RETHINKING COMMUNICATION IN CONSTRUCTION

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SUMMARY: *In many of the industrialized lean construction efforts in the construction industry today, collaborative communication and its supporting ICT have been reduced to a secondary issue in favour of rationalizing the physical design and production processes, as if effective project communication practices and technologies are taken for granted. Often when ICT based communication is discussed and managed in construction it often only comprises the technical aspects of information handling, such as modelling, classification and standardization. This paper introduces the subject field of Project Communication, which considers the improvement of organization, group processes, work procedures, as well as the sharing and transfer of knowledge between different professional domains in projects and corporations. The subject area has a special focus on the concept of the integration of project organizations and the creation of an effective platform for collaboration through shared ICT business tools. One prioritized field of research in this area is the problematic issue of creating true usefulness, user acceptance and organizational adoption of ICT in project team work. The paper describes four indicative feasibility studies in Project Communication in the Swedish construction sector. It argues that to solve the practical problems that the industry is encountering, as described in the studies, the perspective must be widened so as to include information and communication technology from an organizational and management viewpoint.*

KEYWORDS: *project communication, design, production, organization, management, ICT usefulness.*

1. INTRODUCTION

Within the framework of the national development program in the Swedish construction industry called 'IT Bygg och Fastighet 2002', a number of pilot projects were carried out on project networks, digital document management and cooperation on construction information models (IT Bygg och Fastighet 2002). These projects focused on solving the technical problems of information management, although practical experience showed that there is a general resistance towards introduction of the technology within the industry. This resistance is not only based on an awareness of technical shortcomings, there were also significant non-technical elements, such as methods and routines, the roles of the various parties involved, and the legal and economic prerequisites. Similar experiences have been noted in studies carried out in other countries which often have highlighted the need for improving integration of design and production and cooperation with the client in construction projects. In recent years it has been identified that some of the fundamental components contributing to the construction industry's poor performance are its ineffective communication practices, its organizational fragmentation and lack of integration between design and production processes (Dainty et al., 2006).

However, until now collaborative communication research and related development initiatives in the construction industry have been completely dominated by the purely technological development of ICT. So far, this research has not resulted in a comprehensive understanding of how new technology works in project communication if we consider human, organizational and process-related factors in addition to purely technological factors. Even a former Nordic chairman of the International Alliance for Interoperability (IAI), has lately questioned the work approach of IAI in the development of the international building product model

standard, Industry Foundation Classes (IFC). After ten years of IFC development, its adoption and use in the construction industry is still marginal. The ambitious approach of IAI may have focused too much on the model based world in stead of the real one, leaving IFC as a theoretical model specification or an academic exercise rather than a useful industry standard for professionals in practice (Kiviniemi, 2006). At the same time, industry has already begun implementing and use new technologies and applications. The large scale adoption of Information and Communication Technology (ICT) in construction stands to derive great advantages only if experience of its use can be gained at an early stage.

It is in this context that Project Communication, a new subject at the Royal Institute of Technology (KTH) in Stockholm, seeks to study ICT in its practical context. Within the realm of this research area, an investigation has been carried out concerning communication in the design stage of two different projects in the Swedish construction industry: the design work of a new building for the National Defence College in Stockholm and a project run by AB Storstockholms Lokaltrafik for the rebuilding of the subway train station at Sockenplan (Wikforss, 2006). The scope of the studies was then expanded to include communication during actual construction, focusing on mobile work activities on the construction site and their special need for communication (Löfgren, 2006). Also, a comparative study was made of how four frequently used Internet based project sites function as a means of communication between the project participants. This led to a discussion on the need for information technology specifically designed for project management purposes (Wikforss, 2006).

This paper describes some of the fundamental collaborative communication issues in planning, design and production phases of construction projects based on four indicative feasibility studies in the Swedish construction sector. The paper introduces the perspectives of project communication research and outlines an initial conceptual framework for developing communication practices combined with supportive ICT as a facilitator for improved organization and management of future construction projects.

2. COMMUNICATION IN CONSTRUCTION PLANNING AND DESIGN

The first case study considered project communication during the final stage of planning and designing a new building and renovation of the National Defence College and the Swedish Institute of International Affairs in Stockholm. This is a unique project, as, paradoxically, is almost always the case in architecture and building; a project group is put together for one particular occasion and is dispersed once the work has been completed. During the stage of the design work studied here, the need for information exchange between the project participants was intense, time being the crucial factor. Demands on the participants' performance and accessibility steadily increased, while the amount of information they were expected to handle was extremely large. The focus was on detailed control and coordination of various part-solutions to the whole. Time deadlines, financial pressures and shortcomings in previously developed technical documentation affected relations and cooperation between the members of the team. In this environment, the project participants tended to become less careful of how they passed on their information. Communication now more frequently took place via informal, direct channels than via those originally planned, which were based on the storage of project data at a shared site common to the project as a whole. And as different participants focused on different areas and had different, sometimes conflicting interests, the distribution of information and cooperation within the project was badly affected.

The second case study involved the rebuilding of the Sockenplan subway train station. The construction project can be described as a component of a continuously running system of regular renovation of train stations. The participants in this particular project had thus worked together previously and a functional organization for the project management was already available – the ideal conditions, in other words, for ensuring that the project and its communication needs could be managed carefully and in good order. In the case study, it was observed how the project was initiated and planned and how communication was handled during the design stage. Initially, the project management expressed an ambition to organize and control communication within the project via an Internet based project management network. Project management set up the network, introduced it to the project participants and encouraged its use – which they failed to do on time. On the other hand, once the network had been set up, even the project management did not use it to its fullest extent. Planning and design documents were not distributed via the project network but were distributed directly among the parties involved, either by e-mail or as regular paper copies. This resulted in that the use of the project network remained limited. Instead, information flowed in an uncontrolled manner among the members of the project team.

The results of these studies highlighted two different perspectives that are diametrically opposed.

The first perspective is that of the project manager. This is the image of the ideal process as it is described in industry-wide documents, contracts, instructions and manuals of various types. It is the image of the orderly process that proceeds in discrete steps clearly defined in advance, travelling along well-signposted information highways. It is an image of the process that is seldom questioned; it constitutes accepted practice. However, project managements have found it difficult to get their teams to adhere to this paradigm. In practice, project participants actually oppose and even obstruct the use of the central project sites that the project managers wish to use for the exchange of information.

The second perspective is that of the designer. This is the image of the design work that will actually be carried out. It is about which issues are important and difficult to tackle, about how ideals, facts and value judgments become inextricably mixed in informal but authoritative design decisions taken in the intervals between the occasions when the formal decisions are to be made. Judgment-based decision-making, planning, improvisation and reflection in action are key concepts. This paints a picture of a somewhat chaotic work process in which informal contact channels – shortcuts – and verbal agreements determine the results that will be achieved. It is a picture of the process that can seldom be discussed openly during the actual project since it is not actually accepted. In this context, it is interesting to note that ICT is also used for a significant proportion of the informal communication, although it differs from the ICT offered at the central project sites. Here, the emphasis is on direct contact and speed of communication.

However, this entails a big risk of losing sight of the big picture and the control of the construction project as a whole. Who, for example, will join up the design process with the preparations needed for production so as to ensure that the proposed building is actually put up? Who ensures that the project team maintains a shared understanding of the project's ultimate objective right up until the time when the building is finally handed over to the customer? What is more, the various specialists involved in such projects all use their own jargon, a kind of professional language that keeps others out and maintains the pecking order between the various groups. Meanwhile, the traditional distribution of roles is controlled by stereotypical notions of what others can do and cannot do, and intentional misunderstandings are part of a technique designed to strengthen one's own role and protect one's own personal space in this ongoing game. In the constant negotiation between the members of the project team, as to exactly where one's duties lie and who is expected to do what, the winner will be the individual who enjoys the advantage of information. For the individual player, the smartest strategy may well be not to communicate everything, not to have heard some piece of information, even to have suffered a slight misunderstanding. This, indeed, may be the real reason why participants are reluctant to publish their information on the common project site. There are perfectly rational reasons for not making a technical solution available to the project network too early on – who wants to risk being held responsible for having spread inaccurate information? Likewise, there are perfectly rational reasons for instead getting in touch directly with a project member you know you can trust, someone you can rely on not to look for faults and demand damages. Project networks are thought up for an ideal situation in which accurate information is exchanged in predictable patterns drawn up in advance. However, the conditions under which real projects must operate are typically unclear and unpredictable, and technical solutions remain imperfect for a long time. Professional skills consist in an ability to manage this ongoing search for the end solution, which is why professionals will wait as long as they can before they publish their information.

Construction projects are assembled by gathering different professions and areas of expertise under one "flag" (Söderholm in Wikforss, 2006). Typical of such assemblies is that each professional group also bears with it a set of principles, rules, knowledge domains and professional skills formulated in a certain manner. At the same time as this helps make the profession strong and successful, it also explains why they cannot cooperate with other professions particularly well. Taking this professional barrier as the starting point, a construction project can be described as a 'battle of the giants' in which each of the professions involved is fighting for supremacy over the others. But the battle is not fought within individual fields of knowledge. Design engineers and other technical consultants know that the design is the responsibility of the architect, and although they may have their views on the subject, the architect's monopoly of knowledge in this respect is not seriously challenged. However, when it comes to new work practices, project management tools or collaboration forms, of which none of the established professional groups holds a previous monopoly, the battle suddenly becomes important. It is not always a battle for the best solution, but rather a contest to establish whose opinions carry the greatest weight and what sort of information is actually of importance.

Communication tools introduced with a purpose of imposing better control and coordination of construction projects are an arena for such knowledge contests. Communication solutions aim at breaking down barriers that

professional groups carefully and successfully have built up over a long period of time. They aim at making construction knowledge more general, thereby challenging the expertise that for decades has become more and more the province of specific professions and home to an every increasing array of professional jargons. These tools also aim at coordinating activities between professional groups, which today all apply their own special routines and have their own particular ideas as to how coordination should be achieved. This may result in communication tools that are so generally conceived, so shallow and so uninteresting that they can be generally accepted but are hardly ever used; or, someone may take control of the tools and modify them to suit their own special needs, thus obtaining a toolkit that is both sophisticated and functional – for a few (Söderholm in Wikforss, 2006).

3. COMMUNICATION IN BUILDING PRODUCTION

In an introductory investigation of problems ahead of an attempt to introduce mobile ICT support at construction sites, the actual work at a construction site north of Stockholm was studied for half a year on regular basis through direct observations, interviews and document analyses (Löfgren, 2006).

The production environment of the construction site involves a very tight time schedule with the full attention to planning, coordination and completion of the building activities. Production managers, construction supervisors and superintendents are needed on site to coordinate work, do inspections, conduct environment and safety rounds, document and follow up ongoing and completed construction activities. The very same persons also need to be located at their computers inside the site office ordering equipment and building materials, exchanging digital drawings between architects and design engineers, e-mail subcontractors about upcoming work, follow up budget figures and invoices as well as prepare deviation reports on construction work with unsatisfactory result. In addition to this, there are daily production meetings that afterwards need to be transcribed in computer documents and e-mailed to all involved parties.

Construction projects of today are dependent on reliable and updated information through a number of ICT based business systems, communication tools and shared storage servers. To solve problems that have arisen on-site and handle critical construction issues there is a need for quick access to necessary information. To solve a site problem, production management personnel have to run back and forth between the construction site and their computers inside the site office. This leads to inefficient use of managerial resources due to that the production management team is occupied at their computers a large part of their working hours. Production managers and construction supervisors experience that they often have to be at two places at the same time; at the site office doing administrative work at their computer as well as being out on the site coordinating work (Löfgren, 2006). Documentation of building activities, production meetings and various inspections often have to be carried out twice; once when they are actually occurring and then again in a computer document using different templates.

Even though the intention of the ICT based business support systems is to improve project communication, they have lead to production managers, construction supervisors and superintendents experiencing that they are doing the wrong things. For example, whole days are sometimes spent in front of the computer writing protocols from previous meetings. This has resulted in negative effects on management presence and leadership in the production site environment. Most of the available project oriented ICT tools are meant for formalized office use. These tools only give modest support to the craftsman-like construction activities and the unpredictable and mobile environment that the site personnel work in. Improving information and communication support for the core activities at construction sites has become a strategic challenge for the construction industry to increase efficiency and productivity in the construction process (Samuelson 2003).

4. PROJECT COMMUNICATION – A DILEMMA OF PROJECT MANAGEMENT

Both design and production of construction projects share a need for rapid access to information and communication in real time. An interesting study object is therefore the communication toolkit commonly used for ICT-based project communication today – web based project networks, or project management extranets. Four different project networks were compared with respect to their basic structure and their different functions and methods of use (see Löfgren in Wikforss, 2006). The aim was to identify the potential offered by each of the networks for coordinating communications within a project and to compare this with how the networks were actually used. The results were based on a large number of interviews with users, who described their work procedures and their experience of using the networks.

The study showed that the visions and intended purposes of project networks do not comply with how such systems are perceived and used in practice. Users considered that project networks wasted precious time and were overly complicated. It was difficult to upload and structure documents and to describe them with correct metadata. Users also considered that it was difficult to find the information they needed and that it took time to log on, search for and open documents. They tended to use the networks as little as possible, and if they did use them, it was primarily as a simple pool for storing documents that had already been approved. In other words, project networks were not used as active, dynamic communication networks but as passive, static archives. They did not support the intensive communication needed for the actual problem-solving and decision-making processes. Instead, this vital communication was conducted through other channels, and information was more likely to be distributed in real time rather than being stored and archived in the system.

These information and communication patterns are also highly prevalent in building production where such real-time distribution of information must function in mobile work environments which pose other requirements on appropriate ICT support. No matter how much effort is put into the design and planning process, as soon as the production work at the construction site starts all kinds of problems and issues arise that calls for immediate attention. In this constant reactive production environment, handling problem situations result in natural communication patterns that are dynamic, spontaneous and informal (Dainty et al., 2006). The recognized problems with information management and project communication at production sites in the construction industry could possibly be explained by a partially misleading conception of what mobility is and what production site based mobile work involves. For more than a decade ICT systems designed for stationary office use have been pushed out to the production environment, which have resulted in construction management teams being tied up inside the site offices at their desktop computers a large part of their working hours. The ICT implementation at construction sites has gradually forced production teams into partially unnatural and ineffective administrative work routines, due to the inflexibility and fixed nature of the ICT systems. But wirelessly extending these business systems to the construction site using certain mobile computing devices will probably not be a sufficient solution of these problems in the long run. A legacy office based system design will then be forced into a mobile ICT platform that might need an alternative design to better fit the mobile work context. There are differences in how ICT is related to different work types. In office work the computer is often the main tool for performing work, and functions virtually as the workplace itself. In mobile work the main job activities are regularly taking place external to the computer, and often demand high level of visual attention and hands-on execution (Kristoffersen and Ljungberg 1999). Therefore, in mobile work environments like construction sites ICT based systems only play a supportive but important role, if they are designed according to the needs and demands of the mobile workforce.

In the indicative studies described above it was found that communication was going on at two levels at once. The formal, controlled exchange of documents took place on one level, while informal, interactive problem-solving took place on the other. Even though ICT plays a decisive role, communication cannot be viewed as a whole and is impossible to control through formal tools. Although ICT contains tools to enable us to keep track of the entire stock of information, it can also give rise to the information anarchy prevailing in certain projects. To explain this, we need to return to the basic question of how the not-yet-built can be visualized, communicated and understood among the participants involved in a project. Linn (1998) describes how technology based on ‘pre-images’, is actually a prerequisite for the construction of large complicated buildings, forming architecture as knowledge:

“Images enable the pre-conception to be processed step by step. It serves as a work piece in a visible process that is open to criticism. The various components can be kept apart and can be individually studied in a more analytical manner….The situation is not unlike a game of chess: if the game is illustrated move by move, the consequences of individual measures and the choice of options become clearly visible and are available for action…The significance of pre-image technology as a means of creation lies in the fact that it has enabled us to bring in a screen on which we may project and concretize the game and open it up move by move. The method has functioned extraordinarily well, has given rise to rich building traditions and has dominated the field for over four thousand years. It remains as useful today as ever, although we’re now beginning to realize the potential of alternative methods more clearly than before.” (Linn, 1998, p. 75, translated)

Computer modelling has added whole new dimensions to this knowledge technology:

“A possible new knowledge technology may be glimpsed in the world of computer modelling. In the computer, an objectified virtual model can be created. It is not visible in itself…The computer does not primarily create an

image but models a 'virtual shape' which it is prepared to visualize in the form of an image displayed on the screen or on paper. This is where the computer has added a new step…What's new is that the model's existence before the image has been split into two separate stages. After the model's first stage in the mental world the computer has inserted a virtual existence in which the model has been made collectively available. Several people can work with an identical model (at the starting point) and the changes they make can be referred back to the model. Its significance, therefore, is to a high degree communicative. So far, we have recognized only some of this new potential." (Linn, 1998, p. 147, translated)

The vision of a common building information model (BIM) is very much alive, and great efforts are being made all over the world to realize this new means of sharing information – in fact, it has been of interest to researchers for the last 30 years or so. However, there is still a long way to go before it sees full-scale use in architecture and construction. The question of how practitioners can solve their communication problems in the meantime has in many cases simply been ignored. Much has remained as before, although with ICT as an additional factor to be managed in already complex situations.

The accepted practice for ICT-based project communication that has evolved over time is based on the use of web based project networks and central storage of shared documents at project sites. This has given members of the project team immediate access to the information stored in the shared archive but has reduced the flexibility and overall understanding of the project provided by the traditional approach to work and its practices. It is no longer possible to decide who is to receive what information at a given time. The information is available at all times, it is continually changed, and project members do not wait to be given information. They obtain it from the easiest accessible source and hope that it is accurate and up to date. It is from this information that each participant creates his or her own 'pre-image' of the project. The difference between the old and the new approach to work is very large. The project manager cannot control the 'images' of the project that are being spread among the members of the team.

Pressured by tight schedules and concerns about fees, everyone takes a chance on being able to complete their assigned duties at the last minute, which sometimes leads to near chaos. If, as in one of the above studied cases, after a year-long planning and design process a meeting has to be called on the day after distribution of the tender documentation in order to go through 600 corrections, anyone can see that much remains to be done before order can be brought to the used project communication channels. The point is that although IT enables rapid communication and allows changes to be made at the last minute, it also creates new problems in such important areas as coordination, quality assurance and responsibility (Wikforss, 2006).

The ideal model of good project organization in the construction industry is the linear, hierarchical approach. The planning and design process is described in linear terms; it is divided into phases and is then successively broken down to an ever finer level of detail. Everything seems to fit logically together. It appears that in construction contexts, the design and production planning processes are treated as a single process, even though the work involved in the design of a building differs significantly from technical planning and work on construction and detailed building solutions. The problem with this mechanistic way of thinking is that the ideas used to describe both the conceptual and actual construction of a building, from the finished whole down to the smallest detail, is also used to plan project organizations, human cooperation and the exchange of ideas between professionals – professionals who have very different educational backgrounds, knowledge and experience and use different technical jargon.

ICT tools, too, are often put together in the form of systems which can be broken down into logical sub-systems and functions. When these systems are used in their intended context, the hierarchy of the organization, it turns out that they do not always produce the expected benefits but rather help to bring about the chaos witnessed by the participants in the project. The real exchange of information takes place via other, informal channels, where other forms of information and communication technology such as e-mail, SMS messaging and mobile telephones, which enable direct contacts between project members in network-like cooperation. The problem is that this communication behaviour provides no possibility of ensuring the overall understanding and degree of coordination that a large project requires. How can a planned, mechanistic approach to systems be combined with a flexible, dialectical one so that it enables appropriate communication practices between interacting project members, as a complex project demands? Dahlbom and Mathiassen (1993) discuss the importance of uniting these two perspectives:

"One of the challenges of systems developers is to understand and respect the Platonic nature of human knowledge and communication, and to understand the computer not only as a machine for processing data

based on Aristotelian concepts but at the same time as a tool to support human beings in using and communicating Platonic concepts." (Dahlbom and Mathiassen, 1993, p. 37)

5. FROM DILEMMA TO STRATEGY – AREAS FOR FURTHER RESEARCH

The question of how the project management should organize project communication involves much more than the choice of form and technology for representations of the future buildings and whether it should be structured in two, three or four dimensions within a product and process model. A narrow search for standards for information deliveries as the only solution to the serious communication problems encountered during the course of the project obstructs many of the other factors that must also be dealt with by management of construction projects. In the context of the indicative studies described in this paper a variety of areas can be identified that calls for further research. These research areas will now be briefly introduced and discussed.

5.1 Formal and informal communication

It is a question of how the project as a whole should be organized in order to facilitate both formal and informal communication (see e.g. Kraut et al., 1990; Whittaker et al., 1994). How can the project management achieve the flexibility of organization and method of work needed to enable the project members to handle the many unexpected situations that almost by definition can be expected to occur during activities organized in the form of a project? How can a project organization and method of work be designed that would support a combination of real-time, interactive, ICT-supported problem-solving and strict, quality-assured information deliveries? How can one facilitate rapid problem-solving and direct contacts between the project members without disrupting the formal structure of the project?

5.2 Communication in mobile work environments

The mobility of work is increasing in both design and production phases of projects. Mobile work is often seen in relation to a place, for example an office or a desk, from which workers move away. Designing mobile ICT then becomes giving people the same possibilities in the field as they would have at their bases. But mobility can also be a more fluid form of activity, where there is no such thing as a base. In work types like construction site work the mobility is an important component of the work itself. In these work environments people are mobile as the work activities occur, they are not mobile in order to transport themselves to some place to perform the work. This constant 'inbetween-ness' (Weilenmann, 2003) is an important part of genuine mobile work, but also results in contextual unpredictability and heterogeneity concerning job activities and their proactive and reactive assessments. This view on mobility poses new challenges of understanding what ICT is supposed to deliver in various job settings, as well as appropriate system design and use of the technology for different mobile work contexts.

5.3 Roles and incentives

The forms under which the project members are taken on, their individual contracts and the distribution of their individual roles also affect communication. Attempts to define areas of responsibility too closely risk creating barriers between the members of the team, who will all cut down on their individual contributions to communication within the project. Important information is lost and, in problem-solving, participants tend to underperform when there is no incentive to provide information over and above the agreed deliverables. This also raises the question of what obstacles are created when new technical solutions for project communication upset the traditional distribution of roles. How can the project management deal with the resistance to change, which is commonly encountered when different professional groups start defending their own interests?

5.4 Organization and management

As noted in the introduction, construction industry oriented information and communication research has until now concentrated on information modelling and standardization. To solve the practical problems that the industry is encountering, as described in the case studies, the perspective must be widened so as to include information and communication technology from an organizational and management viewpoint (see e.g. Sverlinger, 2000). How should one prepare, assess and decide on ICT strategies for differing purposes and financial conditions? How should one organize the merging of new enabling technologies and ongoing knowledge intensive activities? How should one organize ICT usage, and how should the overall operations be

organized? Questions about the role of information technology in project management and its significance for knowledge formation, experience feedback and clear communications in project-oriented enterprises are becoming ever more central issues. It is also a question of how ICT affects the dynamic relationship between the individual and the project or company.

5.5 Usefulness and user acceptance

Achieving actual benefit of ICT tools is a matter of creating acceptance of the technology among the intended users through everyday usefulness in their ongoing work (see e.g. Davis, 1989; Nielsen, 1993). One of the main challenges in this context is to understand the socio-technical gap of what is required socially within a work group and what can be done technically (Ackerman, 2000). It is important to understand how people really work in groups and organizations so that the introduction of new ICT systems do not deteriorate and distort the collaboration process and social interaction. If the technology does not serve and enhance these processes, it will be considered as an obstructive element for effective operations and project delivery, and will therefore not be used as planned. Therefore the technology has to be designed as a supportive resource in everyday work that allows for intuitive and effortless use. In this sense, the usefulness aspect is about balancing the formal use, structure and functions that is embedded in ICT systems technology with the complex fluid and social nature of work practices and collaborative activities.

5.6 Implementation management

New changes, large or small, introduced in any project, corporation or industry will probably not turn into an immediate success. Tweaking both organization and technology will be necessary to achieve an appropriate configuration. The pieces of the puzzle do not fit together from the beginning and it is through the continuous trial and error process of implementation (Fleck, 1994) that eventually will lead to a configuration of technology, communication processes and work practices that fit the social and organizational context. This view on implementation as an enabling process for development involves continuous mutual adaptation between the technology and its environment, and recognizes the crucial role of the people inside the user organization. This collaborative adaptation process is necessary because technology rarely fits perfectly into the user environment (Leonard-Barton, 1988). Collaboration, communication and feedback between users and developers are often critical in achieving the proper fit between technology, organization, and users (see e.g. Rosenberg, 1982; von Hippel, 1988; Voss, 1988). User involvement in the technical development and implementation process therefore plays an important role in achieving long term usefulness and benefit of ICT based collaborative project communication tools.

6. THE ROLE OF PROJECT COMMUNICATION IN CONSTRUCTION

The knowledge obtained in the presented case studies concerns the organization of information technology in project-oriented enterprises. The questions as such are of an interdisciplinary nature, since successful research in the field of project communication will derive from knowledge of developments in ICT along with profound understanding of the theories and practices of management and communication of projects. One of the principal tasks will be to develop an understanding of the type of communication and information management that will be able to cross the many professional, disciplinary and geographical boundaries normally encountered in project organizations.

The improvement of project communication processes and technologies on different functional levels may change the organization of future projects and how its business activities and work routines are designed, planned and performed. This can for example help enabling just-in-time deliveries and the more industrialized and rational business processes that the construction industry in fact is striving for. On-demand access and mobility of information, enhanced communication tools together with new ways of organizing and performing collaborative work could be important components of this development process. The full recognition and determination to improve collaborative communication and information exchange throughout all project phases will probably have considerable effects on the industrialization process of construction projects. These issues have lately started to become a focal point for the construction industry. That is a welcomed change of attitude in a project based industry that historically has seemed to have taken appropriate project communication practices for granted.

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