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THE ROLE OF CONTEXT IN MANAGING INFORMATION INFRASTRUCTURE SERVICES

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Research-in-Progress

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Abstract

Contemporary organizations are increasingly dependent on information infrastructures to deliver their services. However, information infrastructures are highly complex and dynamic, which lead to considerable management challenges. This research aims to contribute to our understanding of these challenges through an in-depth investigation of a team responsible for information infrastructure services at a large business and technology service company. The complexity and dynamics faced by the team emphasizes the important role of context in managing its information infrastructure services and underlying technology platform. To investigate the team's practice we therefore adopt contextualist inquiry in combination with a pluralist approach based on four complementary theoretical lenses; technological frames of references, risk management, control versus drift, and dynamic capabilities. As contributions, this research has the dual goal to improve the teams' practices while at the same time providing new theoretical insights about the role of context in management of information infrastructure services.

Keywords: Information infrastructure, Services, Information technology management, Context.

Introduction

In today's dynamic environments, IT companies struggle to deliver high-quality services. The need to more effectively manage key business processes is therefore crucial for both product- and service providers. This research-in-progress paper outlines a study targeting a development team situated within a large IT firm (from here on called Weilgo). The teams' key activity is to provide and maintain administrative portals for their customers. However, the complexity and dynamics involved in managing the team's portfolio of information infrastructure services is overwhelming. In particular, the shift from isolated artifacts to infrastructures – and the associated increased complexity that follows – presents Weilgo with substantial business opportunities, but also considerable challenges. Infrastructure development is often tied up with socio-technical patterns within the related user communities (see e.g. Hanseth et al 1996; Hanseth and Braa 2001; Iannacci 2010). As a result, IS developers need to serve more as change agents and facilitators, raising issues for the commissioning organization's user community. In such politically charged contexts, project, service, and role demands are not easily addressed and disentangled and they pose great challenges for service providers such as Weilgo. Moreover, greater emphasis must be placed on developing shared understanding amongst key stakeholders of the various perspectives on IT infrastructure.

While business had been good for Weilgo during the past few years, the challenges involved in managing the team's information infrastructure services had grown due to increased customer scope and additional team members. As the complexity and dynamics faced by the team emphasizes the important role of context in managing information infrastructure services and the underlying technology platform, we adopted contextualist inquiry (Pettigrew 1997) in combination with a pluralist approach based on four complementary theoretical lenses. 1) The competing views of the infrastructure services are investigated through the lens of technological frames of references (Orlikowski and Gash 1994). 2) The challenge related to providing infrastructure services to customers is investigated using the lens of risk management (Lyytinen et al 1998; Iversen et al 2004). 3) The tensions involved in organizing work around the infrastructure services are investigated through the lenses of control versus drift (Ciborra et al 2000). Finally, 4) the challenge of dealing with the unexpected is investigated through the lens of dynamic capabilities (Eisenhardt and Martin 2000; Teece et al. 1997). We will present our research-in-progress where these approaches ideally can provide IT firms with insights into how to successfully manage information infrastructure services. We argue that companies that are successful in developing a portfolio of approaches to the management of information infrastructure services are well-positioned to build and sustain competitive advantage. To date, we have performed one focus group session with team staff, and are planning to conduct qualitative interviews with Weilgo's customers in the near future.

Hence, the premise underlying this research is that a company's, or in our case a team's, management of information infrastructure services is an important source of variation in acquisition of competitive capabilities. Companies that are successful in developing a portfolio of approaches to management of information infrastructure services are therefore well-positioned to build and sustain competitive advantage. Based on this premise, the argument proceeds as follows. In the next two sections we describe the theoretical background on information infrastructure service management and contextualist inquiry. We then outline our research design followed by a presentation of the theoretical lenses through which we will analyze the insights from our problem solving at Weilgo. In the concluding section, we discuss the expected contributions and their possible implications for the team at Weilgo as well as for research.

Information infrastructure service management

Considering IT as information infrastructures rather than as information systems has become increasingly common in the literature (e.g. Braa et al 2007; Ciborra et al 2000; Hanseth et al 1996; Star and Ruhleder 1996). In contrast to information systems, infrastructures are typically described as heterogeneous assemblages of technical and social components (Hanseth et al 1996; Hanseth and Monteiro 1997). An important concept related to infrastructures is the installed base (Hanseth et al 1996). The notion of installed base builds on the ways in which infrastructures evolve over time and refers to the technological platform that is already in place, thus affecting the pre-requisites upon further extensions and/or improvements of the installed base (Hanseth et al 1996). The infrastructure perspective makes it possible to focus on the character of technology while at the same time theorizing about the actual use of technology. In particular, the perspective can provide us with insight into the path dependencies that often occur due to infrastructure decisions (Rönnbäck et al 2007).

There is a rich body of literature on information infrastructure management (Ciborra et al 2000; Weil and Broadbent 1998). The need to go beyond rational decision making by addressing contingency is recognized (Ciborra 2002). Ciborra (1997) stresses that information infrastructure services, due to its complex and seemingly unpredictable nature, cannot be controlled and managed in accordance with traditional managerial thinking. As an alternative, Ciborra (2002) promotes a management approach based on the idea of 'cultivation' where the information infrastructure is not understood as a planned activity, but rather as an organic process in which technology is allowed to drift. Exploring a middle ground between the extremes of control and drift, Tjornehoj and Mathiassen (2008) advocate a management approach where control and drift are to be handled as complementary and intrinsically related opposites in a dialectical relationship.

Understanding the connection between technology and organization is the foundation for managing information infrastructures. While some scholars use terms like enterprise architecture to stipulate the relationship between technology and business in organizations (Ross et al 2006; Weill and Ross 2004), we use information infrastructure to capture the continuously evolving and technology under study as well as the events, people and processes that all together constitute the managerial challenge.

In summary we use the term information infrastructure to include the technological and human components, systems and processes that are present in the services offered by the team at Weilgo. This definition of information infrastructure services helps to capture the installed base and the historical trajectory behind the development of the information infrastructure services. Our initial findings, based on the focus group results, indicate that these historical trajectories are of critical importance for Weilgo in outlining future strategies.

Contextualist inquiry

In information systems research, the term 'context' tends to denote a background, situation, or environment through which we view an information system. However, our understanding of what constitutes a context varies within different approaches to research and has changed over time. Dahlbom and Mathiassen (1993) argue that our understanding of context varies between individuals' own choice of underlying thinking and perspectives. Hence, context could be understood as more of a perceptual condition that to some extent is flexible and negotiable rather than a factual environment. In the 1980s, contextualism as a theory of method to study organizational change arose based on earlier thinking by the American philosopher Stephen Pepper (Pettigrew et al 2001), which describes contextualism as the view of an historic event in the present. Events should be explained within the context of their occurrence. Contextualism in organizational change consequently views organizational life as complex with interconnected events and continuously changing patterns. In this tradition, context is dichotomized into the outer and inner contexts of organizations (Pettigrew et al 2001). The outer context includes the economic, social, political, and sector environment. The inner context is defined as features of the structural, cultural, and political environments through which ideas and actions for change proceed.

The perspective of events represents a process-oriented view (Langley 1999), and process-oriented studies of organizational change have been called for to better understand why and how outcomes are differentially shaped by processes (Langley 1999; Pettigrew et al 2001). Process theories are characterized by multiple units and levels of analysis and data of variable temporal embeddedness (Dawson 1994; Dawson 1997; Langley 1999; Pettigrew 1997; Pettigrew et al 2001). In a process analysis, the concept of agency is essential. Agency denotes action, i.e. the capacity to make a difference. While actions drive processes, processes cannot be explained solely by individual or collective agency. Actions are embedded in contexts, which shape and are shaped by agents. The intertwined relationship between agents and context over time must be recognized.

Understanding how people make sense of information infrastructure services is critical to influencing their actions and to achieving planned outcomes. Attempts to change people interpretations are often challenging, due to what Ciborra and Lanzara (1994) articulate as the 'formative context'. Formative context refers to both organizational and cognitive dimensions influencing users' current understanding of technology and context as well as limiting their ability to imagine new interpretations. The widely adopted socio-technical approach to information systems research has been criticized for its limited view of context, its narrow perception of the duration and scope of innovation, and its sociologically naive view on technology innovation and social change (Avgerou 2002). To address these weaknesses, several IS researchers argues for institutional analyses of information systems implementation processes (Avgerou 2001; Avgerou 2002; Christiaanse and Huigen 1997; King et al 1994; Lyytinen and Rose 2003; Orlikowski and Barley 2001).

In summary, context is recognized as a fundamental dimension of technology innovation and social change. A process perspective is useful to study how activities unfold over time with certain outcomes, as well as why and how outcomes are differentially shaped by activities. Hence, the choice of a contextual approach based on a process perspective can contribute to our understanding of, and may be informative about management of information infrastructure services.

Research design

Our contextualist inquiry into the information infrastructure service management at Weilgo is designed as a case study with the dual goal of resolving the practical problems for the team as well as furthering theoretical knowledge (Braa and Vidgen, 1999). In our research project, understanding of the problem setting will be gained by the use of several data sources, including interventions, participant observation, focus groups, interviews, and document analysis. Focus of attention will be on the team that is managing the information infrastructure services and the context surrounding the team. Our investigation looks beyond the immediate context of the team and the internal organization of Weilgo and includes external customer organizations. This allows us to investigate the dynamics and complexities involved in the relationships between these environments in managing information infrastructure services using inner and outer context perspectives (Pettigrew et al 2001). In our study, we refer to the company Weilgo and the team at focus as the inner context with its structural, cultural, and political environments, and the external customers as the outer context including the economic, social, political, and sector environments.

To enable an in-depth understanding of the situation at Weilgo we will carry out a number focus group studies. One of the advantages of this method is that "focus groups allow the researcher to interact directly with respondents. This provides opportunities for the clarification of responses, for follow-up questions, and for the probing of responses" (Stewart and Shamdasani 1990, p 42). We will also conduct qualitative interviews targeting key people from the team at Weilgo and key people at customer sites to investigate both the inner and outer context. Since an important part of the studied team's communication with their customers is mediated via various kinds of documentations and presentations, we will also perform document analysis.

With the aim of generating descriptions and explanations about infrastructure services management to relevant stakeholders, thus studying a sociotechnical phenomenon in practice, our research to date can be classified as Informed Basic Research following Van de Ven's four types of engaged scholarship. Engaged scholarship is characterized by the assumption that knowledge is generated close to practice, and abandon the assumption that knowledge is generated without any tight coupling to practice (Van de Ven, 2007). Compared to the other three types of engaged scholarship, research classified as Informed Basic Research does not involve the same high degree of the researchers' direct involvement in practice problem solving, but focuses on describing, explaining, or predicting a social phenomenon (Mathiassen & Nielsen 2008; Van de Ven 2007). Given that the first author is in industrial PhD student employed by Weilgo, our plan is to move from the descriptive mode towards action taking in our future efforts. The rich descriptions developed in this initial effort will be important to build on in the latter phases.

We adopt a pluralist methodology and apply multiple theoretical lenses for several reasons. Firstly they will guide the design of the investigation. Secondly they will provide the perspective during the analysis of the empirical data. Thirdly the findings stemming from each theoretical lens will constitute the basis from which we will generate guidelines for management of information infrastructure services. Overall, analyzing the empirical data collected using complementary theoretical lenses will help us understand the complex nature of managing information infrastructure services. Also, these theoretical lenses will provide important guidance during the intervention part of the action research endeavor and help establish an appropriate portfolio of approaches to information infrastructure management at Weilgo.

Interpretive frames

In this section we discuss why and how the four complementary theoretical lenses can help us investigate the challenges and opportunities related to management of information infrastructure services at Weilgo.

Appreciating Competing Frames of Reference

Due to business growth over the last couple of decades the organization of Weilgo's products and services has changed significantly. One of the main changes concerns the shift from direct contact between the people in sales and implementation with the end customers, to the structure of an internal service organization dealing with other organizational units who in turn have contact with end customers. This has meant that the number of people, groups, and stakeholders involved in the sales and implementation process has increased giving the team working with sales, implementation and maintenance of the portfolio of information infrastructure services experiences problems keeping the notions of their solutions on track. As an effect, the strategic position of this team is challenged by internal and external competitors, and the new organizational and economic situation requires assessments of the challenges and repositioning of the team's efforts.

Understanding how the stakeholders involved make sense of information infrastructure services is critical to influencing their actions and to achieving planned outcomes. We therefore use the perspective of technological frames of references (Orlikowski and Gash 1994) to investigate the interpretive processes related to information infrastructure services in the contexts. Since information infrastructure services by their nature goes beyond an organization's boundaries, we expand the notion of context from organization to include the inner and outer contexts (Pettigrew et al 2001), which is suggested by Davidson (2006) as a way to develop the theory of technological frames of references. We aim to investigate the process of framing to further our understanding of the dynamics of the interpretive processes, as also suggested by Davidson (2006). Hence, in our research we conduct a contextual inquiry into the competing views of information infrastructure services through the lens of technological frames of references (Orlikowski and Gash 1994).

One focus group is conducted with key people from the team. The data illuminate the competing views of the nature and use of the technology. To investigate the outer context, interviews are planned with key people at customer sites. In addition, documents used for sales in customer interactions, e.g. power-point presentations, will be analyzed. The combination of these data sources are used to illuminate the competing views in the inner and outer contexts (Pettigrew et al 2001). The lens of technological frames of references (Orlikowski and Gash 1994) allows us to carefully analyze how the different groups' context, purpose, power, and knowledge base shape and constrain their interpretations of information infrastructure services. The case study approach enables us to conduct cooperative interventions with the contexts and to study the impact of these interventions, to understand the dynamics in the interpretive processes involved. The emerging understanding of the groups' competing views, will guide the interventions to inform and improve management of information infrastructure services.

As contributions, this research aims to investigate the contextual complexity and dynamics involved in the process of sense-making of information infrastructure services. As information infrastructure services goes beyond the single organization, we expand the context to include both inner and outer contexts, and investigate framing in the context of managing information infrastructure services. The complexity and dynamics involved in the sense-making process indicate a need for continuous organizational learning approach to comprehend and deal with potential incongruence and enable strategic management.

Helping Customers Manage Risks

Due to the organizational changes described above, the team experiences difficulties in creating and maintaining appropriate customer dialogues. As a result, an important risk identified from the first focus group concerns the balance between products versus services. How to deal with this balance addresses the alignment between the team's efforts and Weilgo's business model, which currently creates difficulties regarding product development. In addition, the general technology evolution and efforts by dominating IT market actors to take on, present further difficulties. These difficulties emphasize the crucial need to understand the customers' contexts, needs, and expectations for successful joint efforts and investments. This entails a long term perspective in the customer relationships to support flexibility to deal with technology changes.

There is a rich and differentiated literature on software risk management (Lyytinen et al 1998; Iversen et al 2004; Schmidt et al 2001; Keil et al 2007; Persson et al 2009). The need to go beyond the narrow system rationalism through a contingent, contextual and multivariate view on software risk management is recognized (Lyytinen et al 1998; Smith et al 2001). The turbulence of business contexts, diversity and multiplicity of stakeholders and evolution of information infrastructures invite research to reflect on the dynamics and complexities involved

(Schmidt et al 2001). We draw on the holistic view on risk management (Lyytinen et al 1998; Smith et al 2001; Schmidt et al 2001) to investigate how customer risks and uncertainties that increasingly surround technological change can be appreciated in the management of information infrastructure services.

Data from focus groups, interviews and documents are used to investigate and reflect on the dynamic nature of risk management in the inner and outer contexts (Pettigrew et al 2001). The risk management lens (Lyytinen et al 1998; Smith et al 2001; Schmidt et al 2001) guides us to analyze how a contingent, contextual and multivariate organization allow for learning and gaining insights into appreciating customer risks in the managing of information infrastructure services.

As contributions, this research aims to investigate and address the recognized new themes in the risk management literature: turbulence of business contexts, diversity and multiplicity of stakeholders, and evolution of infrastructure. The tentative finding from the first focus group raises interesting considerations. Based on our early findings it is apparent how Weilgo is focusing their risk management on human resources rather than on information infrastructures. They provide services rather than products which effectively forces all consultants to focus in infrastructure development immersed in the context of a specific customer relation. From the perspective of information infrastructure service management, this is a risk in and of itself. Moreover, there is another side to the long term perspective of supporting flexibility in customer relationships which entails Weilgo taking on more risk. At this point in time, we have no answers to the challenges raised, but further data and possible interventions based on emerging insights will be carefully analyzed.

Managing Between Control and Drift

While the Weilgo team has engaged in some product packaging activities, the current business model does not include budget for keeping a product lifecycle with continuous investments and developments. The solutions are development via customer deliveries and hence new functions can only be developed if it is enclosed within a customer's demands. Currently, the main management efforts at Weilgo are focused on the line organization, managing people and time, while the strategic management in the product and services processes is modest. Due to this lack of attention, there is a continuous process of drift missing the strategic management of the information infrastructure services.

Ciborra and associates (2000) accentuate how the strive for management control of information infrastructures commonly renders experience in drift due to turbulent environments, implementation tactics, complexity, installed base, side-effects and surprises in contexts and users' perceptions. While controlling represents a traditional, top-down management approach, drifting manifest itself as "plasticity in response to the re-inventions carried out by users and specialists, who gradually learn to discover and exploit features, affordances, and potentials of systems (Ciborra 2002, p87)". People respond to technology through improvisation, bricolage, and information infrastructures are shaped by peoples' interpretations and interactions along with the already installed base (Ciborra and Lanzara 1994; Ciborra and Hanseth 1998). Ciborra (2002) argues that we have to move away from the rational management models to see the technology with all its dimensions. Tjornehoj and Mathiassen (2008) suggest that control and drift are complementary and intrinsically related opposites a dialectical relationship as a management approach. This view corresponds to the Competing Values Framework, with the fundamental tensions between external and internal focus, and between control and flexibility (Quinn and Rohrbaugh 1983).

We investigate in retrospect how these tensions have manifested themselves in the inner and outer contexts (Pettigrew et al 2001) over a 10-years period. We collect data from archives of projects proposals, project contracts, meeting minutes, email conversations, focus groups and interviews with key people. The lens of tensions between external and internal focus and control and flexibility (Ciborra et al 2000; Tjornehoj and Mathiassen 2008; Quinn and Rohrbaugh 1983) guides us to analyze how the organization addresses these tensions and make use of them in a management approach.

As contributions, this research aims to gain insight into how these tensions can be dealt with in the managing of information infrastructure services. This research aims to resolve the practical problems faced by the team, as well as contribute to our understanding of strategic management of information infrastructure services. The results may serve as a foundation to derive useful guidelines for the management of information infrastructure services to deal with these tensions in a balanced way between operational and strategic level.

Adopting A Sense and Respond Approach

The missing strategic management of information infrastructure services results in the Weilgo team as a lack of customer interaction and feedback. Due to the organizational structure, users' needs and expectations are difficult to capture and much of the planning work is conducted pragmatically at the operative level, which makes issues such as roles and responsibilities in the decision making unclear. As a result, the complexity and dynamics involved in managing the team's portfolio of information infrastructure services is overwhelming. We are interested in investigating how Weilgo and the team can build upon existing dynamic capabilities to develop new dynamic capabilities within the company (Mathiassen and Vainio 2007). We draw on Haeckel's sense-and-response model (1995), a management model based on context and coordination and the adaptive loop: sense-interpret-decide-act. This approach offers specific design principles about strategy, structure, and governance of the company. Strategy is oriented towards responsiveness to change rather than planning, structure is oriented towards dynamic modules of capabilities rather than hierarchies, and governance is centered on coordination rather than command and control.

Data from focus groups, interviews and documents are used to illuminate the competing views in the inner and outer contexts (Pettigrew et al 2001). The lens of sense-and-respond (Haeckel 1995) guides us to carefully analyze how the contexts, strategies, structures, and management of capabilities enable the team to manage the complexity and dynamics faced by them. Emerging insights will guide possible cooperative interventions with the contexts and allow for studies of the dynamics in the processes to allocate resources in response to actual needs in a sense-and-respond approach.

As contributions, this research aims to take into account the insights gained from the previous lenses and investigate how a sense-and-respond approach and adaptive management of information infrastructure services may contribute to successfully manage information infrastructure services.

Discussion

The aim of this research is to improve our understanding of successful management of information infrastructure services in practice, and provide new insights into the role of context in the management of information infrastructure services. This research-in-progress paper outlines the approach of a study targeting a team within a large IT firm which maintain and provide administrative portals to their customers. The shift from isolated artifacts to infrastructures – and the associated increased complexity that follows – presents Weilgo with not only a challenge but also a substantial business opportunity. Our approach for exploring these challenges and opportunities is based on four complementary theoretical lenses: 1) The competing views of the infrastructure services is investigated through the lens of technological frames of references. 2) The challenge related to providing infrastructure services to customers is investigated using the lens of risk management. 3) The tensions involved in organizing work around the infrastructure services are investigated through the lenses of control versus drift. Finally, 4) the challenge of dealing with the unexpected is investigated through the lens of dynamic capabilities.

The four lenses in this research complement each other by illuminating central aspects of the challenges involved in management in the complex and dynamic information infrastructure services. As Weilgo is faced with difficult decisions regarding the management of infrastructural services, simple contingencies and classifications of possible solutions will not suffice. These decisions cannot be exclusively informed from one perspective alone. Competing perspectives can inform us on different aspects of a complex phenomenon, and the lenses respond to the recognized need for further research on 1) the process of framing to further our understanding of the dynamics of the interpretive processes (Davidson 2006), 2) moving beyond the narrow system rationalism through a contingent, contextual and multivariate view on risk management (Lyytinen et al 1998; Smith et al 2001), 3) moving away from the rational management models (Ciborra 2002) and view control and drift as complementary and intrinsically related opposites of a dialectical relationship of a management approach (Tjornehoj and Mathiassen 2008, Quinn and Rohrbaugh 1983), and 4) investigating how the sense-and-respond approach and the adaptive loop: sense-interpret-decide-act may contribute to successful management of the complex and dynamic information infrastructure services.

We draw a parallel to the research by Robey, Ross and Boudreau (2002) who interpret the implementation of ERP systems as a 'dialectic of learning'. In particular, the dialectic relationship between the past and the future practices. Parallels between information infrastructure and ERP are relevant considering the complexity of ERP systems and the necessity of an infrastructure to facilitate a value chain management enabled by ERP. Hence, we mean that

managing information infrastructure services involves a continuous dialectic of learning taking into account the central aspects illuminated by the four lenses.

This research-in-progress points to some tentative conclusions. Based on early findings we argue throughout this paper that an IT firm's portfolio of approaches to the management of information infrastructure services is an important source of variation in the acquisition of competitive capabilities. Moreover, we argue that companies that are successful in developing a portfolio of approaches to the management of information infrastructure services are well-positioned to build and sustain competitive advantage. Based on our early findings we note how, in such a portfolio, the different dimensions of the portfolio must work together in a systemic fashion. We also note how our initial findings challenge the validity of those models and theories which present IT strategy as a one-dimensional construct (e.g. Weill & Broadbent, 1998). The findings also challenge the validity of those models and theories arguing that the management of ICT infrastructure and their associated services is impossible (e.g. Ciborra 2002). Revisiting the control-drift continuum, findings of this study affirm that even though control is difficult it is not impossible. Nonetheless, findings of this study show that strategic decision-making opportunities among ICT practitioners is complex and requires a portfolio of approaches in order to be successful.

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