DIWA: Design and use of Interactive Web Applications

Midterm Report

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Abstract:

This paper presents an interim report from the DIWA project. The project departs from the assumption that web technology, being a medium for human-to-human interaction and communication, calls for a rethinking of research questions concerning the design as well as the use of web applications. Interactivity no longer equals human-computer interactivity, but also includes human-computer-human interactivity. As a medium of communication and interaction, web applications are continuously moulded in use, to such a degree that the boundary between design and use becomes blurred, and with the result that both designers and users need new qualifications. In order to contribute to a better understanding of the implications of web technology, its design and uses, the DIWA projects conducts exploratory and in depth studies of organizational uses of the web as well as of web development. This paper reports on the first period of the project.

1. Introduction

The DIWA project is a 4-year project (2000 – 2003) funded by The Danish Research Agency's IT Programme. The general purpose of this program is to initiate projects whose findings will support the social and commercial applications of information and communication technologies in the future within Danish society as well as on international markets. One precondition of such applications is a better basic understanding of the impact that specific technologies have on the social contexts into which the technologies are introduced. Other preconditions are related to improvements of the processes through which these technologies are designed.

The objective of the DIWA project is to examine how web-technology – as a networked, distributed computing platform – is changing organizational information systems design and use. The central aim is to develop conceptual frameworks, implementation models, and guidelines to

support the design and use of organizational web-based information systems. The basis for this is primarily empirical investigation and interdisciplinary analysis.

The project has four objectives:

° to examine how the scope, content, and organization of information systems design and use processes change as information services become ubiquitous and software development coalesces with media design.

° to analyse the accompanying implications of this for the division of labour, skills, and knowledge in information systems development and use.

° to identify key organizational and technical factors that facilitate or impede successful implementation of Interactive Web-Applications (IWAs), and

° to develop and evaluate concepts, methods, and tools for guiding both the design of IWAs and the development of distributed and networked organizational forms.

1.1. Background

As a basis for complex information systems, the web-technology has matured a lot over the last few years. The technology is still simple with a number of unsolved problems, but the advantages and potentials are so significant that many of today's information systems to some extent are based upon web-technology. Organizations increase their investment in, and usage of, web-based technology. The scope of web-based application has grown enormously and has moved to become a platform that can support all facets of organizational work. Furthermore, the web-technology differs from traditional information technology in that it might be labelled as a new type of information system, but it is fundamentally a new medium for human interaction.

In parallel with this trend, the activities in the organizations that call for support become increasingly complex. Work becomes more knowledge intensive and demanding, and the actors are confronted by increasing demands for improved quality in products or services, improved complexity of the products and services, higher flexibility, shorter lead-times, etc. To cope with these demands, work is often undertaken by large groups including people with different backgrounds and perspectives. More actors become involved, and an abundance of decisions have to be made by interdependent actors. Actors involved in complex cooperative activities need support for communicating and coordinating their activities, keeping track of the state of affairs in the field of work, sharing information, etc. Thus, where the notion of interactivity previously has been used for addressing the interaction between a user and a computer, it now makes sense to address interactivity as the interaction between collaborating actors mediated by information and communication technology.

To complicate this further, an increasing part of the work that needs better IT-support will be conducted in virtual organizations, meaning that the control structure and the spatial and functional arrangements differ from situation to situation.

The trends mentioned above have serious implications for design and usage of web-based information systems: New groups of expertise must be involved, the technology is rapidly changing, and well-established products and standards for development and use are rare. Therefore the roles of, and interplay between, design and usage are dramatically changing: most (in-house) web-application design and usage is started as ad-hoc based 'quick and dirty' establishment of small sets of web-pages mainly used for 'toy purposes', information publishing or advertising. To phrase it differently: many of the recently adapted traditions within software development on careful analysis and modelling, punctual establishment of architectures, attempts to estimate, etc. are absent or fail in most web-application development and usage. We might in fact need a paradigm shift to:

° understand the nature of design and use of interactive web-applications,

° come up with recommendations on how to organize the processes, and to

° be able to discuss and reflect upon requirements and conceptual designs for interactive web-applications (or platforms for building these).

The technology is mainly an interaction medium. New applications will be developed and assembled by cloning existing components. Thus, the notion of tinkering is much more important in web-application development than 'rational' design decisions. Interactive web-based applications (information systems) are often results of grass-root efforts. Others have also stressed the differences in terms of the speed of change in the technological basis. The pace of the continuous evolvement of tools and features of the web-technology is extreme even compared to the rest of the IT-area. It is thus hard to make use of many of the approaches usually applied in traditional information systems design and use.

A need for new competences, new roles, new approaches and methodologies, new ways of organizing the development and usage of interactive web-applications has been widely recognized, but proper approaches for addressing the themes listed above have yet to be found.

1.2. The objectives

The DIWA-project was developed to examine the design and uses of cutting-edge interactive technologies in Danish organizations.

° *Organizations* represent social microcosms with internal as well as external dynamics, both of which are increasingly mediated by information and communication technologies. Through empirical studies of communication systems within and between different types of organizations, the DIWA project has begun to uncover some of the changing conditions of cooperation and coordination in modern companies. Certain aspects of the interactions within a workplace can be generalized to other settings, for example education, and cultural institutions. The DIWA project aims to suggest some wider consequences of IT for public as well as private life as the technologies are diffused to more and new social contexts.

° *IWAs* (Interactive Web-Applications) are among the most recent additions to the field of IT resources, and are currently being developed and implemented internationally in organizations. A distinctive feature of IWAs is their relative openness to continuous modification – the distinction between using and designing an application has become less clear-cut than in traditional information systems. This feature, for one thing, renders IWAs especially relevant for long term and complex forms of cooperation within and between the units and projects of an organization. For another thing, IWAs are most likely harbingers of IT resources that will be increasingly customisable also outside the organizational setting as such. DIWA addresses the implications of this prospect for design requirements in future product development.

° *Design processes* determine essential aspects like structure, functionality, and aesthetics of the IWAs. In addition, they create openings and limitations to the subsequent re-design of an IWA during its use. The need for diverse professional backgrounds in the design of IWAs creates severe challenges for how to manage and carry out such design processes. Each profession brings its own perspective on the artefacts to be designed, and it offers tools and techniques that are not always understandable or considered relevant to the other professions. It is the aim of DIWA to develop new insight into the cooperation of the various professions; the challenges they meet, and how they may overcome these challenges.

The DIWA teams have managed to secure the cooperation of relevant companies with a range of IT uses, which have been explored in the exploratory case studies. IWAs have been examined and compared with traditional information and communication resources in the participating organizations, and the DIWA teams have analysed a number of projects carried out by internal IT-departments as well as by web-companies. The exploratory case studies have consolidated contacts to rele-

vant organizations and have developed foci for the next phase of research.

In addition to generating new knowledge about the area of organizational IWAs, and about their implications for the uses of IT by individuals and groups in other social contexts, the later phases of the DIWA project will also develop criteria for the design of web-applications in future practice. For this purpose, the project has been fortunate to establish working relations with both organizations applying the technology in large scale and companies involved in design and development of web-based applications. The conclusions from the next phase of studies within these organizations, and from comparisons between them, will be an asset to Danish firms in this sector and, ideally, to their clients and customers in Denmark and abroad.

2. The project so far

2.1. Activities

The core activity of the first 18 months has been a series of field studies (exploratory case studies) focusing on how web-applications are designed and used. The subject fields for the studies have been both general use of web-based systems, usage of specific IWAs, and the processes in relation to developing specific web-based applications. The concept of interactivity has been addressed in many of the studies. We have carried out 13 exploratory case studies, varying in scope, extension and depth:

° in a Danish pharmaceutical company we have performed 5 case studies, 3 in use-departments, 2 in the IT-department,

° in a Danish bank we have performed 5 case studies, 1 in a use-department, 4 in the IT-department,

° in web-companies we have performed 3 case studies.

All of these studies have been documented in working papers, technical reports (in Danish), which have been presented and evaluated by the involved companies.

In order to establish a coherent picture of the state of affairs in the area of Interactive Web-Applications, the project has studied existing web-applications, technologies, and standards for constructing IWAs. This has been done partly as functional analyses of applications and technologies, partly as a reflective use of IWA technologies like BSCW and Lotus Quickplace. The applications and technologies have been a mixture of open source products, commercial products, and projects created for the scientific community.

We have started the first two focus studies in the Pharmaceutical Company and the Bank. One or two more is being planned to start later this spring in web-companies.

2.2. Challenges

The project has faced a number of challenges. These are presented below along with a short description of how we have tackled them.

It is very difficult and time-consuming to find well-qualified PhD students. Nevertheless, when we finally had all positions filled in January 2000, we came up with a much larger group of PhD students than expected. On top of the project's two PhD scholarships, we managed to get three additional grants from our institutions. This represents a dramatic increase in the total man-hour effort of the project. Nine senior researchers and seven PhD students are involved in the project.

The slower start has had some side effects: as we wanted to form cross-institutional and cross-disciplinary teams for the exploratory case studies, we could not start the case studies until spring 2000. One of the companies had set aside resources for the study in November/December 1999 and could not postpone the study. Thus, we had to cancel this case study. In some of the companies involved, the case studies quickly revealed that currently no relevant projects could be studied. This was the case for one of the web-companies. Instead, we have made contact to another successful web-company. In some of the

other companies involved, we actually conducted more case studies than originally planned to give us a broader picture of the use of web-applications.

The web-companies find themselves in an increasingly stressed market situation. In 2000, they have faced a declining market due to the problems of dot.com companies, and the resistance in traditional companies to pursuing opportunities in the e-area. Therefore, despite willingness to engage in research projects to develop for example Intranet support for design projects, these endeavours are hard to justify economically in a short-term perspective. We continually have had to work hard to have web-companies involved and will have to keep on doing so also during the remaining period of the project.

3. Results

The following chapter presents in a very short and ”rough” form the main findings from our exploratory case studies. The results are, of course, much more detailed than what can be presented in this short form.

3.1. Empirical findings

3.1.1. Organizational uses of web-based technology

The basic web-technology can be described in terms of a network, based upon open standards (i.e., http, html, cgi, etc.). From the client side, only a browser and some ‘plug-in’ extensions are required, and the transport protocol is neutral with respect to data formats (.html, .jpg, etc.). As a result, specification and re-specification of the functionality of the system is relatively simple (e.g., adding URLs to a page). Furthermore, because web-technologies facilitate incremental systems development, they provide a potentially strong platform for IT-supported social interaction in communities and organizations (e.g., mutual help, exchange of information, horizontal coordination).

° The exploratory case studies have documented the *availability of web-technologies* in different types of organizations.

The primary use of web-technology in the organizations studied is, by far, one of electronic publishing. A major portion of web-use can be described as “decentralized publishing,” in the sense that individual departments or project groups within an organization make information available to others within the organization in an informal presentation. Another quite common form of web-use is “centralized,” in the sense that the web-technology is used as a means of “mass communication” from a central entity (typically a communications department) to employees distributed around the organization. One advantage of such “publishing” is that a body of relevant information can be hyperlinked. Another advantage is that efficient tools for searching this information are easy to provide to those involved. However, in both its centralized and decentralized varieties, electronic publishing via the web often only involves a slight aspect of interactivity, for example, updating information bases or ordering materials.

° Web-based technologies are used in the organizations studied mainly as *publishing tools*.

3.1.2. The nature and scope of “interactivity”

The first round of exploratory case studies has suggested that, at the present time, web-based technology is rarely used for interaction among collaborators within organizations, in the sense of “interaction” as defined in the original outline of the DIWA project. Here, Interactive Web-Applications were said to ”mediate interactions among multiple distributed actors who are not only users, but also designers in the sense that they contribute to the system’s structure and content.” The underlying aim was to examine the potential of Interactive Web-Applications as resources in social interaction. This view of IWAs is partly in contrast to traditional web-publication, which is unilateral, and to electronic commerce, which is asymmetri-

cal. Although web-technology, in many ways, is very applicable for this kind of interaction, it has proven difficult to identify actual IWAs operating in organizations.

° The uses of web-technology for socially interactive purposes seem rare.

Instead, the exploratory case studies have revealed a number of situations in which the web-based technology is one of several components that facilitate interaction among distributed collaborating actors. In such cases, the technology was used, at first, primarily as a publishing technology, but the rate of modifications of the system increased over time, and this "interaction through publication" was supplemented with an extensive use of e-mails, video-conferences, etc. The documentation of such complementary usages of various technologies may provide a basis for developing design ideas and requirements regarding the next generation of IWAs, including basic technologies and architectures for IWA design and use.

° The findings indicate that the interaction between organizational actors – mostly or at least initially – takes place in the form of *collaboration and coordination through other media than the web.*

In addition, some situations have been observed where web-based technology as such is used to support cooperative work and its coordination. Also in these instances, other means of communication are introduced to cover features not provided for by existing web-applications (e.g., e-mail, video-conferencing, phone conversations, etc.)

° Even when web-based technology is used, it tends to be *supplemented by other media.*

3.1.3. The need for new competences – and for cooperation

In most of the cases observed, the development and implementation in the organizations of web-based applications has been organized in a highly iterative and incremental manner. A first draft is launched and used within the organization without a precise idea of what the next version is going to look like, or how it could or should function. The next version is then produced by "tinkering" with the previous one. This process actively involves both what is usually called users and the designers. An important finding, anticipated in the DIWA project outline, is that the relationship between design (and designers) and usage (and users) is no longer as simple and straightforward as was commonly taken for granted in the past regarding other information technologies. The distinction may even become irrelevant in situations where organizational actors, as part of their daily activities, continuously change their environment so as to make their life and work easier, more comfortable, more safe, etc. Obviously, this is one of the findings that will be investigated in the coming phases of the project.

° The development of web-technology is dissolving the traditional distinction between design and use.

Despite the ongoing redefinition of the relationship between design and use, the distinction still has a number of consequences for job descriptions and for the practical division of labour between designers and users. On the one hand, designers will have IT as their main task, and are typically employed in a web-development bureau or an IT department within the organization in question. On the other hand, users will mainly think of IT as a tool supporting their daily work, which may be quite remote from IT issues. At present, the interaction between designers and users is very much influenced by the fact that users today have a well-established understanding of the technology, so that, according to designers, users are much more demanding today than they were in the past. These different types and degrees of "computer literacy" are a key to the development of both work routines and design standards, and call for focus studies in further research.

° The interaction between designers, for whom *IT is a task*, and users, for whom *IT is a tool*, has emerged in the exploratory case studies as a key issue.

On top of the distinction between designers and users, the difference between traditional systems developers and web-designers affects the current implementation of web-applications. A characteristic pattern of the development processes observed in the organizations studied, has been the introduction of a variety of new skills and competences, compared to traditional information systems design. Many of "the new people," who are hired to participate in the development of web-based systems, have their primary competences in areas such as communication and information handling. At the same time, "the old developers" must be trained to master new skills, tools, and techniques. In that process, the developers expressed that they saw major differences between the kind of work conducted within web-design and the design of more "traditional" information systems. Indeed, the meeting of several different competences caused problems in many projects, because the different groups of professionals relied on different concepts, and had difficulties establishing common structures to support their interaction.

° One concrete problem of web-development in organizations is the *cooperation between "old" and "new" people* with different professional backgrounds.

3.1.4. From small-scale to large-scale web-development?

A final, important finding concerns the scale of web-development for organizational use. In section 3.1.1, we described how web-applications could be viewed as a "decentralized publishing tool" or as a "central publishing tool." Findings in the empirical studies indicate strong differences as to how such applications are developed. In both cases, we are dealing with in-house development. Development and implementation of web-applications for "decentralized publishing" often take place as small-scale, or "quick and dirty," efforts often led by professionals in specific use domains. Young developers usually conduct the activity with little or no training in (or understanding of) what may happen when software solutions are expanded and applied on a large scale. Opposed to this, development of web-applications for "central publishing" take place as purposeful efforts, organized as traditional IT-projects staffed with professionals from the user domain and IT-professionals. Sometimes external bodies are also involved, for example outside vendors taking care of specific sub-contracted parts of the project. However, in both cases, the importance of the design-in-use taking place is considerable.

° The design processes involved in decentralized publishing and central publishing, are quite different. However, in both cases, design-in-use is a key issue in understanding how such web-applications are (re-) designed and appropriated in their use-context.

When dealing with web-development understood as contract development (or product development), i.e. seen from a vendor or an Internet bureau's perspective, the pattern of development has changed dramatically over the last year or two. Earlier, web-applications could be described as publishing or web-presence sites. This also reflected how many web-companies were primarily described as marketing agencies using a new medium, and how the central competences were related to design, communication and usability. Now, a large part of an Internet bureau's projects are more closely integrated into the business processes of their clients. This means, for example, that the web-application has to be closely integrated into several of the client's legacy systems, maybe running on different platforms, databases, etc. So large-scale web-development now also requires competences related to business development and technical skills. It has proven hard for many web-companies to integrate professionals with these competencies into a workplace culture dominated by design, communication and usability issues, as discussed above in section 3.1.3.

° As web-applications have matured, requirements concerning business development and integration with legacy systems have risen, in turn raising require-

ments for new competences in web-application development.

3.2. Theoretical implications

As noted in the DIWA project outline, interactivity and design are two central concepts that require careful reconsideration in the light of the potentials of web technology. The exploratory case studies have all addressed these two concepts, and have specified aspects to be examined in the focused studies. A third theoretical issue, not discussed explicitly in the project proposal, centres on the structure of the content which is made available to users via interactive web-applications, for example, in the form of document repositories. Finally, the empirical studies have shown that IWAs are still being conceptualized and developed, even as we study them.

3.2.1. Interactivity

Two different meanings are usually ascribed to the term, "interactivity." On the one hand, computer science and some multimedia studies define interactive systems as IT systems which allow, indeed require, the human user to interact with the machine, thus selecting, influencing, and, to a degree, controlling the session. Such principles of interaction depart from the deductive and mono-causal structures which predominate in traditional IT systems.

° Interactivity 1: *the human-machine nexus*

On the other hand, communication and organizational research mainly defines interactive systems as IT systems, which serve as media of communication and cooperation among people, often within geographically distributed organizations.

° Interactivity 2: *the human-human nexus*

Though the two definitions of interactivity do not necessarily conflict, they focus on different aspects of the totality of technologically mediated communication. DIWA has given priority in its empirical studies to the human-human nexus, while at the same time exploring the implications of different IT systems for organizational co-operation.

Some of our exploratory case studies have suggested a trend for further research. The gradual redefinition of the day-to-day use of a web site, from being primarily a medium of general publication, toward being a means of information sharing within work teams of different sizes, and further on toward small-group publication that is very closely related to the work processes of distributed teams. Some of these teams have quite recently realized a need for facilities for cooperative work, especially co-authoring, on the web site, and they would like developers to integrate these facilities in their web-resource. From the DIWA point of view, this development provides an opportunity to study newly developed web tools and applications for cooperative work in a real-life setting.

° A need for web-resources arises from the *dynamics of organizational cooperation*, and can be studied from the DIWA perspective.

3.2.2. Design

Web-design is described in the project outline proposal as an activity, which, we hypothesize, is rather different from the design of traditional IT-systems, over and above the need for people with experience in graphic design and hypermedia. One aim of the DIWA project is to account for the specificity of interactive web-design. Another aim is to contribute to standards and guidelines in the area.

Perhaps the most important difference between web-design and other IT development follows from the redefined relationship between design and use. To some degree, it is the "content providers" (who include a wide range of users), not the designers, who give the web site its structure and substance. In doing so, they help to determine how the site will be used. Some of the more detailed findings above, concerning the designer-user relationship indicate that some of these content providers also play the role of "mediators." This means that they initiate new ways of using a web site and encourage other people to

use it as well. Mediators also articulate demands for a different or extended functionality, such as the possibility of password protection of certain parts of a shared web site, encryption, extranets, etc., and they impart these demands to developers. Such web sites, then, evolve because of collaboration between different kinds of users, and between users and designers. A key issue for design is the cooperation between mediators and designers, which likely will require new qualifications on both sides – qualifications that may evolve as part of the collaborative process itself.

° A category of "mediators" facilitates cooperation between other users and designers, and can be studied from the DIWA perspective.

3.2.3. Document repositories and their classification

When a web site has been used for some time, for publication and for the sharing of documents, it contains a wealth of written information. While developed ad hoc, it can become a useful document repository. One of the exploratory case studies strongly indicates that the structuring of such a repository poses major practical problems, simply because people cannot find the documents they are looking for.

° The difficulty of retrieving documents, in turn, gives an opportunity to study *the evolution of classifications for web sites* that are used by distributed groups in organizations.

3.2.4. The 'I' in DIWA

The concept of "interactivity" has been a continuous challenge, not only conceptually and operationally in the exploratory case studies, but also in very concrete terms of the state of the technology as employed in organizations at present. In fact, it has proven difficult to identify genuine Interactive Web-Applications in the exploratory studies. A preliminary conclusion is that the DIWA project has aimed to examine cutting-edge technology, and that, accordingly, many companies have not yet implemented IWAs (as defined in the project proposal) on a significant scale. However, the companies that the DIWA project cooperates with see great potentials in such applications, just as the development companies are eager to develop and implement the applications. As one solution to this challenge, we have suggested an experiment to some of the companies, so that the DIWA project may implement an IWA, to be tested and used as part of the organization, and to be studied closely by the DIWA group.

° The absence of genuine IWAs in most companies today has generated a proposal for *an action or participatory research project*.

4. Phase II: Focused Research

In the second phase of DIWA, we will focus on selected organizations and themes based on their relevance for understanding the theoretical issues and for supporting the development of new practices, organizational structures, competences, and requirements for and conceptual design of IWAs.

4.1. Themes

Many interesting themes have emerged from the exploratory case studies. In chapter 3 above we have described emergent themes in relation to two central concepts in DIWA, *interaction* and *design*.

In relation to interaction, the focused activities will have to position themselves in relation to a "potentiality-actuality dilemma": On the one hand, it has been hard to identify interactive web-applications supporting the human-human nexus of interactivity empirically, and interactions of this kind often take place through other media than the web. On the other hand, there is a clear potential and interest in using web-technology for these purposes. Findings from the exploratory studies strongly indicate the existence of a web-platform which, though based on existing static and stateless protocols and standards, is evolving as an important platform

for organizational communication and even supports some aspects of collaborative undertakings. Thus, the plan in the focused activities is, first, to ascertain the relative proportion and prominence of mediated interaction in distributed work settings, compared to face-to-face interaction. Second, the studies will examine the specific combinations of face-to-face and mediated forms of interaction (web, e-mail, phone, fax, etc.) in relation to different work settings and purposes. The studies will focus on a number of activities addressing:

° *the relative use of mediated interaction in distributed work arrangements, and the configurations of means according to their ends* in such activities.

The exploratory studies have focused mainly on design of web sites in intranets and design of (business-to-consumer) web-applications. The widest sense of the word design includes activities within web-development companies or departments; activities of users who build and structure web sites and mediate the interests and stances of the involved parties; and finally, activities of the users who search information on a site and further develop the site by adding documents. In doing so they create, and maintain a platform as part of a computer mediated communication. However, it may not, prove useful to denote all these very different activities "design," perhaps even misleading. We will thus focus on

° the *design-in-use* taking place when a web-site is appropriated in its use-context. Secondly, we will focus on design *in relation to large-scale development* of web-applications.

In the latter, some of the toughest issues are usability and taylorability of web-applications to different user groups and integration of web-applications with legacy or business systems.

New roles have emerged in relation to the design and use of web-applications. Seen from a use-perspective, the exploratory case studies have identified the importance of roles such as content providers and mediators, both in terms of propagating a web-application and in terms of the design-in-use taking place. As noted in section 3.1.3, the mediators also play an important role in terms of their cooperation with designers when the web-application is undergoing major re-design. In a design or development perspective new competences are needed when we are dealing with large-scale web-development. As noted above, the exploratory case studies strongly indicate that usability and taylorability to different user groups and the integration of web-applications with legacy or business systems are essential issues. How competences to deal with these challenges are integrated in the development context is not at all clear or straightforward. Therefore, a focal theme in the focus studies is

° *roles and competences*.

The project will use the results from the exploratory as well as the focused activities as input and inspiration to work dedicated to the establishment of requirements for IWAs and the basic technologies for building IWAs. This will then provide a basis for discussing conceptual design of IWAs supporting the interactivity needs identified in the case studies. The basis of these design discussions will of course be the current versions of HTTP/XML etc., which means stateless technology for publication. It is the hypothesis that the work-related, de-centralized use with relatively swift interaction will call for facilities that support notification of changes (who, when, where); allocation of responsibility for page structure and site structure; allocation of responsibility for documents, collections of documents, or part of documents to persons or groups; and finally annotation facilities. A fifth and final theme will be

° *requirements* for IWAs and for basic technologies for building IWAs and *conceptual design* of IWAs.

The DIWA project will mainly work on design issues on the conceptual level. In general, we do not have the resources required to implement the design ideas.

4.2. Organizational context

We have identified three contexts for the design and use of IWAs for the focus studies: Product development, Organizational integration, and Web-development. The basis for the distinction is the basic organizational objectives of the work activities, hereby also ascribing different roles to the web-application.

In *product development*, the core activity is the development of a new product. The work activities are organized as a project which in the concrete case typically is a huge endeavour with a life span of 10 years, involving several hundreds of various, highly skilled professionals and a budget over 100 millions US$. The people involved are dispersed physically and organizationally. The web-application in question is used to facilitate communication and coordination of project management activities.

Organizational integration denotes the activities involved in integrating procedures, corporate image, etc. in relation to a big merger of financial companies in the Nordic region. Here the web-application in question facilitates the work of approximately 100 working groups each with their specific task in relation to organizational integration.

In *web-development* the web-application is the central object of the work activities. The goal is simply to develop a new, complex web-application, and the organizational context is the development organization, their client(s), and the sub-contractors involved in developing the product.

4.3. Combining themes and organizational contexts

Combining the themes and the organizational contexts yields a 3*5 matrix (Figure 1)

In the following, it is illustrated how the matrix can be used to identify the content of three focus studies. The letters (A-C) indicate the elements in the matrix covered by the studies.

A. Development and structuring of web sites on intranets and extranets

The preliminary findings indicate that the structure and important parts of the content of a web site are developed by people who are responsible for the dissemination of different kinds of documents. These people endeavour to establish the web- application as a generally accepted platform for distribution of documents, which is a first and very decisive stage in the development of an active web-application. Only a few people elaborate the site, choose the content and the content providers, and persuade the colleagues to use the site as a rostrum for dissemination of information.

	Product development	Organizational integration	Web-development
Mediated interaction and configurations of means	A	B	
Design-in-use	A	B	
Roles and competences	A	B	C
Large-scale development of web-applications			C
Requirements towards and design of IWA's		B	C

Figure 1

From the viewpoint of their colleagues, these people are the "site-owners" and responsible for its layout and functionality. They negotiate the technical properties of the site with the web-company or department and mediate viewpoints across functional borders.

Studies have identified a few of these mediators and "site-owners." Their work will be discussed further in the focus studies.

The content providers are the people who amplify a web site by adding or updating documents. The web-protocols and standards support publication, which, however, can be centralized as well as decentral. The centralized publication is usually decided or approved by the management with a specification of the one(s) responsible for the updating of a well-defined set of documents. The de-central publication is different and depends on the use of the web for exchange of information within a group of people. The exploratory studies have identified groups who are geographically dispersed and use the web-application in this way. They publish documents on the web just to inform about something or to exchange a part of a document, e.g. the writing of a report.

B. Web-applications supporting organizational integration

One of the corporate partners was recently part of a big merger of financial companies in the Nordic region. Since the merger, a lot of effort has been directed towards organizational integration. Apart from hectic activity at top-management level, this involves the communications department as a central player in forming corporate identity and supporting work groups responsible for formulating new procedures. For the latter purpose, an interactive web-application platform has been proposed by DIWA to the working group. Based on studies of usage of specific tools (e.g., Lotus QuickPlace) we intend to identify patterns of use in relation to various types of interaction and different roles in relation to structuring and using the application.

A second element of the focus studies will be a comparative analysis of how different groups of professionals – both designers and users within various types of organizations - define the key notion of "interactivity."

C. Web-development in constant flux

As noted above, "web-development in the large" is facing major challenges. The challenges are related to the fact that the technology has matured and has come to be a central element of IT strategies in many companies. From the perspective of competences, the challenges can be formulated as a "knowledge gap" in dealing with issues as usability and taylorability of web-applications to different user groups and integration of web-applications into business or legacy systems. From the perspective of changing work practices in web-development, the challenges can be phrased in terms of how people with "new" skills can come to work effectively with people with "old" skills.

The project will pursue further studies in web-development organizations focusing on communication, knowledge sharing, and project organization within functionally and professionally heterogeneous web-development organizations. Based on the focus studies, we might also take a more active role for example in relation to formulating requirements towards web-applications designed to support communication and coordination or knowledge sharing in web-development projects.

4.4. Research approach

Though web-development and use are widely and vividly discussed in the literature, there are still only few accounts of longitudinal studies of web-applications in organizations. DIWA, therefore, will build on the case studies to substantiate and elaborate the preliminary findings discussed in chapter 3. The exploratory case studies will be followed by focus studies within four companies: two web-development companies and two user-companies.

The focus studies will use interviews and observation to describe and analyse the trends within user-organizations:

° interviews and analyses of the many documents that with time are stored in a web sites and which sometimes make documents hard to find. The idea is to analyse the structure and the classifications that evolve in such a de-centralized, work related site.

° interviews and observations to elaborate the analysis of the design and use of sites but also to more actively discuss and experiment with more advanced web-applications for cooperative work.

We also plan to actively participate in the implementation and use of more advanced forms of web-applications and conceptually discuss and describe such advanced forms of collaborative web-applications. Results from the focus studies will be presented and discussed at international workshops organized by DIWA.

As part of the focus studies, we will participate more actively in the organizational implementation of an existing platform, Lotus QuickPlace, to support exchange of documents within dispersed workgroups. Studies of use and identification of use patterns will produce recommendations concerning the technology as well as concerning improved use practices. DIWA intends to collaborate with the organization in question to implement some of the recommendations.

The project uses qualitative, longitudinal studies within a small number of organizations of different kinds. Though this approach is useful and generally accepted for in-depth studies of organizational processes, it is not useful for verification of the results and their general applicability. To remedy this shortcoming, we plan to organize a number of international workshops, to invite researchers with experience and results from similar studies, and to conduct a small number of verification studies to investigate the generalizability of concepts, models, and solutions. The workshops will give the project an opportunity to verify the results from the exploratory as well as the focus studies and to enhance the DIWA researchers' network and position it in the international research community. Finally, of course, these workshops will inspire the project and help us to maintain a high standard.