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From IS Design to Workpractice Construction

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ABSTRACT

In this paper we describe an approach for information system design that aims at constructing the social reality in which the system is used. Thus, rather than designing the information system in a given context, the design target is the context itself, including the information system. The expertise knowledge of users and information system designers are jointly utilized in co-constructing the context, which is structured as a particular form of workpractice called the activity domain. In the activity domain, coordinating elements of a practice are integrated into a coherent whole. The theory behind the approach – the Activity Domain Theory – originated in the Ericsson telecommunication company where it has been gradually refined over more than a decade by the author. It has profoundly influenced the coordination of the development of the 3rd generation of mobile systems at Ericsson.

Keywords

IS design, coordination, praxis, co-construction of social reality, shared meaning.

INTRODUCTION

Product developing organizations are facing a turbulent reality today due to increased product complexity, diversification of organizational functions and an ever increasing rate of change. One of the most arduous tasks in these circumstances is to establish a workable, shared meaning among the actors concerning the coordination of development projects [10].

The issue of shared meaning with respect to coordination concerns several aspects. First, there must be a sufficient level of agreement about what should be coordinated and how. Items which are crucial for coordination must be identified, characterized and related to other items. Often, abstract concepts such as "increment" are introduced, something which is particularly difficult to acquire a shared meaning about [6]. Second, the actors may be geographically dispersed, have different roles, come from different traditions, speak different languages, etc. Third, the contents and structure of coordination will change according to new insights, new demands from the market, new tools and methods supporting coordination, etc. Finally, cues used in models and diagrams must make sense to the actors.

The coordination of complex system development projects is only possible with information system (IS) support. In this contribution, we describe an IS design approach that addresses both the technical and social issues as described above. The gist of the approach is to construct *the social reality* in which the IS is used [9]. Thus, rather than designing the IS in a given context, the design target is the context itself, including the IS. The expertise knowledge of users and IS designers are jointly utilized in co-constructing the context, which is structured as a particular form of *workpractice*. A workpractice is a meaningful, goal oriented social entity where some actors produce a result that other actors need [2].

In order to construct the workpractice, it is structured as an *activity domain*. The activity domain is the central construct in a new theory for coordinating human activity – the Activity Domain Theory (ADT) [11]. An activity domain may be regarded as a particular perspective of a workpractice where coordinating elements are emphasized.

DESIGNABLE ELEMENTS OF AN ACTIVITY DOMAIN

According to the ADT the following elements are designable in an activity domain:

The context model

This model signifies the structure and extension of the activity domain. It shows what types of phenomena are considered relevant in the domain, how these are related and how they are characterized in terms of attributes, state sets, revision rules, etc.

The coordination model

The coordination model signifies the dependencies between the activities in the domain. By coordination we understand "[…] managing dependencies between activities" [5, p 90]. This model has the same purpose as ordinary process models.

The transition model
The transition model signifies how different activity domains interact. This model is an elaboration of the Specification Based Data Model suggested by Gandhi & Robertson [1].

The domain core
The domain core is a place-holder for various items which provide stability to the domain. Examples of such items are habits, norms, traditions, rules, routines, domain specific languages, etc.

The running application: the IS supporting coordination
Typical features implemented are support for requirement management, configuration management, test management, project planning and control, etc.

THE CONSTRUCTION STRATEGY

The approach towards constructing the activity domain is called the "domain construction strategy" [10]. The results of the strategy are both intangible and tangible. The intangible form is a shared meaning among the actors about the social reality of coordination. The tangible form consists of domain elements as described above.

The construction strategy requires certain prerequisites. Besides personal and financial resources, management approval, etc., the most important prerequisite is the availability of the IS platform. In the applications at Ericsson the IS platform was Matrix [7]. This system is targeted as a backbone for managing product related data in large, globally distributed organizations. It can be characterized as a high performance, complex system of its own.

In addition, the capacity of the IS platform and the communication network must be secured. This is especially important if the IS is to be used globally. Also, strategies for replication and synchronizing data exchange must be defined and tried out.

The construction strategy is carried out in three phases: *exploration*, *trust boosting* and *expansion* (see Figure 1).

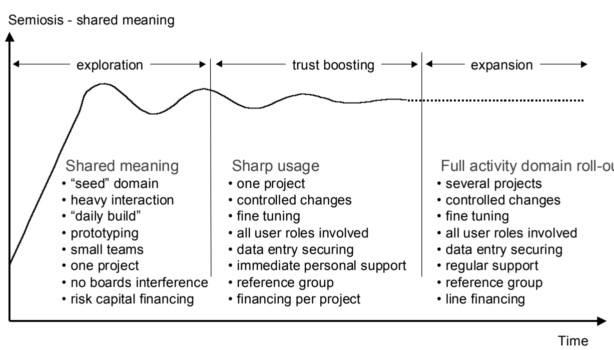

Figure 1: The domain construction strategy

In the first two phases the focus is on establishing the activity domain as a "bridgehead" in one project before expanding it to other projects in the third phase. This means that the gist of the strategy is to quickly establish a relatively stable "seed" domain which is then deployed to other actors in an ongoing domain construction process.

Exploration
In this phase the initial construction of the domain is carried out. The main purpose is to rapidly achieve a tentative consensus about the content and structure of the domain. The driver of the activity is the first project to use the domain. The work is carried out in a "daily build" manner by a small "task force" consisting of target users and IS designers. The work is financed on a risk capital basis.

Trust boosting
The purpose of this phase is to boost the trust about the feasibility of the domain as constructed in the exploration phase. Key issues are getting all actors in the project to trust the data in the IS and to make sure that the performance of the IS is acceptable at all units world-wide. This is done in a sharp project, that is, a project which develops a product for a customer. The task force is still driving the construction. Additional user roles around the project are involved and immediate, personalized support is provided. The construction of the domain in the trust boosting phase progresses by controlled changes. No major reconstruction of the domain is allowed at this stage. Reference groups and steering boards are consulted and the financing is done on a project basis.

Expansion
In this phase several projects are included in the domain. As in the trust boosting phase, the construction is done by controlled changes, however now in a formalized way. The financing is done by the line organization rather than the project organization to keep the domain intact between projects.

An example

As an illustration of the construction strategy we take an example from Ericsson in late 1998 [10]. The task was to construct a domain for requirement management (RM) in a project developing switching equipments for the 3rd generation of mobile system network.

Traditionally, requirements were stated in requirement specification documents that were stored and managed in large databases. Thus, the document was the item put under revision control. However, this meant that it was not possible to directly trace individual requirements to impacted design items.

With the introduction of modern, object-relational based ISs it became possible to manage each requirement individually. This required the context of RM to be defined in terms of objects, relations, attributes, etc. The task force consisted of users, an IS design expert from the vendor of Matrix and a domain architect (this author). The role of the domain architect was to provide a bridge between the users and the IS design specialist. The users were represented by an experienced requirement manager and the project manager running the project where the new way of managing requirements was to be used for the first time.

The work was carried out as follows. A first version of the context model for RM was suggested, based on the established way of working. Individual requirements were loaded into Matrix from existing requirement specification documents. In a series of meetings the context model was gradually elaborated. Each version of the model was implemented in Matrix. Reports and on-line information were evaluated in the project by the user representatives. If the result was not satisfactory, the context model was changed and implemented anew in Matrix. In order to facilitate the signification process it was important that the model notation was easily understandable by all actors. This was achieved by using a notation based on the Object Modeling Technique (OMT) [8]. Standard drawing tools like PowerPoint were used to describe the model.

An example of the context model from early 1999 is given in Figure 2.

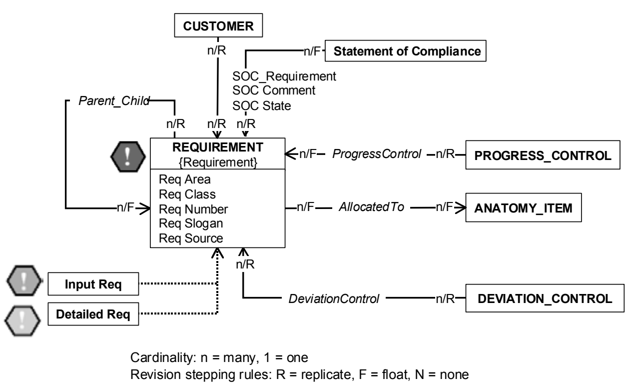

Figure 2: A context model for RM

The major obstacle in the definition of the RM context was to arrive at a shared meaning with respect to:

- Entities, i.e. what phenomena are relevant for RM (signified by boxes in Figure 2).
- Relations between entities.
- Icons signifying entities, names of entities and relations.
- Types and life cycle states of requirements.
- Attributes on requirements and relations.
- Cardinalities on relations, revision stepping rules.
- Actor roles and access rights for roles.

The construction strategy was repeated for other coordination areas until the entire scope of coordination was constructed (see Figure 3, where the RM domain as described above is encircled). During 1999 several hundreds of changes were made in the context model and its corresponding implementation in Matrix.

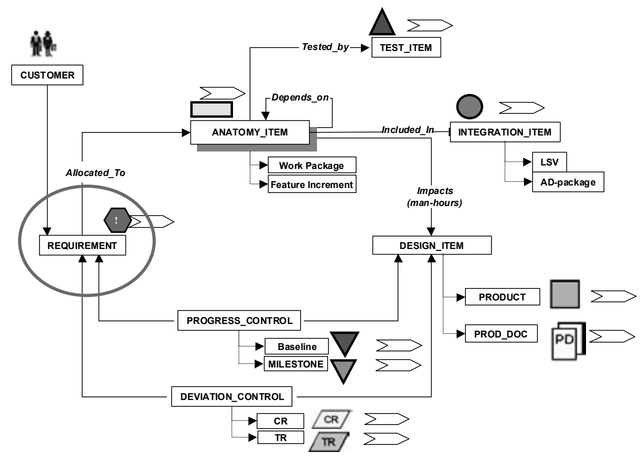

Figure 3: The context model for the entire domain

Conflicts concerning the structure and content of the domain were mostly solved by evaluating the usefulness of the domain in practice. If a certain construct worked satisfactory, it became gradually established as a good way of working. However, if a working consensus could not be achieved, the sponsor of the construction activity, i.e. the project manager, decided how to proceed.

From a learning point of view, the approach can be characterized as *experiential learning* [4]. By constantly iterating between reflection over the models and trying their IS implementation out in action, a gradual, shared understanding emerged simultaneously with the evolution of the models and the IS design.

RESULTS

The domain construction strategy began to influence the Ericsson practice around 1997 with the introduction of a method package for incremental development of large software systems. The first sharp project to use Matrix was carried out in 1998. Between May 1999 and mid 2002 the number of projects using the strategy rose to around 140 distributed over more than 20 development sites worldwide. During this period four domains were constructed. As indicated in the following statement the impacts on the Ericsson practice were profound:

> “Especially for the execution part I think we would not have been able to run this project without the tool. I think if you simply look at the number of work packages, the number of products that we have delivered, the number of deliveries that we have had, if we would have had to maintain that

manually, that would have been a sheer disaster. [...] we had some, only in my part of the project, some 200 work packages or work packages groups or whatever you want to call them, deliveries, on the average 2-5 subprojects within them 5-10 blocks being delivered, just keeping track of that [...] would have been a hell of a job." (Project manager, 3G development)

It is beyond the scope of this paper to give a full account of the impacts. This is reported in [10].

DISCUSSION

Early IS design methods concentrated on the technical aspect of the IS [3]. A clear separation was made between users and designers. Largely influenced by Scandinavian researchers, the use context of the IS became more pronounced in design approaches such as the socio-technical, the trade-unionist, the language action, the professional work practice approach and others [ibid]. However, in all these approaches, the IS was still the target of design.

The suggested approach in this paper means that we are opening up a new line of investigation into IS design. The main target of design is no longer the IS but the entire workpractice in which the IS is used. This means that all actors performing coordination acts are contributing to the IS design, some more, some less. The users are one of several groups of actors participating in the co-construction of the workpractice.

The basic mode of design in the approach is an ongoing interaction between reflection and action. Thus, the approach does not follow the traditional phases of requirement analysis, design, implementation, testing and deployment. This means that the approach can be characterized as an evolutionary type of IS design method [3]. A similar approach is suggested by Truex et al. [12].

TRANSFERABILITY OF THE RESULTS

So far, the suggested approach has been proven operational in one area – the coordination of extremely complex system development tasks at Ericsson. However, Ericsson can be seen as a paradigmatic example of the very turbulent situation that product developing organizations are facing today. Thus, it is reasonable to expect that the approach is transferable other organizations. The applicability of the approach to other areas than coordination, however, is a matter for future research.

CONCLUSION

In this paper, we have described an approach for IS design based on the Activity Domain Theory. The experiences show that the proposed approach enables the design of IT artifacts which can support the coordination of very complex system development tasks while taking individual, social and technical aspects into consideration.

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