is like pouring cement in the organization" (The Economist, 2007), while others point to evidences of the opposite (e.g. Goodhue et al., 2009). A related issue is alignment; the capability of the organization to align IT and business, which still is among the top concerns of CIOs (Luftman & Kempaiha, 2007; Luftman et al., 2009).

In order to meet the ERP challenges, there is a need for a theoretical framework by which informed actions can be taken. In particular, the reciprocal interaction between context and technology needs to be better understood:

> [There is a] need to research the design, implementation, use and evaluation of ES [Enterprise Systems] (and indeed any other technology) within and across contexts so that we can examine the ways that such systems shape and are shaped by individual and group interests and preferences as well as organizational and societal structures and cultures. (Howcroft et al., 2004, pp. 272-273)

To this end, I propose to use the construct of "activity" in Activity Theory (AT) as a way to understand the non-trivial notion of "context". In doing so, I link up with an increasing number of research approaches take some kind of practice construct (Schatzki, 2001) as the basic Unit of Analysis. Examples of such constructs are "social world" (Strauss, 1985); "communities of practice" (Lave & Wegner, 1991); "thought world" (Dougherty, 1992); "knowledge domain" (Boland & Ramkrishnan,1995); "work situation" (Bannon & Bødker, 1997; "workpractice" (Goldkuhl & Röstlinger, 2002); "work context" (Bechky, 2003); "work system" (Alter, 2006); "activity domain" (Taxén, 2009).

The underlying belief in all these practice related constructs is that goal-oriented, situated human activity is the genesis of individual and constructional aspects of the society in which the individual is immersed. My motivation for concentrating on the "activity" construct is that it has some inherent qualities concerning, above all, collective meaning construction that I wish to further elaborate.

The purpose of this contribution is to investigate what insights on ERP systems can be achieved from an activity perspective. Activity has a very specific meaning in AT that differs from its usual connotation in ordinary English. According to Leont'ev (1981), activity is the social framing within which individual actions make sense. The formation of an activity is driven by the work object towards which actions are directed, and the motive for the existence of the activity. Over time, each activity will develop its own, particular worldview in terms of structures, language, tools, norms, etc. Since many different kinds of objects are worked on in an organization, the organization can be apprehended as a constellation of activities. In order to produce whatever products or services the organization provides these activities need to be coordinated.

An ERP system can be apprehended as a mediational means with certain built-in capabilities. Depending on the nature of the work object, these capabilities may be more or less useful in an activity. For example, the ERP system is not useful in an activity that develops ASICs (Application Specific Integrated Circuits). On the other hand, the ERP is highly relevant in an activity that makes up the balance sheet of the organization.

Following this line of thought, the paper is structured as follows. In the next section, the activity construct in Activity Theory is recapitulated. Next, the conceptualization of the organization as a constellation of activities is outlined. The following section analyses ERP system from the activity perspective. Based on this analysis, some guidelines for implementation of ERP systems are given. The main conclusion is that the activity perspective provides an alternative way for addressing the challenges associated with ERP systems; a way that is promising enough to deserve further exploration.

THE ACTIVITY CONSTRUCT

"Activity" (German: Tätigkeit; Russian: deyatel'nost') is the central concept in Activity Theory (AT).[1] Activity was first introduced by Leont'ev as a fundamental unit in his investigations of the early manifestations of the mind in the human evolutionary history:

> I will call the process of *activity* the specific processes through which a live, that is, active relation of the subject to reality is realized, as opposed to other types of processes. (Leont'ev, 1981, in Kaptelinin & Nardi, 2006, p. 55)

Activities cannot exist without *objects*: "Any activity of an organism is directed at a certain object; an 'objectless' activity is impossible" (ibid., p. 55). Activity in this sense is equally applicable to every organism that engage in its immediate "life-sphere", whether they merely respond to signals like ticks, modify their environment like spiders or use tools like apes using sticks to catch termites. With the evolution of neural networks in organisms came the possibility of activity mediated by representations of phenomena, for example, heeding calls warning for predators. However, the significance of these representations rarely stretches beyond the immediate situation in space and time that the organism encounters.

With the human mind, a qualitatively new level of the psyche is reached. Representations can signify situations beyond here and now: past times, future events, places far away, and so on. The survival of a human being is not solely determined by naturally given physical and biological things such as the availability of food, shelter, etc., but also of the social reality the individual is born into. Ontogenesis, i.e. the development of the individual, implies the appropriation of meaningful, referential concepts and signs that have evolved historically over time in a specific cultural setting. In particular, the individual must learn to master the language of its social milieu.

With the cultural dimension, activity becomes a social phenomenon in which humans join forces to fulfill social needs such as producing food. This brings forward another dimension of activity – the division of labor. Rather than having everyone doing all and the same tasks, the collective effort is distributed to different individuals, each proficient in performing a specific task. This implies that the actions of each individual need to be coordinated with the others. Thus, the division of labor brings about a more efficient way of fulfilling the social need at the expense of an extra effort to coordinate individual actions.

In order to illustrate the activity construct, we can use the mammoth hunting scene in Figure 1:

[1] Activity Theory was an attempt to apply Marxian ideas to psychology in the early decades of the new socialist state, the Soviet Union. The front figure in this pioneering movement was the psychologist and semiotician L. S. Vygotsky (1896-1934) together with his collaborators A. N. Leont'ev (1903-1979) and A. R. Luria (1902-1977). Other prominent researchers in this spirit were V. N. Vološinov (1895-1936), M. M. Bakhtin (1895-1975), and E. Ilyenkov (1924-1979). During the last couple of decades, AT has gained a renewed momentum among Western researchers and been further developed by the works of M. Cole, J. Wertsch, Y. Engeström, and others. For good account of Activity Theory, see e.g. Kaptelinin & Nardi (2006).

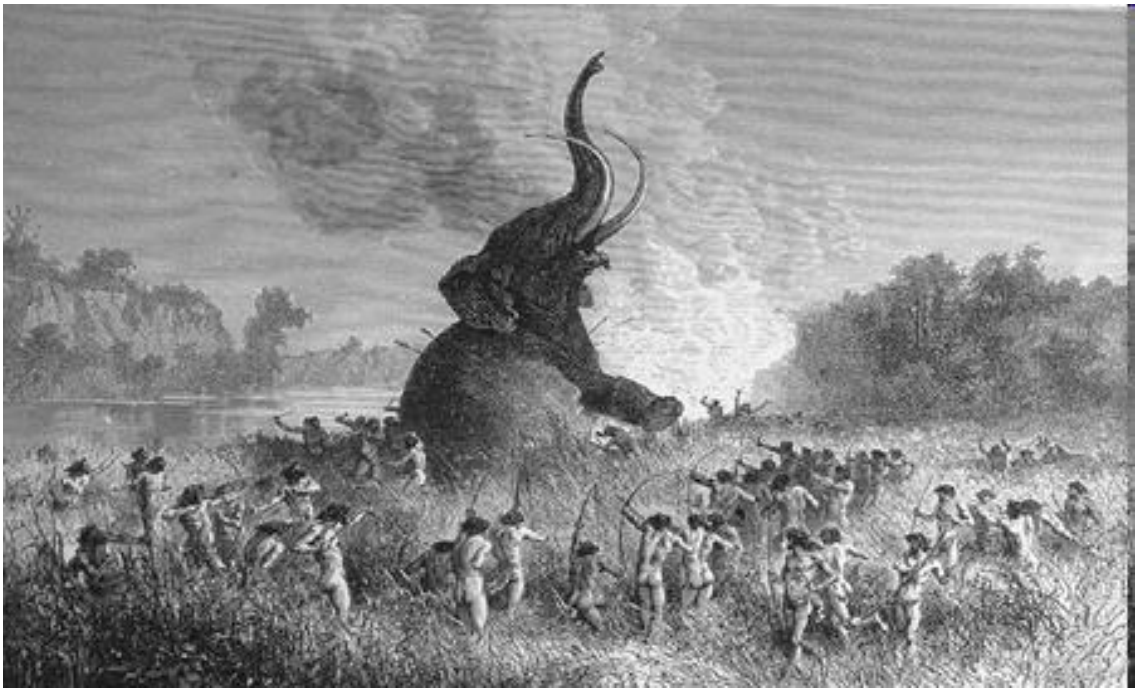

Figure 1: Illustration of an activity (Bryant & Gay, 1883. Original wood engraving by E Bayard).

When looking at this scene some things immediately come to mind. The mammoth is the object around which everything else revolves: hunters, bows and arrows, actions, shouting, making gestures, and so on. There are also several perceivable motives for the hunt in the scene: the primary one is presumably to get food. Related motives may be to get material for clothing, making arrowheads, and the like. Thus, by killing the quarry, social needs motivating the activity is fulfilled.

It can also be seen in the background of the illustration that some actors, the beaters, have started a fire and make noises to scare the quarry away. The mammoth escapes in a direction where other hunters wait to circumvent the quarry and kill it. It is only in the light of the activity that the beaters' actions stand out as meaningful. Just scaring the quarry away does not make sense if other hunters are not waiting to ambush it somewhere else.

It is obvious that the activity is a social one. The hunters have to coordinate their actions. If every hunter attacked the mammoth one by one without coordination, the result would be disastrous. In order to coordinate actions, certain commonality must exist about how the hunters conceive the activity as a whole, including what constitutes purposeful and relevant actions. Thus, the activity frames a context, which determines what is relevant, and how these relevant things are characterized.

Activities are not isolated. The brought-down quarry will be cut into pieces and prepared to eat. This is done in a cooking activity, which in turn has its motive (to still hunger) and an object (which happens to be the same as for the hunting activity: the mammoth). Other related activities might be manufacturing weapons and weapon parts from the bones and the tusks of the mammoth. When several activities cooperate, certain issues must be resolved in the transition between the activities, such as how to share the quarry between hunters and cooks, or decide how many ready-made arrow heads will be returned for a certain amount of food. Since each activity necessarily creates its own worldview over time, these worldviews must be reconciled to the extent that the interaction is made possible. This, however, does not mean that the worldviews have to be identical. In fact, this is not even possible; every activity is, from an epistemological point of view, unique to some extent even if the object and motive are the same.

Capabilities

Actions are always *mediated* by activity specific means: tools, rules, symbols, languages, and

the like[2]. Means may be essentially material, such as hammers and axes, or essentially communicative, such as commanding persons, requesting things to be done or simply declaring things: "We appoint you the leader of the tribe!"

By focusing on the mediational aspects of actions, the concept of "capability" is near at hand. Someone acting with mediational means is easily conceived as a capable person. It is the joint capabilities of humans and means that enable actions. So, for example, the action of felling a tree implies that the lumberjack is capable of using the chainsaw in a proper and safe way. Moreover, he must make a series of judgments concerning the strength and direction of the wind, how to transport the cut tree out of the forest, how to take proper actions if something goes wrong, etc. It is virtually inconceivable how to characterize the activity of felling a tree without taking into account the joint and indivisible capabilities of the lumberjack and his chainsaw.

However, the joint capability is useful only in the particular activity taking shape around the object (a tree) and the motive (to get cut wood for heating or building purposes). In another context, such as painting a wooden house, the lumberjack and his chainsaw would be utterly useless. Thus, capabilities of persons and means become resources only in relation to the context where these capabilities make sense.

Still another aspect of capabilities is that they are inherently individual – social in character. Even if human capabilities reside in individuals, there is always a social aspect included. This is of course most evident when it comes to language; we cannot cooperate unless there is a common understanding about the particular language in a work context. Terms like "spanker", "jib boom" and "brace up" make sense only to those engaged in square rigged sailing vessels.

The use of "capabilities" rather than "knowledge" indicates a deliberate intention to include mediational means as parts of actions. Means and actions are so deeply intertwined that it is more appropriate to speak of "individual(s)-acting-with-mediational-means" rather than individual(s) alone when referring to the agent of action (Wertsch, 1991). This view is also a dialectical one: the joint meeting between actor and means will inevitably change both. The actor will gradually learn how to master the means, and the means will be improved, changed or recast according to its usability in an activity. As a consequence, changes are inevitable; they are inherent in the activity itself.

Over time, the inner workings of the activity and the way actors think about it will become "common sense". Certain things will be taken for "facts" and be treated as such. However, what is counted as "facts" is a consequence of the activity and its development in time and space.

> The question whether objective [*gegenständliche*] truth can be attributed to human thinking is not a question of theory but is a *practical* question […]. The dispute over reality or non-reality of thinking which is isolated from practice is a purely scholastic question. (Marx, 1852, p. 13, italics in original)

This also means that new capabilities, both in humans and means, emerge in activity:

> [Man's] actuality and his potentiality change in the course of man's historical development. Genuinely new potentialities arise as a result of human praxis. (Bernstein, 1999, p. 70)

In summary, activities emerge as an inevitable consequence of actionable humans. The activity frames a context within which individual actions make sense. Thus, the activity perspective can be thought of as a perspective where meaning and sense-making are brought to the fore. Mediational means, whether essentially material or communicative in nature, must stand out as meaningful. A tool, which no one recognizes as a tool, is as useless as a term that no one understands.

THE ORGANIZATION FROM THE ACTIVITY PERSPECTIVE

How can the activity perspective presented in the previous section be applied to organizations? A first observation is that the reality in contemporary organizations is, in principle, not different

[2] For a thorough analysis of mediation, see e.g. Bødker & Bøgh Andersen (2005).

from that facing the mammoth hunters in times long gone[3]. Activities are still formed today, producing things that fulfill social needs such as food, cars, trains, health care, weapons, and whatever commodities we think we need. The fundamental structure of activities remains the same; only the objects – henceforth referred to as *work objects* – motives, means used, norms, work methods, etc., have changed.

Since many different work objects are transformed in an organization, it can be regarded as an activity that in turn coordinates a constellation of activities. The work object of the organization itself is the product that is offered to its customers or clients. The organizational motive is usually veiled in the business idea or slogan. For example, Ericsson, a supplier of telecom systems and mobile phones worldwide, promotes the slogan "Taking you forward". This illustrates "Ericsson's vision of being the prime driver in an all-communicating world" (Ericsson, 2008). The Ericsson competitor Nokia retorts with "Connecting People" (to which some witty person added: "Disconnecting Families" due to the high work load on employees).

The activity perspective can be illustrated with the example from Ericsson in Figure 2:

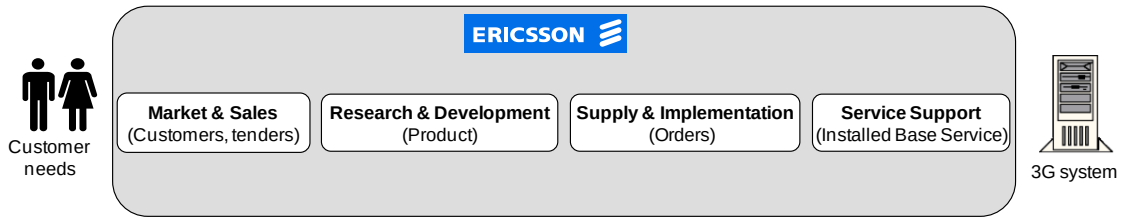

Figure 2: An activity view of Ericsson

Ericsson may be considered as an overall activity that provides products such as third generation (3G) mobile systems to customers. In order to do so, a number of other activities are mobilized: Market & Sales, Research & Development, Supply & Implementation, and Service Support. These activities work with different work objects according to Figure 2. In addition, there will be other activities concerned with financing, human resources, supply chains, software development, hardware development, mechanical design, manufacturing, and so on.

It is important to distinguish between activities and organizational units as displayed in an organizational chart. The activity is a more basic phenomenon since it is shaped around a work object. So, for example, if an organization decides to outsource, say production of printed circuit boards to another organization, the corresponding unit in the organizational chart is removed. The activity, however, remains since the motive and the work object have not changed. Of course, outsourcing has a number of implications that will impact how the work is carried out: people in the outsourced organization may have to enact capabilities to work with different kinds of circuit boards from various customers; they might need to learn new rules for naming the boards; contracts have to be written to regulate the business transactions between the two organizations, and so on.

Transformative and coordinative actions

Since coordination is essential for the analysis, the question is how we elaborate conceptions of coordination to include the activity construct? Malone & Crowston have suggested a commonly quoted definition of coordination:

> [Coordination is] managing the dependencies between activities. (Malone & Crowston, 1994, p. 90)

This seems straightforward enough. However, in this definition, "activities" correspond to individual actions, not activities in the sense I am discussing here. As we shall see, however, it

[3] The reason for the fundamental consistency of activity structure over time and place is to be found in the cognitive and biological constitution of human beings. We construct activities based on fundamental faculties achieved during the phylogenetic development of mankind. I have suggested that basic faculties engaged in coordination are contextualization, spatialization, temporalization, stabilization, and transition; the so called *activity modalities* (Taxén, 2009).

is still possible to use this definition, provided that activities are interpreted in the AT sense.

I will start from the assumption that two basic types of capabilities are needed in an activity: capabilities to perform transformative actions by which the work object is transformed into an outcome, and capabilities to coordinate transformative actions. In order to distinguish between these, the activity may be seen from two interrelated viewpoints: the *transformative* and the *coordinative* ones. These represent two different foci; one where the transformation of the work object is in focus – the transformative mode – and one where coordination of transformative actions is in focus – the coordinative mode. Sometimes it is convenient to regard these perspectives as two intertwined activities – the transformation and coordination ones respectively – however, with the transformative one as the primary, since this mode is directly related to the work object. Consequently, coordination is seen as an activity in itself that has its own work object – coordination:

> Thus, by entering into cooperative work relations, the participants must engage in activities that are, in a sense, extraneous to the activities that contribute directly to fashioning the product or service and meeting requirements. That is, compared with individual work, cooperative work implies an overhead cost in terms of labor, resources, time, etc. (Schmidt, 1990, in Schmidt & Bannon, 1992, p. 8)

An example may clarify the relation between the transformative and coordinative modes. Let's consider a possible requirement of a car. The content of such a requirement may be: "The car shall consume less than 0.5 liters per 10 km at a cruising speed of 100 km per hour". The work object – the car – must fulfill this requirement. In addition there might be a multitude of other requirements on form, safety, exhaust limits, and the like.

In order to coordinate the actions in the transformative mode, there is a need to keep track of all the requirements, preferably in a requirement management tool. To achieve this, certain coordinative capabilities must be enacted such as unique rules for identifying and revising requirements; a set of states indicating what state a requirement is in (for example, whether the requirement is fulfilled or not); attributes characterizing requirements; relations to other items such as requirement issuers/customers and the product the requirements are directed to, and so on. In the coordinative mode, only such coordinative aspects of requirements are relevant, not the actual content of a requirement. The content, on the other hand, is of course relevant in the transformative mode.

The outcomes in the coordinative mode – the realized work object – are information models, process models, rules, information system (IS) support, etc.; means that are relevant for coordinating actions. In the transformative mode, coordinative capabilities are utilized to coordinate transformative actions. Both these types of capabilities have to be enacted; i.e., the capabilities evolve in interplay between actors and their mediational means. Thus, the activity unfolds through an ongoing focal shift between the coordinative and transformative modes. This is illustrated in Figure 3:

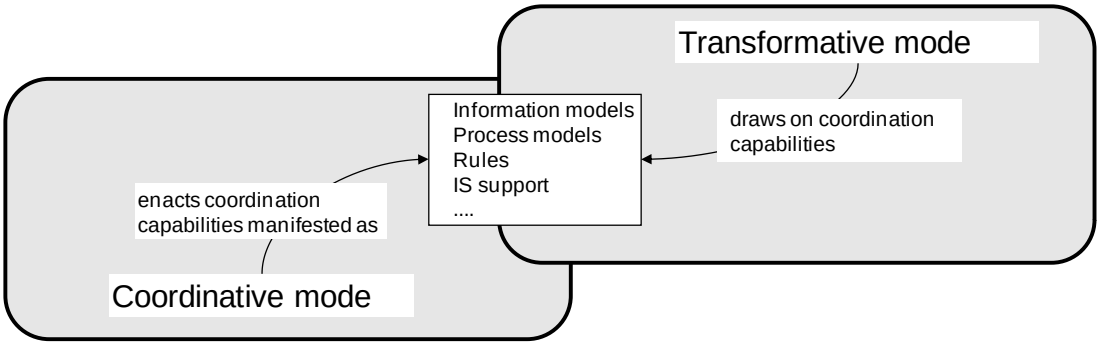

Figure 3: The two modes of the activity

The pattern of coordinative and transformative modes of actions can be generalized to activities themselves. When a certain activity employs other activities, these must be coordinated as well. This is illustrated in Figure 4:

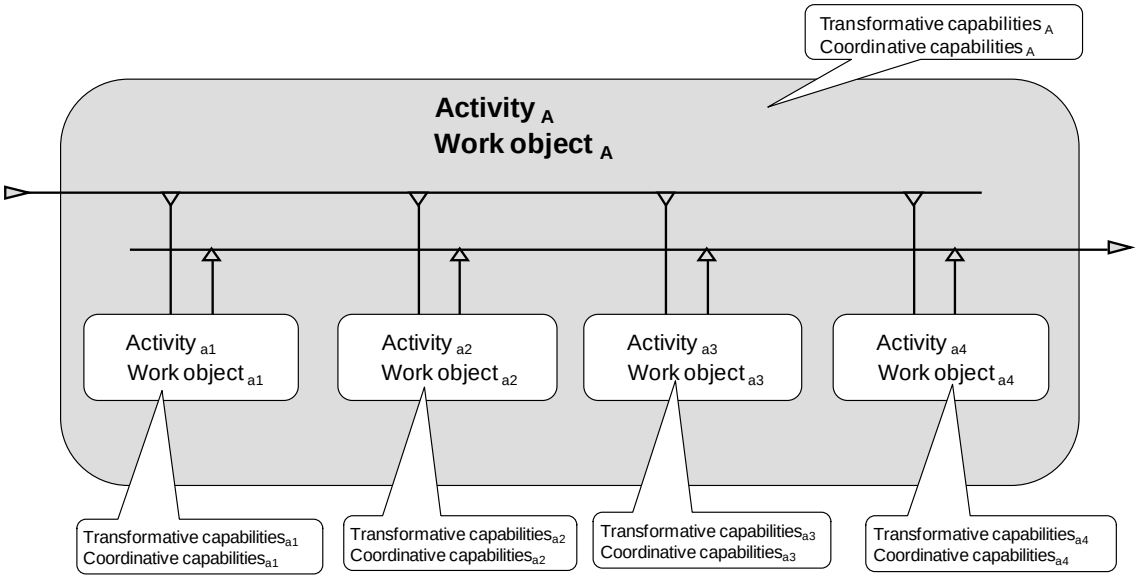

Figure 4: The recursive nature of the activity

Suppose an activity (A) is employing four other activities to produce its outcome. This means that activities a1, a2, a3, and a4 provide capabilities that are useful in A, provided that they are properly coordinated (symbolized by the lines and arrows in Figure 4), which in turn implies that specific coordinative capabilities must be developed in A.

This pattern is repeated in each of a1, a2, a3, and a4, which in turn may employ other activities, and so on. Thus, the activity construct is a recursive one. Since every activity evolves its own worldview, however, there is a need to elaborate how the transition between the "inner" and "outer" of each activity shall be take place. For example, there is a need to reconcile different terms and concepts used inside and outside an activity. The effort to develop these transitional capabilities is a substantial part of enacting coordination[4].

Dependencies between activities

How shall "dependencies" in the definition of coordination, suggested by Malone & Crowston, be understood? When struggling with coordinating complex telecom development projects at Ericsson, it was gradually realized that the most efficient conceptualization was to see the system as *dependencies between capabilities*; the reason being that if such dependencies are not known or erroneously conceived, the system does not work. Take, for example, an ordinary computer. All parts of the computer, the processor, the screen, the DVD-player, the network controller, and so on, depend on one single capability: the one provided by the power-on button.

The same reasoning can be applied to organizations. An activity can be seen as a capability that the organization needs in order to operate. Since the capabilities depend on each other, there is a need to clarify these dependencies. This can, for example, be visualized in a *capability dependency map* like the one in Figure 5:

[4] The capability to "move" between activities is the *transition* activity modality (Taxén, 2009).

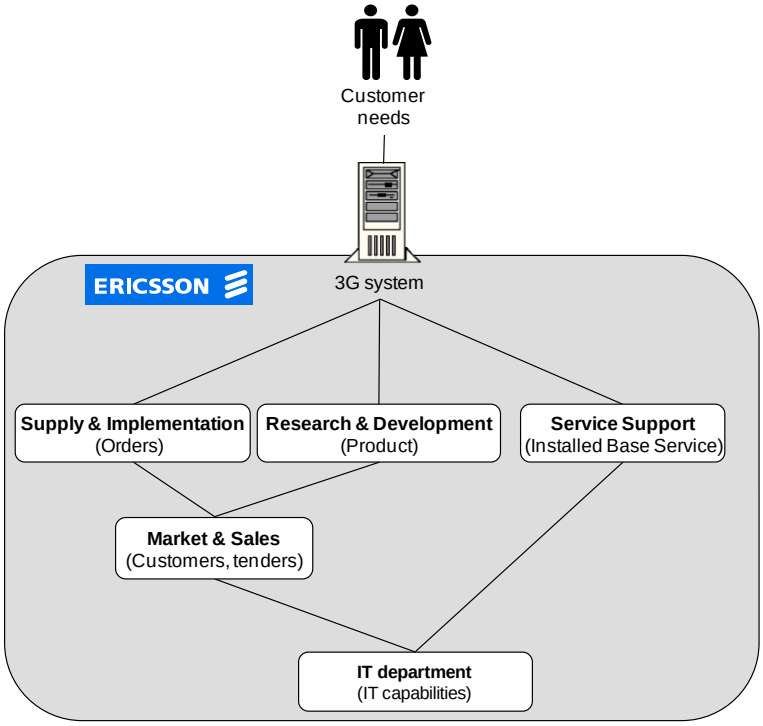

Figure 5: A capability dependency map of Ericsson

The map shows that the 3G system fulfilling the customer's needs is realized by the Supply & Implementation activity providing order management resources, the Research & Development activity developing the product, and the Service Support activity providing services of sold products. The Research & Development and Supply & Implementation activities both need the resources of managing customers and tenders provided by the Market & Sales activity. The resources provided by the IT department activity are needed by all other activities in the organization, indicating that if this activity fails for some reason, the entire organization will come to a halt[5].

It should be remembered that capabilities provided by activities refer to both human actors and means. For example, if the organization experiences a power supply failure, this will cause severe problems in spite of the capabilities of, say IT infrastructure actors have not "failed". Summing up: provided that activities are understood in the AT sense, coordination can still be conceived as "managing the dependencies between activities" as Malone & Crowston (1994) suggested.

ERP SYSTEMS FROM THE ACTIVITY PERSPECTIVE

A straightforward consequence of the activity perspective is that the activity should be taken as the Unit of Analysis (UoA) when analyzing the effects of the ERP systems. The recursive nature of the activity construct – activities can employ other activities – makes it possible to apply the same analysis on any organizational "level", whether that is the individual, the group, the organization itself, the inter-organizational context, or any other "level" [6]. This is a definite advantage when dealing with complex things; a simple, recurrent structure that can be applied in different contexts alleviates common understanding among actors. In this section, I will discuss some aspects of ERP systems from this standpoint.

[5] Due to ease of reading, the direct dependencies from the IT department to Supply & Implementation and Research & Development are suppressed in the diagram. These dependencies are indirectly present through the Market & Sales domain.

[6] See e.g. Wiley (1988) or Markus & Robey (1988) for thorough discussions of the micro-macro problem in social theory.

Contextualization

A first observation is that the activity perspective brings about a focus on contextualization. The ERP system will be interpreted in the context of the activity, as will other tools, methods, rules, terms, etc. The latent capabilities of the ERP systems to become a resource in different activities will vary. In some activities, such as those working with the intended target functions of the ERP system, the impact will be high. In other activities the impact will be less or none at all.

The relevance of an ERP system in an activity is two-fold. Either the system becomes an activity-internal resource, or the activity may provide data to the ERP system that is needed in other activities. Suppose, for example, that an activity A makes use of ERP-data created and maintained in two other activities B and C (see Figure 6, left part). The size of the ovals represents the relative importance of the ERP system in activity A.

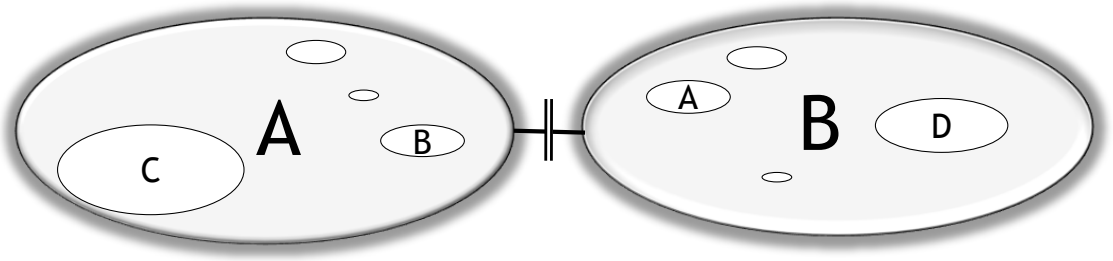

Figure 6: Two interacting activities

If we change focus and view the ERP system form the context of activity B, the situation may appear different. B is making use of ERP-data produced in A and D, but not C (see Figure 6, right part). Thus, there is a need to understand how contextualization affects ERP systems and their implementations in organizations.

Commonality versus locality

Contextualization implies that data residing in the ERP system may be interpreted differently in different activities. Although an enormous amount of data are stored in the system, only a fraction of that may be relevant in a particular activity. Consequently, contextualization brings about a tension between what is activity-specific data in the ERP system and what is meant to be common, organizational-wide data, so called master data. This tension does not concern data only; it concerns organizational fundaments. The primary role of "[the firm is in the] application of existing knowledge to the production of goods and services" (Grant, 1996, p. 112). However, this knowledge must necessarily be of different kinds; otherwise there is no reason for the organization to exist:

> [Knowledge integration] depends upon the extent of commonality in […] specialized knowledge. There is something of a paradox in this. The benefit of knowledge integration is in meshing the different specialized knowledge of individuals - if two people have identical knowledge there is no gain from integration - yet, if the individuals have entirely separate knowledge bases, then integration cannot occur beyond the most primitive level. (Grant, 1996:116)

Thus, commonality in relation to ERP system should be conceived as a balancing problem: what should be common across all activities and what should be considered to be "local", i.e. activity specific? Where the optimum balance point is situated can only be worked out in practice. It is quite certain though, that both end-points – complete commonality and complete locality – are devastating for the organization. Complete commonality will drive the organization to a standstill, while complete locality will result in a constellation of isolated activities that cannot be coordinated.

It is also important to realize that commonality is not in conflict with flexibility. In fact, without some stable or relative persistent core in an activity, flexibility is not possible. Such cores are mostly materialized as rules, standards, norms, etc. For example, the standard dimensions of an electrical outlet enable a multitude of electrical equipments to be connected to the electrical network. However, the scope of commonality is always bounded. Different

regions of the world have different designs of outlets, requiring adaptation plug-ins for equipments to work across regions. The same goes for ERP systems: their scope is always bounded. If ERP systems are to communicate across such boundaries, some kind of "organizational adaptation plug-ins" is needed.

The emergence of capabilities

Suppose the motive for implementing the ERP system is to get a common way to manage products, and to replace overlapping and fragmented legacy ISs. The starting point for such a task is usually an investigation of the "as-is" situation, by which current "facts", that is, the current constellation of ISs and the information managed in these systems, are established. This is followed by a phase where the "to-be" situation is envisaged, that is, the "ought" is established. Based on this information, plans are executed to transform the "as-is" state into the desired "to-be" state.

From an activity perspective, the current "facts" are a congealed form of human activity that is specific for a particular organization. When establishing the "as-is" situation by using, for example, a particular method and type of documentation, the situation will inevitably change. With the creation of artifacts describing the "as-is" situation (process models, information models, and the like), actors will see the situation in a new light. Thus, the mere act of establishing the "as-is" situation will change that situation.

The same considerations are valid for envisaging the "to-be" situation and the task of implementing the ERP system according to the "to-be" vision. Carrying out these tasks is a dialectical process where both the "as-is" and the "to-be" situations will inevitably change[7]. From a rationalistic point of view, these changes are regarded as undesirable disturbances that should be minimized by improved methods and planning techniques. However, from the activity perspective, changes are inevitable.

Adaptations

The vendor of an ERP system provides a platform with built-in capabilities that might or might not turn out to be useful in the organization. Among these capabilities are various modules supporting activities related to ERP targets such as purchasing, manufacturing and distribution, customer relationship management, sales order processing, online sales, financials, human resources, and so on. For each of these areas there are reference models available representing alleged "best practice" ways of working. Additional capabilities may be means to configure the system, to set up and distribute physical databases and client servers, to define reports, and much more.

In order for these "latent" capabilities to become resources in a specific organization at least two things must happen. First, the ERP platform and the organization must be adapted to each other. Sometimes, ERP-systems are promoted as OOTB (Out-of-the-box) systems, i.e., system that can be put to use immediately with minimal or no effort. However, adaptation cannot be avoided since every organization, seen as a constellation of activities, evolves its own worldview, which needs to be matched to the built-in worldview that is designed into the ERP system. For example, the basic item in SAP is the "material", which means that SAP sees the world as consisting of "materials". Organizations that are not managing "materials" will then face the problem of introducing the term "material" in its worldview, or continue using its own

[7] This view corresponds to the "emergent perspective" suggested by Markus & Robey (1988) in their work on information technology and organizational change.

terms, thus veiling the term "material" in some way.[8]

Second, the capabilities of users must evolve to meet the capabilities of the adapted ERP system. This is usually a long and arduous process that involves a reorientation from legacy systems to the new system. Only then will the ERP system become a resource in the organization.

IMPLEMENTATION GUIDELINES

With the activity perspective at hand, it is possible to outline some tentative guidelines for ERP implementations as follows.

Identify activities and create a capability dependency map

The first step is to identify the activities in the organization that most likely will be impacted by the ERP system. In doing so, the focus should be on the work objects and motives for the activities; what things are being worked on and why?

The second step is to figure out the dependencies between activities and to visualize these in a capability dependency map such as the one in Figure 7:

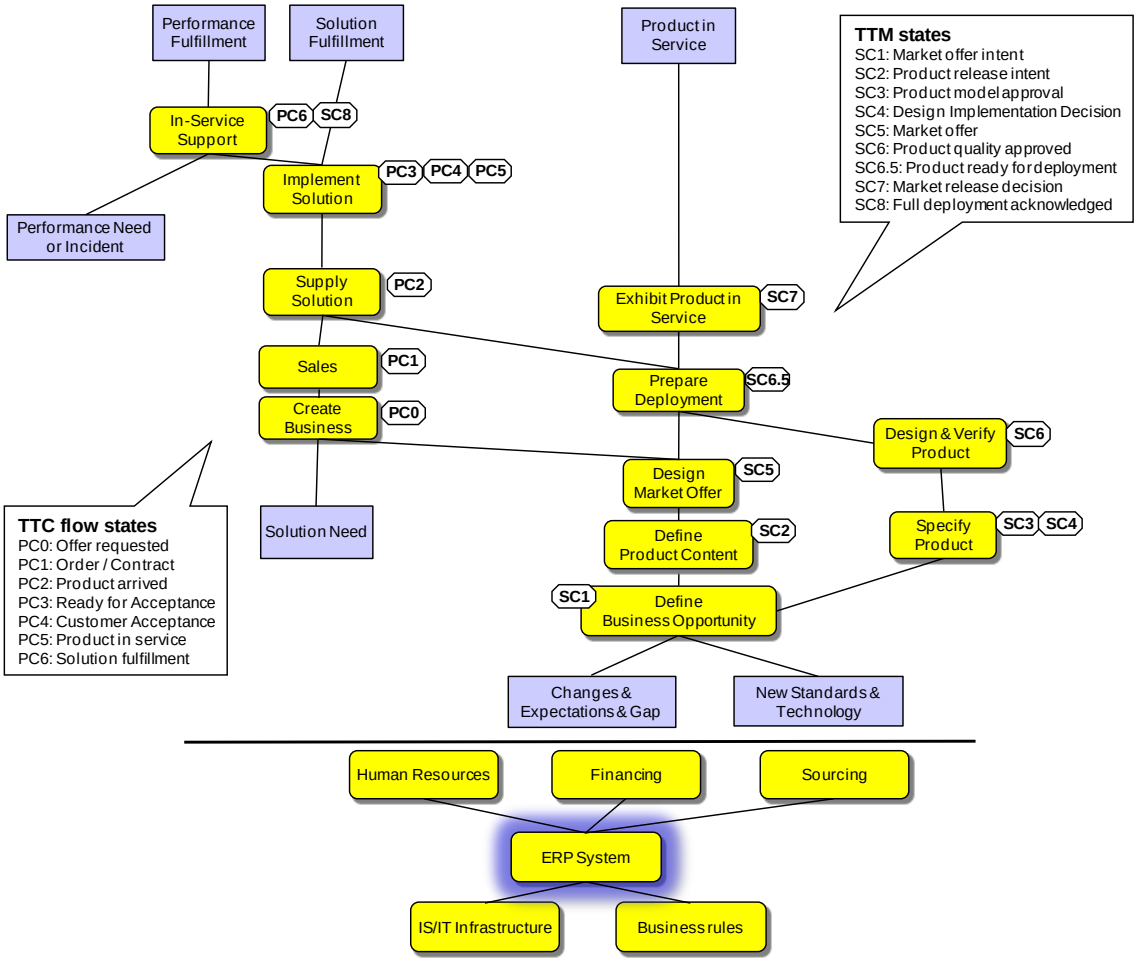

Figure 7: A capability dependency map for Ericsson

[8] This issue became a major issue at Ericsson with the first implementations of SAP in the early 2000ies. The basic managed item at Ericsson is the "product". It was quickly realized that the effort of brainwashing the organization to think in terms of "material" rather that "products" was prohibitive. Moreover, the number of characters in the identification of products superseded the available 32 character fields in SAP, which posed the additional issue for Ericsson of replacing its entire identification system with something else. Again, this was considered unattainable. As a result, various Ericsson-specific workarounds had to be implemented.

This map is derived from the main business process at Ericsson around 2003 (Taxén, 2009). TTC stands for "Time To Customer" and expresses the delivery from order to installed solution without the need for developing new products; a fast configuration of existing product variants. TTM stands for "Time To Market" and involves the development of new products. The map should be read from the bottom up. Towards the bottom, the prerequisites are shown: "Performance Need or Incident"; "Solution Need"; "Changes & Expectations & Gap"; and "New Standards & Technology". At the top, the outcomes delivered to the customers are found: "Performance Fulfillment", "Solution Fulfillment", and "Product in Service". The dependency map shows the capabilities needed for transforming prerequisites to outcomes.

Without going into details, it can be imagined that the map is fairly easy to comprehend for a group of stakeholder. The focus on dependencies makes it easier to imagine the consequences of taking or not taking certain actions. The absence and presence of a certain capability becomes immediately discernible.

With the map at hand, the influence of the ERP system (depicted towards the bottom of Figure 7) in various activities can be examined. For example, the motive of the activity "Supply Solution" is to provide a complete product to a customer location. In order to plan for this delivery, the number of cabinets in the product must be known. This information is created and stored in the ERP system during the development of the product, which takes place in the "Design & Verify" activity. Thus, the ERP system is relevant in both activities, which is easily seen in the map.

The dependency map is a living document. Depending on the issues at hand certain parts may be "zoomed in" and detailed further. In addition, it is important to realize that the map is a social product; it reflects the view of the persons that defines it. In this sense, the map should not be regarded as a more or less true representation of the "real world". Rather, it is a means enabling actions in the same way as any other means.

Decide least acceptable commons

Maintaining a balance between commonality and locality requires that certain organizational items are common across all activities that the ERP system is supposed to span; usually the organization[9]. One such item is the master data, i.e. information structures that are meant to be the same in all activities concerned. For example, the Ericsson-way of identifying products and product related documents are shown in Figure 8. This is an example of a business rule; rules that are organization specific, quite unintelligible for outsiders, but nevertheless of fundamental importance for the stabilization of the organization. Other examples of master data are revision rules, states, attributes, description fields, relations to other items, and so on.

Figure 8: The Ericsson way of identifying products and product related documents.

[9] It is of course possible to conceive of inter-organizational scopes of an ERP system. Somewhere, however, there is a limit for the implementation of a single ERP system.

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An important task in the ERP implementation is to decide how master data should be structured. A good approach is presumably to start with data that are definitely common; data about which there is no doubt that they must be adhered to throughout all activities. One example could be the way articles / products are identified. Concerning attributes, some may be valid in all activities, while others are relevant only in a certain activity. Thus, during implementation there will be a "gray zone" where certain insecurity remains about whether certain data should be included in the ERP system or not. This is something that can ultimately only be solved in practice; during actual use of the system.

Take heed of emergence

The emergent perspective implies that capabilities of actors and the ERP system will evolve as the implementation proceeds. This perspective has several consequences for the implementation. First, it does not make sense to spend too much effort in developing a detailed requirement specification for the system. Such a specification will inevitable become obsolete as new capabilities emerge. Instead, the implementation should proceed from a specification of constraints that frames the solution space. An example of such a constraint is the compulsory adherence to common business rules.

Moreover, the implementation should be carried out in small steps – increments – that can be verified in practice; thus providing stepping stones for the further implementation. When deciding such increments, it is advantageous to use the capability dependency map in order to specify which capabilities should be delivered in each increment.

Another consequence of the emergent perspective is that the implementation will never be "complete". The ERP system must be aligned to changing organizational circumstances, while maintaining the balance between commonality and locality. One suggested strategy to achieve this is the so called "coordinated flexibility" (Taxén, 2009). This strategy is based on two assumptions:

- The autonomy of activities to evolve to their specific needs must be maintained.
- The items needed to coordinate different activities must be mandatory for all activities.

This means that a federated architecture of information systems is proposed (Sage, 2001). The idea is that all mandatory and common parts are implemented in a "kernel" part of the ERP system, which evolves at a far lower pace than applications geared to fit local needs in various activities. New activities will be able to use the kernel system as a starting point for their own, local adaptations. Items, that over time emerge as common, are implemented in new revisions of the kernel system. In this way, it may be possible to maintain the balance between commonality and locality.

Enabling capabilities of ERP platforms

The implementation approach outlined above requires that the ERP platform has certain built-in capabilities. First and foremost, the emergent perspective implies that there must be room for an experimental atmosphere where failures and mistakes are allowed. In doing so, users, ERP system vendors, and organizational architects working with the dependency map, must all work closely together. This requires fast design and verification cycles, which means that the ERP implementation must be very quick and easy to change. This can be achieved by various mechanisms such as an interpretative programming language, graphical modeling of data structures, a database that does not require shut-down during changes, and much more.

Moreover, to support the dialectical evolution of joint actor – ERP system capabilities, the system must be very flexible with respect to activity specific needs. This concerns capabilities such as generation of specific reports, adaptation to activity specific language and symbols (e.g. icons), and generation of tailor cut forms for data entry. In particular, the ERP system must have the "activity" as a basic construct, i.e., a capability to contextualize the data with respect to in which activity they are relevant.

Today, there is hardly any ERP system that has these capabilities. It is interesting to note, however, that Fredriksson & Arola (2009) report on a successful change of an ERP system, which is in line with the approach suggested here. The ERP system (ComActivity) is implemented in steps; it is possible to adapt the layout of the screen to various actors without changing the code; it employs graphical model-driven development of applications; instructions are interpreted in run-time; and it is based on a flexible development platform (Eclipse). The authors state that one very important success factor is that the ERP system "was flexible so that users could get the system as they wanted" (ibid., p. 190, my translation).

SUMMARY AND CONCLUSIONS

It is my conviction that the issue of *meaning* needs to be brought to the fore if we shall manage the complexities associated with ERP systems and other similar IT-based means. What constitutes the meaningful? How do communal, i.e., common meanings evolve? Where are the boundaries for "common" situated? What kind of approaches and methods can be used to alleviate the construction of communal meanings?

In order to address these and other questions, I have suggested taking the activity construct in Activity Theory as the Unit of Analysis. This enables the conceptualization of an organization as a constellation of activities; each having a motive for its existence and working on a work object. A fundamental task of the organization then becomes to integrate these different "knowledge bases" in to an outcome that can be provided to its clients.

Each activity frames a context in which individual actions stand out as meaningful. Actions are carried out using mediational means; material and communicative. These means are enacted into meaningful resources, comprised of individual and mediational capabilities; a pattern that is repeated in every activity.

The context formed by the activity implies that irrelevant things outside the activity are deemphasized; they disappear, so to say, below the "intellectual horizon" (Gingras, 1995, p. 140). In situations where several activities interact, this immediately brings about the need to understand how the different worldviews in separate activities shall be reconciled. Provided that this can be done, the activity becomes a recursive construct that can be applied at any organizational "level".

In this contribution I have utilized the activity perspective to inquiry into ERP system. Needless to say, much remains to be done. The limitations and transferability of the approach must be established. As it is formulated so far, the focus is on the coordination of collective actions. Issues such as individual motives, power structures, conflicts and contradictions, and much more are left out. Concerning future research tasks, some straightforward ones are:

- Investigate the transferability of the approach to other cross-activity ISs such as, for example, Product Lifecycle Management (PLM) systems.
- Analyze the value of "best-practice" reference models included in the ERP system.
- Investigate the trajectory that eventually leads to the implementation of an ERP system. A major motive for getting involved with ERP systems is to replace many separate, "stovepipe" systems with a single ERP system. A relevant question to ask is why this trajectory never occurs the other way around: from a common system to many separate ones?
- Clarify the concept of "integration" associated with ERP systems.
- Elaborate the theoretical foundation. One such attempt is the Activity Domain Theory, which builds on the activity construct (Taxén, 2009).
- Refine and validate empirically the implementation guidelines.

As it stands today, the activity perspective on ERP systems should be seen as an attempt to break new grounds for coming to grips with the utmost complexity of implementing such systems in organizations. So far, there is no case where this perspective has been fully utilized in practice. In parts, however, some of the ideas suggested here have been empirically validated,

for example at Ericsson (Taxén, 2009). There is also persuasive evidence in the literature sustaining the viability of some aspects of activity perspective. Thus, the activity perspective might be one possible way to approach the call for research that

> […] embraces the importance of simultaneously understanding the role of human agency as embedded in institutional contexts as well as the constraints and affordances of technologies as material systems. (Orlikowski & Barely, 2001, p. 158)

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