



The adoption of ICT in project-based and traditional organizations

The adoption of
ICT in
organizations

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Evidence from Finnish and Swedish companies

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Abstract

Purpose – This research aims to investigate the adoption of electronic communication tools and seeks to shed more light on their diffusion process, a challenging task for project-based (PBO) and traditional business organizations (TBO).

Design/methodology/approach – The data for the study were collected through three surveys, one total population survey in the Finnish and Swedish house building industries representing traditional business organizations, together with a focused and a total population survey in project-based organizations.

Findings – The main findings from the survey indicate a difference in attitude between the employees of TBOs and PBOs. Moreover, electronic document management and scheduling were more prominent among PBOs, because these firms exhibit more inter-organizational communication.

Research limitations/implications – The findings are limited to project-based and traditional business organizations. The research emphasises the fact that PBOs make more inter-firm collaboration efforts and thus require more extensive communication systems for inter-organizational links. Further research is needed in other industries to validate the present findings.

Practical implications – By looking at the use of ICT, the aim was to determine which e-communication tools are more tightly coupled to management and how firms can benefit most from these tools for organizational governance.

Originality/value – This is one of the few studies to have examined the uses of ICT in a PBO and TBO context and especially in Finnish and Swedish background.

Keywords Project-based organization, Traditional business organization, E-communication, Communication tools, Communication technologies, Sweden, Finland, Organizations, Organizational structures

Paper type Research paper



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1. Introduction

Electronic communication (e-communication) plays a fundamental role in any organizational activity. Today this includes a multitude of communication tools, ranging from simple forms such as e-mails to more complex forms, e.g. electronic document management (EDM) systems, electronic data interchange (EDI), enterprise resource planning (ERP) systems and project planning systems. The introduction of different e-communication tools may alter the operations of firms, providing them with innovative venues to enhance their management processes. E-communication can be divided according to intra-organizational or inter-organizational context, each with its own challenges and opportunities. Depending on the forms and types of complexity in their interaction, project-based organizations and traditional organizations face different communication needs and barriers to require different applications of e-communication. Project business involves the interaction of inter-organizational and intra-organizational activities and their structures with respect to marketing, procuring and executing project activities. Davies and Hobday (2005) refer to it by the term “project-based business” (PBO) when they mean “organizations – which may be entire firms or units within firms – that deploy projects to achieve major business objectives, including all firms which design and produce complex products and systems (CoPS)”. For the purpose of this study, project business is defined broadly to encompass all business functions in the process of which many stakeholders are involved. These functions running through the life cycle of a project can be described as: “management”, “customer interface” (or “concept development”), “engineering”, “supply and procurement”, “transportation and logistics”, “construction” and “operation”. In all these activities, intra-organizational processes interact with inter-organizational processes throughout the project life cycle and, hence, communication plays a vital role in organizations.

Earlier research on improving communication focused mainly on internal organizational communication and most of this attention concentrated on the availability of communication for intra-organizational communication of traditional business organizations (TBO) (Amaratunga *et al.*, 2002; Greasley, 2003). It was hoped that some research on the perceived usefulness (an outcome expectancy) would produce key predictors of intention/behaviour for adoption. Since the current research builds on the technology acceptance model (TAM), there is an implicit assumption incorporating an outcome-process perspective (Venkatesh, 2000). However, the distinctive characteristics of project-based business (uniqueness, uncertainty and complexity), with its distinctive communication needs, mean that any attempt to improve communication on the basis of traditional organizations is unlikely to fulfil the special requirements of project business. In particular, a focus on the company’s internal communication fails to recognise in the conduct of project business the importance of communication with external networks, partners and other stakeholders. Indeed, researchers in the area of project management have largely neglected such inter-organizational communication as can be supported by the adoption of available technologies or developing new technologies.

Therefore, the driving force for this study is the lack of research on firms engaged in e-communication covering project-based organizations and the way in which traditional business organization e-communication differs from these organizations. An attempt should be made to elaborate some thoughts and views on e-communication

which interrelate the firms' inter- and intra-organizational communication use. In line with the integrated communication and available technologies, we discuss its uses in PBO. In short, this research has been undertaken to answer the following questions:

- How do project-based organizations use e-communication in the form of available technologies and
- How does this differ from the use made by traditional business organizations?

The first step in addressing the above research questions is to establish the difference between PBOs and TBOs. The organizations involved in project business are always formed around the tasks involved with its stakeholders. Therefore, it is appropriate to establish a framework for their intra- and inter-communication applying the emerging technologies. Establishing such a framework will provide a better understanding of the way in which firms communicate with their internal and external partners. The communication needs to specify what sets of available technologies can be implemented by the firms, thus leading to the actual use of them by the two groups of organizations. We will also determine whether there are any differences in the actual use of e-communication between the two different forms of organization.

2. Project-based and traditional organizations

The major characteristics of PBOs along with others are uniqueness, complexity, and discontinuity. A project is unique in the sense that every project differs from the others in size, type, customers, suppliers, volume, price and so on. It is complex in terms of the technical, financial, political and social factors involved. Finally, it is discontinuous in terms of a high degree of discontinuity in economic relations between suppliers and the customers.

These changing external dynamics offer new challenges to project-based organizations. Moreover, growing organizations have a variety of problems and putting those problems in a project framework is a very effective and efficient way of handling the turbulence. In Table I we list the most prominent features of project-based and of traditional organizations. The emphasis on differences in time-frame (temporary vs continuous arrangements), environment (dynamic vs stable) and decision making (decentralised vs centralised) enforce the distinction between the two forms of organization (Sandhu, 2005; Artto and Wickström, 2005; Sandhu and Naaranoja, 2009).

Project-based organizations	Traditional business organizations
Uniqueness	Continuous operations
Complexity	Emphasis on working processes
High degree of uncertainty	Low degree of uncertainty
Discontinuity	Stable processes
Temporary arrangement	Permanent arrangement
Emphasis on goals	Inflexible
Dynamic	Hierarchical organization
Flexible	Centralised decision-making
Non-hierarchical organization	Bureaucratic
Decentralised decision- making	
Adhocratic	

Table I.
Characteristics of
project-based
organizations and
traditional organizations

In many ways, a project is, in itself, an organization – a “new” organization which links to other organizations, externally and internally. Therefore, it needs to take into account the unique characteristics of this “new” organization. However, the problematic issue in use is that a particular organization may have difficulty in adapting to a new situation.

In spite of the increasing adoption of the project approach, project managers are still perplexed, for two reasons. First of all, the goals of the project are likely to change and become more demanding with changing external circumstances which are beyond the company’s control. Second, in more recent times the traditional techniques of handling the project have not always been a proper fit. The nature of project business means that organizations involved in project management must be specialised in communication if they are to offer a full range of services to their customers, cope with demand fluctuations and shorten response times. Past research (Sandhu, 2005) has emphasised the importance of communication and improving communication processes, in particular on internal organizational capabilities, and most of this attention has been focused on communication and process development. However, some industry-driven research has been done in this area in Finland, mostly on the technological development of producing applications and agreeing on standards, e.g. the VERA programme during 1997-2002 (The VERA programme, n.d.) and the KITARA programme started in 2005 (The KITARA programme, n.d.).

Inside the TBOs, there are constant and well-known institutions; for example, functional groups, departments, plants and branches, where knowledge and experience are acquired, stored and disseminated. These institutions can be consulted and their knowledge and experience can be retrieved, whatever the specific source from which they were collected, e.g. in documentation, records, competent employees or hidden within the working process. However, in PBOs the established methods and tools of communication for sharing knowledge require further investigation and development to cope with contingencies (Sandhu and Naaranoja, 2009; Ajmal *et al.*, 2010).

In general, there are no methods of capturing the knowledge and experience obtained and collected during projects. Projects are as distinct as temporary organizations with particular objectives, detailed tasks and restricted time and budget. When a project is finished, normally there is no institution or group left from which to access the stored knowledge. Meeting points, such as groups, departments, plants, branches in the regular organizations, are dispersed after the ending of a project. In many cases, even the place where the records of a specific project are accumulated will be unidentified. It is even hard to discover which employees have worked on a recently finished project, who were accountable for specific tasks and where these employees are working now within the company. Difficulties of this kind will increase with the number of projects running in parallel and therefore the organized securing of knowledge and experiences is even more important in multi-project management. Companies that do not systematically capture for later use the knowledge gained in projects before they end risk the loss of some certain knowledge and some useful experiences.

Communication is a key issue in the storing of such knowledge. This study presents a framework which is elaborated on the basis of the reciprocal interactions of activities within and outside the organization – thus providing a coherent basis for continuous improvement in e-communications. Therefore, though the differences in characteristics

and communication needs are great, the similarities are even bigger, implying that technologies for supporting PBO and TBO can be cross-productive.

3. Intra- and inter-organizational communication

Communication is most often described along three dimensions: content, form and direction. Content and form together make up the messages which are sent (directed) through a channel to its receiver. Any of the three dimensions can get disturbed by “noise” which distorts the message or direction of the message. There are many barriers to impede communication, ranging from language-barriers to lack of understanding of the context.

Adriaanse and Voordijk (2005) state that the contract, the frames of reference of the parties involved and the interests of the parties involved (together with a lack of trust) are three major factors influencing inter-organizational communication (i.e. communication between client and contractor) during different project phases. Here we argue that in projects the initial phases are extremely important because the need for pre-contractual communication is crucial and so is the need for early risk analysis, implying that much communication takes place before an actual contract is drawn up. In the early phase of the project, the communication could be of many forms: oral, written (e.g. textual, drawings, graphics) or non-verbal (e.g. gestures).

The project management literature has focused mainly on intra-organizational communication aspects (Almeida *et al.*, 2002; Tsai, 2001) how a project is planned, controlled and delivered. But communicating in a project is conceptually different in the traditional stable manufacturing organizations. This focus seeks to develop a greater understanding of the contextual aspects of communication in an inter-organizational and intra-organizational context. Communication tools have been revolutionised with the explosion in information technology, as a multitude of methods and software programs has become available for business. Sophisticated software programs are available and procured, but many are left on the hard disk without being used by the senior managers who commissioned the software.

A project business involves intra-organizational and inter-organizational networks that require different types of knowledge and communication. One of the difficulties is that the available communication methods are not easy to use or are deemed unnecessary in project-based organizations. A framework which combines intra-organizational networks with inter-organizational networks is required to communicate efficiently and effectively throughout a project’s life cycle. Otherwise the project manager cannot learn how to communicate in various situations in order to manage the project-based organization.

A variety of intra-organizations can exist – for example, matrix organizations, projectised organizations and coordinating organizations. Moreover, several structures of intra-organization can exist to perform project activities. These arrangements depend on the proportion of the business involved in a project, the scope of the project and the duration of the projects involved. All these issues are connected to the communication needs of the organization.

Earlier research on intra-organizations has focused mainly on environments that could impede the development of corporations, rather than those from which benefits may be derived (Brady and Davies, 2004; Collyer, 2000). However, most organizations are in an “intermediate context” which allows processes to be developed and benefits to

be mutually derived. The important organizational characteristics for successful project development include openness in communication, adequate environmental scanning, management support and established organizational values.

Developing communication methods with an inter-organizational as well as an intra-organizational perspective requires a precise understanding of what kinds of communication practice foster business development. According to Amabile (2005), managers often destroy creativity in project-business development by failing to make good connections between people and activities. It is therefore important to identify the interdependencies between actors and activities and to identify the resources which they require to perform their tasks. The communication needs are tightly coupled with the characteristics of the actors, activities and resources. Thus, in order to provide sufficient support and ease of communication in project-based as well as traditional organizations the communication needs should be investigated and developed. In Table II, we categorise the communication diversity between PBOs and TBOs, by looking at the focus and the tools used.

Table II presents the notion that, because project-based organizations are more involved in collaborative communication over organizational borders, the tools should support the features associated with inter-organizational communication as the electronic data management (EDM), enterprise resource planning (ERP) and three-dimensional visualisation (3D visualisation) are being commonly used. The emphasis in traditional organizations is on the efficiency of internal communication and on the functional level this is why organizations use MRP I-II, groupware, 2D/3D and CAD/CAM.

4. Adoption of e-communication technologies

E-communication facilitates the information flows of the firm, within and across firm boundaries (Wu and Lee, 2005). E-communication in an industry setting can be roughly divided into two forms:

- (1) intra-organizational communication (within an organization); and
- (2) inter-organizational communication (e.g. customer communication, supplier communication and partners, i.e. multiple organizations working together on a project).

Each of these communication modes requires its own data sets, communication channels and tools to facilitate the communication. Using e-communication, organizations today have added tools for their communication needs, whether the communication takes place between organizations (with customers, suppliers, partners) or inside their own organization.

Table II.
Communication diversity

Form of organization	Main focus of e- communication	Communication tools utilised
Project-based (PBO)	Collaborative, inter-organizational emphasis	EDM, ERP, 3D visualisation
Traditional (TBO)	Functional, intra-organizational emphasis	MRP I-II, groupware, 2D/3D, CAD/CAM

The cost of communication has declined compared to traditional means (e.g. attaching a file to an e-mail vs distribution of paper copies), the speed of communication has increased rapidly (e.g. time for an electronic message to arrive compared to snail mail delivery) and the technologies involved in bringing e-communications are becoming ever the more versatile (e.g. both video-conferencing and textual communication simultaneously). There are still some disadvantages with e-communication, e.g. lack of interpersonal exchange and legal implications (e.g. the validity of signed paper compared to e-mails). These areas are remedied over time as technologies evolve and as digital signatures, for example, are standardised. Still, the study of barriers to adoption is important for recognising why technologies are rejected, in this case, the use of e-communication. Firms should take stock of the adoption barriers they retain and how they can manage them, what can be done internally and what should be placed in the hands of outside partners.

The distinction between adoption and use is that adoption is the decision to implement whereas use is what happens after the implementation has been carried out. The adoption decision is a precursor to use, but use is not a definitive consequence of adoption since implementation can be stalled or cancelled even after the actual adoption decision has been taken. During use, there is often some form of adaptation of the technology as the firm or individual learn more it. Often a technology is implemented and tested, but in a simpler mode or partial way. As the organization or individual gets comfortable with the technology, the functionality can be incrementally extended.

Barriers to adoption can be classified on the level of general e-business and specific applications. When considering such barriers in firms, it may be necessary to investigate whether the barriers are generic or time/firm-specific. Generic barriers do not change rapidly as they are inherent to the industry or the market. Firm-specific barriers are associated with the organizational schemas and resource constraints affecting the decisions to be made. Time-specific barriers might become obsolete with the introduction of new infrastructure support technologies or lower internal requirements of technical competence to the adopting firm, for example. Depending on the type of barriers, adoption may be slow or even brought to a standstill, leading to patterns of early or late adoption.

Central to the problem under discussion is that the barriers may be considered to occur on three different levels:

- (1) individual level (e.g. project team member, procurement manager);
- (2) firm level; and
- (3) network level.

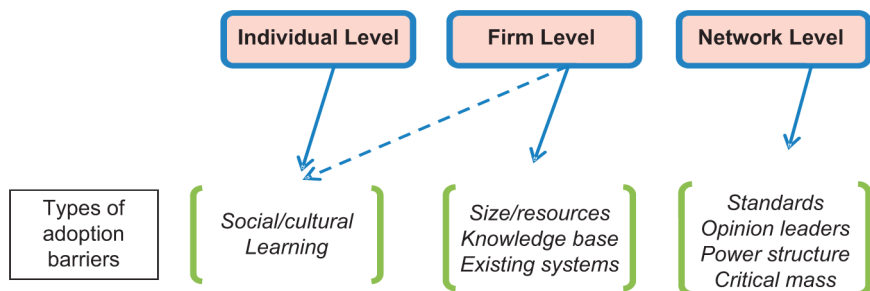
The notion of adoption at different levels is nothing new, for these levels are dealt with in the literature on innovation diffusion in the form of optional, collective and authoritative decisions (Rogers, 2004). What is novel here is the view that the barriers (and benefits) are located at different levels and that conflicts between levels create situations more complex and multifaceted than previously conceived. Adoption barriers at the firm level are mostly identified as resource issues, e.g. technological and monetary restrictions. The network level consists of connected firms co-operating on projects or in the form of supply-chains. Barriers at the network level may consist of

social norms, risks of non-established standards or legal issues. This is illustrated in Figure 1.

Further, ICT implementation barriers exist and can be identified and handled from different perspectives, e.g. the top-down effects on multi-level IT implementation barriers with links to implementation coping strategies (Stewart *et al.*, 2004). At the industry level, the nature of the industry in the areas of competitiveness, cost sensitivity, resource limitations and fragmentation, may raise barriers that inhibit IT implementation. At the organizational level, the lack of IT investment justifications and available resources may discourage implementation, and so may problems with strategic foresight. At the project level, the nature of the projects themselves (uniqueness, complexity and discontinuity) creates barriers to IT implementation. In a study (Stewart *et al.*, 2004) of the Australian construction industry, the most significant barrier on project-level was tight project time-frames which inhibit training and experimenting with IT, followed by limitations in IT funding, lack of IT leadership and low levels of technological literacy.

Evaluating IT costs when developing an IT infrastructure which can be economically justified is an issue which needs more focus and development, especially regarding indirect human costs (e.g. management time on planning and integrating new systems, internal system support) and indirect organizational costs (e.g. productivity losses, resistance to change) (Love and Irani, 2001). The concept of the IT lifecycle is providing firms with further complexity in the investment situation, but also a more realistic picture of what can be expected from investment in IT.

Communication processes (i.e. the exchange of information) for firms can occur either internally or externally. Intra-organizational e-communication is in its simplest mode merely electronic mails (or faxes), while more enhanced e-communications over intranet or local networks can be streamed in different forms: text, audio and/or visual. An intranet is a network based on transfer control protocol/internet protocol (TCP/IP) protocols and available only to the members of the organization and is often protected by a firewall (Horton *et al.*, 2001). Inter-organizational e-communication can be focused on customers, suppliers, partners or other parties. The interface with external parties provides support for order taking, procurement, collaboration or other processes. Applications exist for constructing and managing these relations, in the forms of extranets, EDI, e-commerce, EDM and so on.



Source: Adopted from Stewart, *et al.* (2004)

Figure 1.
Links between levels and
adoption barriers

The spread of e-communication varies across industries, networks and even organizations. The rate, extent and frequency of adopting of e-communication all quantify the adoption of technology, from the economic-rationalistic perspective (Fichman, 2004). The critique against the so-called dominant paradigm of ICT innovation coupled with economic and rationalistic behaviour is that the focus on quantity of adoption and the inherent perceptions of innovation as beneficial may not paint a totally realistic picture. The adoption of transient technologies, the affluent results of early adoption and “more is not always better” are factors which contradict the quantity approach to IT adoption.

When a firm decides whether or not to adopt e-communication, the complexity of the decision should be apparent. The decision is based not only on internal perceptions but also on the business milieu of the firm. The determinants of e-communication adoption can be divided in several different groupings: incremental vs. revolutionary, internal vs. external stimuli, key drivers (technological, economic, social, organizational drivers and barriers). In a study (Wu and Lee, 2005) on e-communication in four different industries, two sets of factors are recognised which affect the adoption of e-communication: internal push factors and external pull factors. Both sets of factors are influenced by the environmental turbulence, whether the changes are in technological or market turbulence. Internal push factors consist of customer orientation and competitor orientation. In communicating on a project, the modes and tools of communication may be set from the beginning. For example, in big construction projects, the use or non-use of an electronic document management system can be enforced by the head contractor and the systems may vary according to what collaborators the organization communicates with.

To analyse which e-communication solution is or could be adopted by an organization, we have first to understand the network structure that the company is part of and maybe consider where in the network the organization wants to position itself. The locus of control among partners in the network affects the choice of solution, implying that a hierarchical network structure indicates a narrow locus of control and less need of completely open solutions (Marchewka and Towell, 2000). For example, in a network situation where the relative power of one or a few participants is very high, one could expect partner-specific solutions, as the larger organization(s) may dominate their smaller partners and can therefore enforce solutions more suitable or compatible with their existing internal systems (Ratnasingam, 2000). In a network with a more evenly distributed power structure, no single participant can be expected to enforce an individual solution, as this could limit the options to connect to potential partners.

As pointed out earlier, the ability of the e-communication solution to integrate with existing systems in the organization is of the utmost importance. Therefore, an investment in an e-communication solution may require further development or even re-invention of the business information systems which are the backbone of the firm (Engsbo and Sandhu, 2007).

4.1 Challenges associated with the use of ICT

Wixom and Watson (2001) identify three broad factors regarding the success of ICT related projects; these are project, organizational and technical factors. Each of these critical success factors is discussed below:

- *Project considerations.* It is well known that a project proponent is important but if an enterprise system project is spread over a long period of time, the leader may change. Similarly way, the original members of his team may also be replaced. The newly joined members may not be as “sold” on the project concept as the initial team members, for example, the “vanilla implementation.” Usually projects take off with a good deal of excitement and fanfare and the team members have a clearer common vision of the goal than someone who joins at a later stage.
- *Technical considerations.* A project can start with a plan which contains technical details about the data format, update, use and testing, but it may not be possible to have a completely accurate plan at the outset. One example is “data-cleaning” in the HR system of a university. The cleaning process would ensure that there is only one data set on every student across the institution. This may be a daunting and lengthy task because it may not be easy to predict the quality of existing records maintained in multiple locations. So the development of a clean, integrated database can take longer than originally anticipated.
- *Organizational considerations.* Commonly, the implementation plans do include the resources required for an organizational restructuring program which is critical for getting people to adopt the new practices, for example, training, workflow control and communication. But the resources allocated for organizational changes are often diverted to other areas, such as addressing the pressing technical issues which may have exceeded their original budget.

4.2 Participation of users

A requisite of a successful ICT project is the participation of users. They are not only involved in defining users’ requirements, but also in the implementation and adoption phases, which would ensure that changes in organizational level do take place. Although the research shows that even when the users have been “bought-in” during the definition phase, they may still not adopt the technology due to the following reasons:

- The users may be reluctant to change to the ways of working required by the new system. Not fully understanding the technological aspects may be a contributor to the “legacy” frame of mind.
- If the users did contribute to the design phase, but their suggestions were not included in the implemented version of the project, the users could be resistant to adapting.
- It may be hard to get the users to start using the new technology because they may already be busy with their previous work or may not be convinced that the technology brings them an advantage.

4.3 Literature synthesis

Many studies have been conducted to address the ICT adoption issues in MNCs and SMEs. Research synthesis of these is listed in Table III.

However, so far very few studies have addressed particularly the ICT adoption process in project-based organizations and compared it with that in traditional organizations. Hence the present study aims to closely look into ICT adoption in such organizations by providing evidence from two Scandinavian countries.

Author and year	Title	Methodology	Findings
Kohna and Husig (2006)	"Potential benefits, current supply, utilisation and barriers to adoption: an exploratory study on German SMEs and innovation software"	A survey with a uniform questionnaire was sent out to marketing and IT executives of manufacturing oriented SMEs in Germany	The findings are that software tools are rarely used to support the innovation process in German SMEs
Yang <i>et al.</i> (2007)	"Adoption of information and communication technology: impact of technology types, organization resources and management style"	An empirical method was employed in this study about ICT diffusion process between the early and late adopters	Due to management characteristics there is significant dissimilarity between early and late ICT adoption in organizations. However, no significant differences were found in organization resources or corporate strategy factors. Also, there are significant differences in organizational characteristics such as sales volume and rewards
Bayo-Moriones and Lara-Lopez (2007)	"A firm-level analysis of determinants of ICT adoption in Spain"	The data were collected in a survey with a sample of 337 Spanish workplaces	The need for reviewing the traditional public support for ICT implementation on small workplaces arises, together with the existence of complementarities with policies aimed to attract foreign investments and to increase the workforce education level as a way to spread ICT implementation. Results also show that managers need to align ICT adoption and the strategic focus of the firm more consistently
Gupta <i>et al.</i> (2008)	"Adoption of ICT in a government organization in a developing country: an empirical study"	A survey questionnaire was used to collect data regarding use of internet technologies among employees in an e-government setting	Study found that performance and effort expectancy, social influence and facilitating conditions all positively impact the use of the ICT in government organizations

(continued)

Table III.

Author and year	Title	Methodology	Findings
Kamhawi (2008)	"Enterprise resource-planning systems adoption in Bahrain: motives, benefits and barriers"	A survey method was employed	Attitudes towards ERP systems implementation could be a critical point for non-adoption. Having positive intentions is an important step towards realism, i.e. really implementing ERP systems
Ramdani <i>et al.</i> (2009)	"KM and enterprise systems adoption by SMEs: predicting SMEs' adoption of enterprise systems"	Interviews were made to collect the data	SMEs appear to be more influenced by technological and organizational factors than environmental factors
Ahuja <i>et al.</i> (2009)	"Study of ICT adoption for building project management in the Indian construction industry"	A questionnaire survey was conducted and through quantitative data analysis the extent of adoption of formal project management processes, ICT adoption for these processes and factors including perception-based factors affecting ICT adoption were studied	IT infrastructure at site has been perceived as an important enabler for effective ICT adoption by building project management. Rate of increase of ICT adoption in last five years has been found significant. But most of the respondent organizations did not have a communication management strategy
Tan <i>et al.</i> (2010)	"Internet-based ICT adoption among SMEs: demographic versus benefits, barriers and adoption intention"	A questionnaire-based survey was used to collect data from 406 managers or owners of SMEs in Malaysia	SMEs would adopt internet-based ICT regardless of years of business start-up and internet experience. Some significant differences are spotted between manufacturing and service SMEs in terms of their demographic characteristics and internet-based ICT benefits, barriers and adoption intention

(continued)

Author and year	Title	Methodology	Findings
Lopez-Nicolas and Soto-Acosta (2010)	“Analysing ICT adoption and use effects on knowledge creation: an empirical investigation in SMEs”	A structured questionnaire consisting of close-ended questions was developed to conduct face-to-face surveys with the key informant person in each company in May 2005. Studied companies were SMEs and most interviewees were CEOs	The results indicate that ICT has a significant positive influence on the, four processes for creating knowledge. ICT oriented to communication and workflow is found, to produce a significant positive impact on knowledge creation processes, except for socialisation process, while ICT use for information does not influence any of the processes for creating knowledge and organizational learning
Adriaanse <i>et al.</i> (2010)	“The use of interorganizational ICT in United States construction projects”	Interviews were conducted with experts from the US construction industry. In total 20 experts from ten companies were involved in this study	The study found that personal motivation is required to use ICT along with the external motivation to use this technology and facilitating conditions in terms of knowledge and skills and acting opportunities to use ICT

Table III.

5. Methodology and surveys

5.1 Background

A variety of research methodologies has been used in the study of project-based organizations – including both qualitative and quantitative methods. The objective of the present study is to emphasise theory development, rather than theory generation. It thus adopts a survey approach which builds on the refinement of existing theories, rather than attempting to invent new ones.

The present study proposed to describe the electronic communication in the organizations and compare PBOs with TBOs regarding their use and adoption of key IT tools in communication. The aim is to facilitate the discovery of new relations and variables in existing models by developing a comprehensive comparison between existing theoretical approaches and observations taken from the survey under consideration.

The data for the study were collected through three surveys, one total population survey in the Finnish and Swedish pre-fabricated house building industries among representatives of traditional business organizations (TBOs) and interviews to clarify some of the answers given in survey. The other two focused surveys in project-based industries. In the second survey on PBOs, no house building companies were involved. The respondents were project-management personnel at both the strategic and the operational levels. Both surveys with similar questions were combined to investigate the plausibility of our assumptions. In total, 114 questionnaires were sent out and 46 answers to our surveys were received. A graphical representation of surveys can be seen in Figure 2.

The data we used were a subset of questions from two surveys conducted in a TBO and a PBO environment, in turn. In this study we compare the answers from ten questions specifically focused on e-communication from both surveys. The questions asked concerned the e-communication tools to be found in the organizations. These tools were design and planning with 3D modelling, internal communication networks in the form of intranet and scheduling software, EDM, electronic procurement and communication platforms.

5.2 Data collection

The TBO survey was conducted among employees of house building companies as a total population survey for Finland (conducted October-November, 2007 and again at the same time in 2009) and Sweden (conducted in March-April, 2008), where the firms

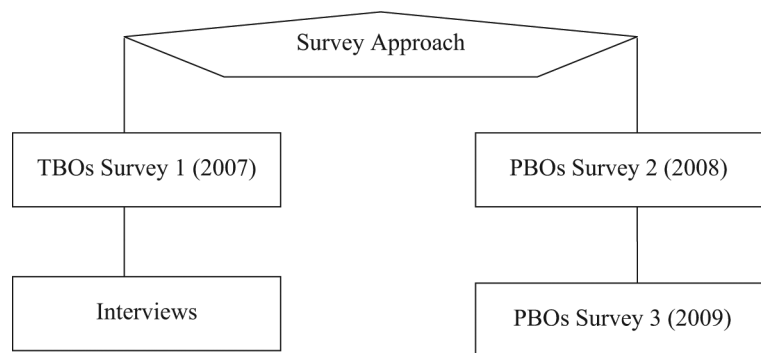


Figure 2.
Graphical representation
of methodology

were selected according to the following criteria: they should belong to the SNI-classification 20301 which denotes producers of pre-fabricated wooden houses and should have more than nine employees. In the study, micro firms with fewer than ten employees were excluded. We excluded this category of firms from our study because their smallness restricts the firms' capability in the field of IT investment. These restrictions are due to shortages of financial and technical resources and to the fact that internal communication technologies in such firms are less needed as the likelihood of face-to-face communication increases. The firms in the study were mainly small and medium-sized enterprises (SMEs). According to the EU definition (European Commission, 2003) of SMEs, small firms have between ten and 49 employees and medium-sized firms are larger but have a maximum of 249 employees. There is also a condition about the turnover and balance sheet related to each category. We sent the survey to 55 house-building companies in Finland and 41 companies in Sweden. The response rate from Finland was 38 per cent (21 answers) and from Sweden 39 per cent (16 answers), 37 responses in total.

The second survey, the PBO survey, was conducted in September-October, 2006, among SMEs as well as multi-national companies (MNCs) located in Finland. The operations of the SMEs were mostly local while the MNCs had offices all over the world. The respondents represented companies involved in projects in the construction industry (excluding house building companies), electronics industry and power-plant industry. The selection criterion for the PBO study was that the PBOs belonged to a project management club because these companies allowed the researchers better access to the required information. We distributed the questionnaire survey to 18 chief executive officers (CEOs), directors and general managers of PBOs. We received nine replies and one reply which stated that the recipient had retired from the project-based organization. Three out of the nine responding PBOs were MNCs with between 750 and 14,000 employees in some 80 countries, including Finland and Sweden. From one of the MNCs we received two responses from its two different divisions, raising the number of responses from MNCs to four. The remaining five companies were SMEs, largely operational in Finland and having some links with MNCs as a supplier. A detail of the respondents from each category is listed in Table IV.

The third survey with PBO was conducted in March-April 2009 in Finland with 46 organizations involved in different types of project (see Table V). The involved in this

Type of firm	Firms	Responses
SMEs 50-249	5	5
MNC 250 +	3	4
Total	8	9

Table IV.
Responses from the
project-based study (2nd
survey)

Type of firm	Firms	Responses
SMEs 50-249	12	11
MNC 250 to 12,000	34	30
Total	46	41

Table V.
Responses from the
project-based study (3rd
survey)

survey were service and manufacturing companies working in engineering, power plants, telecommunications, networks and stainless-steel SMEs and MNCs with between 50 to 250 and 250 to 112,000 employees respectively all over the world. The research sample comprised vice presidents, general managers, a program manager, project managers and project assistant managers working in Finnish project-based organizations. The questionnaire was sent to 400 respondents, randomly selected from the list published by the Project Management Association of Finland on its website as well as from the Project Management Club at Vaasa, Finland. A description explaining the study objectives was also included on the first page of the questionnaire. Moreover, three follow-up e-mails were sent approximately one, two and three weeks after the first e-mail. However, most of the respondents gave an answer in the first e-mail. A total of 41 questionnaires were answered with a response rate of 11 per cent percent only. Among these responses in this survey there were 11 participants from SME and the remaining 30 managers were from MNC. Table VI shows the actual use of ICT tools in TBO and PBO.

In the PBO survey, the respondents were general managers of projects and project managers. In the TBO survey the respondents were either the CEO of the organization or the IT manager. The difference between the groups of respondents is due to the focus on projects in the first group and the fact that the TBOs do not hold project managers. The customer focus between the two survey groups differs since the customers of the TBO are mostly private persons building a small house or a developer producing row houses. The customer group of the PBOs are mostly large organizations whose projects are high in value.

5.3 Findings and analysis

The TBO study provided some interesting details. In their communication to the customers, the house building firms all had homepages and 35 per cent of the firms used 3D visualisation i.e. CAD/CAM, while nine firms (24 per cent) were in the process of implementing this kind of technology. It was more common among the Finnish firms

Technology	TBO	PBO
<i>Intra-organizational communication</i>		
Intranets	60% implemented, 13% rejected.	95%
Design and planning	2D CAD 70%, 3D CAD 60%, CAD/CAM 43 %	2D CAD 100%, 3D CAD 80%
Scheduling	40% implemented, simple or home-made software	100%
<i>Inter-organizational communication</i>		
Extranets	24% implemented, 21% rejected	50%
E-procurement	43% implemented, 40% feel need for it. Advanced use low	45% and will increase in future
Collaborative platforms	No data available	50%
Document management	Internal mostly, 19%	100%
Customer relationship management	37%	70%

Table VI.
Actual use of ICT tools in the two kinds of organization

than Swedish to have 3D visualisation for their customers. 3D visualisation is used to display a model of what the finished product will look like and as a basis for planning or selecting different options, such as colours, porches, etc. Further, 37 per cent of the firms used some form of customer relationship management (CRM) software or database to keep track of customers during the process of delivering the finished house to them. In total 16 per cent of the firms recognised a need for this kind of software while 26 per cent were in the process of implementing such software in their business processes. This was also relevant to the size of the firm; the bigger the firm, the more likely it is the firm is to have implemented 3D visualisation and CRM systems.

Regarding internal communication, the use of intranets was prevalent. Almost 60 per cent of the firms had implemented intranet solutions, but, interestingly, four Swedish firms had chosen not to adopt intranets at all. Moreover, these firms were not the smallest in their group, but three out of the four without intranets were smaller than average for the respondents. The extension of intranet with partner access into what can be labelled as extranets was much less commonly used – only 26 per cent allowed partners access through extranets. It is obvious but worth saying that in order to allow partners access through an extranet, be an intranet should be implemented as a prerequisite for extranet communication.

EDM systems or project banks were used by 21 per cent of the firms, which was unexpectedly high. Then again, this may point to what the respondent considers to be an EDM system or a project bank. A third of the respondents did not know what this term denoted. Once again, size mattered, as six of the seven firms which had implemented EDM were larger than the average firm in their turnover. Time-scheduling systems were used by close to 40 per cent of the firms; once again, a close correlation between firms which have implemented EDM systems and time-scheduling software.

On the procurement side, half of the firms reported using electronic procurement and of these 60 per cent had integrated their procurement to some extent with their suppliers. When asked directly which their connection method for procurement was, the firms revealed that traditional fax or telephone still constituted on average 48 percent of their connection method to the suppliers, while e-mail made up on average. A total of 38 per cent of proprietary systems were used by 11 firms in their procurement process but only made up about 3 per cent on average. EDI communication was used by only three firms, but had high percentages for two of these: 30 per cent and 20 per cent of total procurements conducted on EDI systems. This is a typical trend, as once a firm chooses this method; it will use it as extensively as possible.

The PBO questionnaire survey consisted of PBOs using ICT tools and their communications to customers and sub-suppliers, including other stakeholders. The PBO questionnaire was divided into three parts: A, B and C, in addition to background information on the survey participant. Part A gathered information about project-based organization: which types of project, the sizes of the project teams and the technical engineering function involved. The second part focused on other issues that are not part of this study. Part C is the focus of this study, where we asked questions regarding e-communication technology and ICT tools. This part consists of similar questions to those for the ten main questions of the TBO survey; in this part i we make comparisons and draw conclusions for our study.

All the firms in the study had homepages and the MNCs used a very high level of e-communications in inter-organizational and intra-organizational context. For example, to integrate and coordinate resources across projects they were using project management tools such as time-planning, cost-planning and control, quality management, risk management, deviation management systems, system designs and CRM. As 3D CAD tools are considered important to design in the projects, almost every organization was using 2D and 3D CAD tools and some platform to communicate with their customers. Two out of the nine responding firms did not use 3D and both were among the smallest of the SMEs responding. About 90 per cent of PBO used CRM as their customers required to register complaints etc. about the products. Customers also keep such databases to analyse the performance of their suppliers. The use of intranets was common; almost all MNCs and SMEs were using Intranet solutions. All the MNC and SME used electronic procurements and had integrated their system with their suppliers.

The main results from the questionnaire survey are summarised in Tables IV and V. An important finding from the survey was a difference in attitude between the employees of TBOs and PBOs. According to the respondents from TBOs their employees were more committed to the company strategy than to projects, whereas the respondents from PBOs reported that their employees were more committed to the projects than to the company. It was found that all respondents believed in written contracts as being essential to project business.

Of the use of 3D design software, the Finnish house building firms which used 3D software tended to chose Vertex BD (ten out of 16). The use of e-procurement is confusing, as 43 per cent acknowledged they used it but not mostly in the form of true e-procurement, such as e-mail documents or attachments. The most common form of e-procurement was the proprietary software provided by the supplier, which accounted for 4 per cent of the procurement of materials.

6. Conclusions

This study has addressed the research questions set for investigating the use of e-communication in the form of the available technologies and their adoption, through three questionnaire-based surveys and interviews intended to clarify some of the answers given in the survey. It is anticipated that the findings will provide the SMEs and MNCs with an opportunity to undertake a self-check for the various issues influencing their adoption decisions.

Our conclusions, derived from the study, can be summarised as follows:

- For PBOs which conduct several projects with multiple partners, the inter-organizational communication requirements are higher than they are for traditional organizations, where inter-organizational communication is carried out vertically.
- In SMEs, employees have easy communication access with the head of the company; however, in the MNCs, there is some “distance” between the CEO and project managers.
- The communication needs of TBOs and PBOs are connected to the inter-organizational and intra-organizational relationships exhibited, where

more dynamic and different external relationships might provide firms with differing communication needs.

- The adoption of ICT is restricted to the available technologies, communication needs and organizational characteristics of the organizations, giving different actual use of ICT from PBO and TBO.
- ICT is used in projects and line organizations mainly for governance purposes.
- The use of these tools may help in governance, which is at present developing from the classic hierarchical and market-driven community.

The adoption of
ICT in
organizations

25

The contribution of this paper is to increase understanding of the differences in nature and communication of the TBO and PBO. We emphasise the fact that project-based organizations make more inter-firm collaboration efforts, thus requiring more extensive communication systems for inter-organizational links. The time is a crucial factor in PBO, because of heavy penalties on delays. However, the ever-changing collaborations in PBO also impair the full efficiency of using the same system each time because the project team, if composed of several organizations, is of a different aspect.

Our findings are in line with Kotelnikov (2007) that not all SMEs need to adopt ICT tools to the same degree of sophistication and that there need be no “one-size fits-all” ICT policy across different industries, given those different sectors use ICT differently and thus will adopt them at a different pace.

This study is highly context-oriented and localised; hence generalisation of the result is questionable. There is a need for further studies from other countries to raise the validity of the results. The study makes a contribution to a better understanding of the actual use and adoption of e-communication in SMEs and MNCs.

Further research is needed to measure the wider aspects of differences in e-communication adoption, as our sample of PBO as well as TBO is rather small and we cannot claim high statistical accuracy. The barrier aspect is a further issue to incorporate in future research as to whether PBOs and TBOs exhibit different forms of barriers and the ability to surmount them. We believe the study would also benefit significantly from making more extensive qualitative investigations of the reasons for adopting different forms of e-communication in organization of either form.

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