A Case Study of Systems Development in Custom IS Organizational Culture

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Abstract. This paper presents a study of how the custom IS organizational culture influences ISD practices in organizations developing tailored information systems. We studied four organizations by applying grounded theory and using organizational culture perspective as a lens to the data. The study provides example that illustrate the importance of partnership with customer in the perpetuation of a custom information systems work community. It presents a community of practice that embodies the beliefs in customer satisfaction, growth from global markets and project work along with values of business domain knowledge, customer closeness and doing things right. This study shows how these beliefs and values are manifested in systems development practices and artifacts. Findings show evidence of traditional and customer driven practices aiming to gain a trusted partnership position among customers. The study reveals also the change process going on in those organizations competing in the global markets. This change manifests itself in more product-driven practices aiming to develop more repeatable solutions for multiple customers. The possible consequences of this change process are discussed in the paper.

1 Introduction

There has been strong indication of productivity problems since the mid-1980s associated with ISD projects. These productivity problems include slipping schedules and cost overruns (Boehm 1987; Brooks 1995), and low systems quality with increased maintenance costs (Boehm 1987). In the 1980s many researchers went so far as to speak of a "software crisis" or a "system crisis" (Brooks 1995). The problems forced information systems (IS) and software engineering (SE) communities to direct their efforts primarily towards improvement of software quality and productivity (Keil and Robey 2001; Glass 1994). In spite of this effort problems associated with the software crisis continue unabated. Both IS development and use are full of difficulties and recurrent problems, and most causes of these are social (Lyytinen 1987).

Intensive research on software tools, modeling methods and processes for systems development has not yet delivered tools or techniques that could guarantee success in ISD projects. As against this, there remains a lack of research investigations which are grounded in empirical studies of software development in organizational context. Also the importance of understanding organizational culture has been brought up in (Avison and Myers 1995). This study is part of the larger study to investigate the linkage between organizational context and ISD practices.

This paper contributes to the literature on software and systems development by examining how custom IS organizational culture influences on systems development practices in tailored software developing organizations. According to our study, the beliefs in customer satisfaction and growth from global markets along with values of business domain knowledge, customer closeness, project work and doing thing right influences on the ISD process significantly.

This paper is organized as follows. Next section discusses of what constitutes custom IS organizational culture by giving a short review on related literature. Furthermore, the research methodology of this study is described. In third section, we present findings of our case study. Fourth section discusses the findings. Finally, summary of this study along paths for future work are outlined.

2 Literature Review

This section briefly sets out the important literature which informs the key elements of this study. It starts by reviewing custom information system, then explores community of practice and finally briefly outlines organizational culture as a theory for ISD. The section finishes with the review of organizational cultural perspective and IS research.

2.1 Custom Information Systems

Custom information systems (IS) are those made by either an organization's internal IS staff or by direct subcontract to a software firm (such as Andersen Consulting or Computer Associates). Custom IS are made-to-order systems and are typically built for specific users. This definition of custom IS also includes most government work (Carmel and Sawyer 1998). For example, US Department of Defence (DoD) software development (the focus of much attention by software engineering researchers) is typically custom development. The degree of customization varies within this kind of IS. Some IS are totally constructed from scratch while others, like ERP (Enterprise Resource Planning) systems, are more software products that are tailored to customer needs (Carmel and Bird 1997).

2.2 Community of Practice

A community of practice (COP) is a group of people who share similar goals, interests, beliefs and value systems in a common domain of recurring activity or work (Brown and Duguid 1993, Wenger 1998). Typically such groups do not

overlap with company-assigned teams or task forces. Because they grow out of human sociability and efforts to meet job requirements (especially those not anticipated and supported by the formal organization and formal training for work), a COP is typically not an authorized group nor a role identified on an organization chart. People in COPs may perform the same job (technical representatives) or collaborate on a shared task (software developers) or work together on a product (engineers, marketers, and manufacturing specialists). They are colleagues, bound together by their common responsibility to get a certain type of "real work" done. There are typically many communities of practice within a single company, and most people belong to more than one of them.

The notion of "practice" is critical in COP, pointing out that the group concentrates on learning that emerges only though working, or actually practicing one's craft. COPs supplement the book and classroom learning of many trade and professional workers. To learn how one does in this area (like developing custom IS systems), that goes beyond the official "canonical" training for that activity implies that a key part of learning how to work is learning how to communicate and share information within the community of practice. In this sense, learning is about work, and work is about learning, and both are social (Wenger 1998).

2.3 Organizational Culture

Much like social cultures have beliefs and values manifested in norms that form behavioural expectations, organizations have cultures that form and give it's members guidelines for the way of developing information systems. An organizational culture perspective (Martin 2002;Schein 1992).

Trice and Byer (1993) provides a method of studying an organization's social processes. Organizational culture can be looked at also as a system with inputs, process and output. Inputs include feedback from, e.g., society, professions, laws, customers, contracts and competitors. The process is based on our assumptions, values and norms, e.g., our values on money, time, facilities, space and people. Outputs or effects of our culture are, e.g., organizational behaviours, practices, technologies, strategies, image, products and services.

Organizational culture helps individuals and groups deal with uncertainties and ambiguities while offering some degree of order in social life. The substances of such cultures are formed from ideologies, the implicit sets of taken-for-granted beliefs, values, and norms. Members express the substance of their cultures through the use of cultural forms in organizations, acceptable ways of expressing and affirming their beliefs, values and norms. Organizational cultures, like other cultures, evolve as groups of people struggle together to make sense of and cope with their worlds (Trice and Byer 1993). It is through the interaction between ideologies and cultural forms that cultures maintain their existence. Cultural forms facilitate how people make sense of their world. The reality of the world people cope with becomes socially constructed (Berger and Luckmann 1966). Most organizational culture researchers view work culture as this kind of consensus-making system (Ott 1989; Trice and Byer 1993; Schein 1992). However some researchers view organizational culture as an emergent process (Martin 1992;Martin 2002;Smircich 1983).

Researchers have defined organizational culture in myriad ways (Martin, 2002). We use the following organizational culture definition as the background of this study: "Culture is the pattern of shared beliefs and values that give members of an institution meaning and provide them with the rules for behaviour in their organization" (Davis 1984 p.1).

In this study, the organizational culture is viewed as a phenomenon manifested in an organization's work practices, norms and artefacts. We analyze the connection between content themes and cultural manifestations in the custom IS community of practice by using the Martin's framework (Martin 2002). Table 1 lists typical cultural manifestations found in organizational culture studies.

Category	Examples
Cultural Artefacts	Rituals, Organizational Stories, Jargon, Humor, Physical Arrangements (architecture, dress codes)
Formal Practices	Organizational structure, task and technology, rules and procedures and financial controls
Informal Practices	Norms and Social rules (not written down)
Content Themes	Cognitive (beliefs or tacit assumptions) or attitudinal (values) that underlie interpretations of cultural manifestations

Table 1. Descriptions of Organizational Cultural Manifestations (Martin 2002)

According to this framework, the substance of a culture is its ideology – shared, interrelated sets of emotionally beliefs, values and norms that bind people together and help them to make sense of their world (Trice and Beyer, 1993). While generally closely interrelated in behaviour, beliefs, values and norms are unique concepts as defined below (Trice and Beyer, 1993).

Beliefs – Express cause and effect relations (i.e. behaviours lead to outcomes)

Values – Express preferences for certain behaviours or for certain outcomes

Norms – Express which behaviours are expected by others and are culturally acceptable ways to attain outcomes.

There exist many other approaches to organizational culture, which differs greatly in relation to how this complex concept culture is defined (Smirchich 1983)

2.3 Organizational Culture Perspective and IS Research

The studies have revealed a multitude of ways organizational culture affects organizational change efforts. Some studies highlight that compatibility between change effort and culture is a very important criterion for success. The studies have defined compatible culture types for different kinds of change efforts, e.g. a 'group culture type' is a major facilitator of diffusion of telecommuting (Harrington and Ruppel 1999), 'adhocracy' and 'group' culture types are suitable for TQM (Total Quality Management) (Dellana and Hauser 1999), mature TQM organizations have proactive and collaborative cultures (Fok et al. 2001), and 'adhocracy'and

'hierarchy' culture types are correlated with early adoption of intranets (Ruppel and Harrington 2001).

However, other studies have shown problems in the implementation efforts to becaused by a mismatch between a unique organizational culture and an implementation effort. The studies show that an IS implementation was resisted because the organization was presumed to have different organizational culture than it actually did (Pliskin et al. 1993), an enterprise resource planning packages implementation problems were caused by a mismatch with the values of the organizational culture (Krumbholtz and Maiden 2001) and differences between the cultures of implementers and adopters caused difficulties in an IS implementation (Robey and Rodriquez-Diaz 1989).

Finally, studies on culture highlight that different meanings can be attached to same change efforts in different contexts. Accounting was vested with different meanings in different cultures (Dent 1991), and planned change was interpreted in different ways in different subcultures (DiBella 1996).Culture has been a focus of analysis in studies on organizational change related to the development, implementation or use of IS in organizations. Researchers have theorized the application of a cultural perspective to understand IT implementation and use (e.g. Avison and Myers 1995, Cooper 1994, Robey and Azevedo 1994). Pliskin et al. (1993) suggest that important characteristics of the unique culture of the organization should be considered prior to implementing new technologies.

3 Research Methods

This section briefly sets out a short description of the target organizations and describes the research methodology.

3.1 Target organizations

Following Glaser and Strauss' (1967) technique of theoretical sampling, the four organizations were selected for their similarities as well as their differences in the following way:

Alfa is an internationally operating big software company in Scandinavia. The department participated in this study develops information systems for forest industry customers.
Beta is a small company that develops custom information systems in the agriculture business domain. It is owned by its customers and operates mainly in the domestic markets in Finland.
Gamma is an internationally operating medium sized company in Finland. It develops custom IS for forest industry customers.
Epsilon is a medium sized company that develops custom IS for information logistics customer. The customer owns the company. The company operates mostly in Finland but also has couple of ongoing projects with the company's subsidiaries in other European countries.

3.2 Research Methodology

This study is part of the empirical study of systems development contexts and their relationship to ISD practices. We interviewed totally six custom IS developing organizations in which four of them were selected to this particular study. The ultimate target of the whole research was to increase the understanding of the relationships between organizational context and ISD work. Based on these research objectives this part of the study concentrated on organization culture and how it influences on systems development. The research question was formulated as follows:

Q1:How custom IS organizational culture influences systems development practices?

The data for this qualitative study was collected using theme-based interviews, company's web pages and annual reports. There were three themes present in interviews: systems development projects, methods and practices, effects of company and its business environment on systems development practices, and networking and cooperation. We interviewed totally 26 employees from these four organizations representing different organizational status. The interviews were made between October and December 2006 and five interviewers visited these organizations. Interviews lasted from 30 minutes to 3 hours. Interviews were transcript as text and analyzed using grounded theory (Glaser and Strauss 1967, Strauss and Corbin 1990).

Grounded theory is a qualitative research method that uses a systematic set of procedures to develop an inductively derived theory about a phenomenon. It can be used to study organizations, groups, and individuals (Glaser and Strauss 1967, Strauss and Corbin 1990). The basic idea of the grounded-theory-based data analysis resides in finding conceptual categories and abstractions related to the research goal from data, and combining these categories meaningfully to provide theoretical insight into the phenomenon in question. A requirement of grounded theory is that the researchers demonstrate theoretical sensitivity (Glaser and Strauss 1967). Theoretical sensitivity comes from familiarity with the literature, and from professional or personal experience (Strauss and Corbin 1990). Qualitative data analysis was performed in three phases: open coding, axial coding and selective coding (Strauss and Corbin 1990).

The analysis started with open coding phase in which the seed categories (Strauss and Corbin 1990) from Martin's framework presented in the section 2.2 were used. The open coding phase was followed by axial coding phase that proceeded almost parallel with previous phase. In the open coding phase we interpreted organizations website descriptions as well as physical manifestation of the culture such as dress norms, workplace furnishing and atmosphere. The analysis ended with selective coding phase where the core categories and their relationships were formed. The following table (Table 2) lists the found beliefs and value categories along with examples from data.

Categories	Concepts	Examples from data
Beliefs	Customer satisfaction	"The principle of our company is customer satisfaction. We develop everything customer wants. We have also other principle that once we have developed a feature for customer it can be used also by other customers. Finally we have a situation that when customer want something it is probably already developed "
	Growth from global markets	"In this moment our growth is in international markets and we are there a different organization than others. We are not an ordinary IT firm, because we are concentrated on business know-how. But the price is still the most important factor among our customers …"
	Project work	"The more difficult the project is the more leadership is needed from project manager. It is not working with project people that you just say what to do; you must try to motivate them in a positive way to work hard. "
Values	Customer closeness	"It is always like this: customer has been put on the pedestal and we have tried to do everything customer wants. Sometime we have tried to change this by trying to get more distance, but always we have turned back. Customer closeness is perhaps the most important factor in the competition."
	Business domain knowledge	"Our strength is that we are experts in business domain. So our areas of expertise should be in forest industry domain. Information technology knowledge is the area that every software organization must know; it is like a basic knowledge. "
	Doing things right	"We do not have any standard that we are developing systems in certain way. If we could have this some day in the future it would give some kind of routine to this work and certainly it would influence on better quality of the final system. This standard can be quite simple, for example just standardising the development process. In the beginning it may take some more time and delay projects, but it is the only way to increase the quality. And in the same time it influences the motivation of employees. The motivation in the projects mostly comes from the feeling that is doing in the right way"

Table 2. Categories of beliefs and values with examples from data

4 Findings

4.1 Beliefs and Values

During the analysis, we observed six categories of beliefs and values which seemed to influence mostly on the ISD practices in the case organizations. These categories can be summarized as:

1. *Belief in customer satisfaction:* customer satisfaction forms the core motivator of custom IS software developers
2. *Belief in growth from global markets*: belief that business growth is in international markets, not in domestic markets
3. *Belief in project work*: ISD work is done in projects and project organization is quite formal with project managers who leads the project.
4. *Value of customer closeness*: customer satisfaction is gained by doing everything customer wants
5. *Value of business domain knowledge*: business domain knowledge seemed to be more important than technical skills in developing custom IS systems. The domain expertise is highly valued and the organizations hires employees that have a degree of particular business area
6. *Value of doing things right*: this seems to very important motivator for software developers

4.2 ISD Work Practices

Above introduced beliefs and values seemed to influence much on case study organizations' systems development work practices. The following categories of work practices could be observed in the case organization:

Formal practices

1. *Project planning and management*: Organizations have formal instructions or a model for project planning and management. It is based on distinct phases of requirements gathering, design, implementation, testing and maintenance.
2. *Documentation and coding standards*: Related to above mentioned project planning and management model, the instructions or model includes the documentation standards and coding standards.

Informal practices

1. *Process driven*: The ISD process with customer is seen more important than the final information system. Besides that, the process is determined by customer and mostly follows waterfall style of development (distinct phases

of development following each other in a waterfall fashion) because customer knows it best.

2. *Customer driven*: The belief of customer closeness leads customer driven practices. This means that development process in projects depends on customer.

3. *Requirements driven*: The value of business domain knowledge lead to the requirements driven ISD process.

4. *Distributed project teams*: The belief in project work and globalization influences distribute project teams in which the members of the team resides in different locations.

4.3 Artefacts

According to Martin's framework (Martin 2002), artefacts are the outcomes of the ISD work. The following artefacts could be observed during the analysis:

1. *Trusted partner*: Close partnership with customer is the most important outcome of the ISD projects, even more important than the actual information system. Also the ability to help the customer organizations in its business processes is very important.

2. *Repeatable solutions:* In those organizations starting or willing to develop custom IS solutions to the global markets, the change from developing pure custom IS solutions to develop global repeatable solutions was evident. It is more a software product that can be re-used or 'repeated' meeting the needs of more than one customer.

5 Discussion

According to our study, custom IS industry ways of make success is to achieve a trusted partner position among their customers by having good business domain knowledge, project work skills and motivated personnel. This trusted partner position seemed to be more important than the developed information system. Custom IS organizational success is tied, in large part, to the business understanding, project work skills and customer closeness. In custom IS organizations the domain expertise is highly valued and their focus is hiring employees that have a degree of particular business area. This was the situation in most of our case companies. For example in company Alfa, most of the project personnel had the degree from software engineering, but in the other companies approximately half of the employees had the degree other than software engineering, such as agriculture, logistics and forest industry. All the organizations participated in this study appreciated the work of project people working together and having specified project manager within this project. According to this study, all the other roles, such as designer, tester were not always so clear. In most of the organizations, project manager has a clear leader role within the project. For example in company Gamma, the only person assigned to the project permanently was a project manager, all the

other roles were assigned as a need basis. Project teams seemed to be more like 'ad-hoc' work groups working together only during the project. In some organizations, these custom IS teams were quite big and multi-located distributed teams. In this kind of environment, it is natural that project planning and management becomes very important. All the interviewed companies had a company-specific project model to advice project managers in their work. When the success factor for project managers is good leadership, the main motivator for software developers working in the custom IS projects is doing things right. This value of doing things right along with process driven practices has lead the custom IS companies in the study to develop documentation and coding standards to aid software developers in their work

As shown in findings, customer IS developers have a process view of development. By process view of development is meant belief in the importance of process, not the final system. Besides this, in most of these organizations participated in the study the development work was driven by customers. According to interviewers this was a reason why their development process was more or less traditional waterfall model with separate requirement capture, design, implementation, testing and maintenance phases. They said that customers are used to this kind of model and it is the only model customers know.

The analysis of the data revealed the change process going on these organizations competing or willing to compete in the global markets. According the interviews, competition is hard in international markets and the only way to compete is too seek cost reductions in relation to their normal way of developing information systems. In this kind of situation, some companies seek cost reductions by outsourcing their development work. Organizations participated in this study did not believe that they are ready for outsourcing and turned their development efforts to seek and develop repeatable solutions for their global customers. This means a turn to the more software product oriented way to develop information systems.

This kind of change from pure custom IS development to more product oriented development needs evidently some kind of change in their systems development practices. Perhaps the organizations had to change their practices from customer driven to more product focused practices. A product focus means that the dominant goal of the software development effort is to develop a product and the process is secondary. While custom IS development the project management and planning is very important, in the product oriented software development the release management and planning (Sawyer 2000) forms the most important activity. That is the software evolves through a planned set of releases.

Organizations changing their practices to more product oriented face also change in their organization culture related to systems development. We can speculate that value of customer closeness changes mostly. These companies need also different kind of knowledge in software development, especially knowledge of software products and release management. It is also clear that one cannot be so close with customer when developing software products because requirements of the system must be thought wider. Especially the development process cannot be customer specific in this kind of situation.

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6 Summary

In this paper, we have illustrated how the organizational cultural beliefs and values influence systems development practices in four custom IS software organizations. We applied grounded theory and used organizational culture perspective as a lens to the data. Our study suggests cultural beliefs in customer satisfaction, growth from global markets and project work along with values of business domain knowledge, customer closeness and doing things right. These beliefs and values influence remarkably to the custom IS development practices. Findings show evidence of traditional and customer driven practices aiming to gain a trusted partnership position among customers.

The study reveals also the change process going on in those organizations competing in the global markets. This change manifests itself in more product-driven practices aiming to develop more repeatable solutions for customers. This kind of change from pure custom IS development to more product oriented development needs evidently change both in their organizational culture and systems development practices. The challenge of these organizations becomes how to keep customer satisfied in the situation where you cannot keep one single customer so close and do everything customer wants.

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