Changing information infrastructures: theoretical perspectives and implications for future research

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Abstract. In this paper I explore changes associated with large-scale information infrastructure. I present the establishment of Lotus Notes based information infrastructure at Statoil. Later I discuss to what extent situated change perspective can be applied to analyse large-scale information infrastructures. Considering the results of such analysis, I outline that different theoretical perspectives on IT and change should be used to analyse different technologies. Finally I outline future research directions.

Introduction

During the last decades, dynamics of business environment dramatically increased uncertainty. Companies face new barriers and challenges every day. Mastering change can be seen as every day activity rather than ahead planned action. The knowledge needed to manage continuous changes is every company’s necessity. When it comes to global companies and global challenges, mastering the change is even more important and complex activity.
What theoretical perspectives on IT and change should be used to analyse changes associated with large-scale information infrastructures? In this paper I present several theoretical perspectives on IT and change: planned change, technological imperative, punctuated equilibrium, situated change perspective (Orlikowski 1996). I analyse large-scale information infrastructure with 18,000 users, which incorporates complex heterogeneous technologies and is driven by installed base inertia. Situated change perspective focuses on micro changes performed by 53 users using Notes based application to support their work processes. I will employ situated change perspective and examine to what extent it can be used to analyse changes associated with large-scale information infrastructure in global organization.

Theoretical perspectives on IT and change will be applied on the Statoil case study. The case study was conducted by Monteiro and Hepsø (2000) with the main research focus to analyse the establishment of flexible Lotus Notes based information infrastructure. This research was used as the main empirical source in this paper.

This paper is structured in the following way. The next section outlines theoretical perspectives on IT and change with primary focus on situated change perspective. Later, Statoil effort to establish Lotus Notes based information infrastructure is presented. Then situated change perspective is applied to Statoil case and discussed to what extent it can be used. Thereafter the need of theoretical perspective on IT and changes for analysing changes associated with large-scale information infrastructures is outlined. Finally I provide the upcoming research directions.

**Theoretical grounding**

In this section several theoretical perspectives on IT and change are outlined: planned, technological imperative, punctuated equilibrium and situated change perspective.

Orlikowski (1996) analyzes theoretical perspectives on IT and change and summarizes three types of main perspectives dominated till the end of 20th century: planned, technological imperative and punctuated equilibrium. Planned change perspective assumes that managers initiate and implement changes in order to improve organizational performance. Managers perceived opportunities are seen as the main source of change.

Technological imperative perspective focuses on technology as the primary driver of organization change and managers have little influence in change process. Adoption of new technology in such perspective creates predictable changes in organization structures, work routines, information flows and performance.

Punctuated equilibrium perspective assumes changes to be rapid and radical (revolutionary). The source of change in this perspective can be internal or
external to organization such as new process implementation or compliancy achievement with new public regulations. Above outlined perspectives do not encounter the inertia of information infrastructure installed base and see organization stability as the state after change is completed. Considering today’s continuous changing environment and high uncertainty, which makes global market hardly predictable, such perspectives can barely explain changes associated with large-scale information infrastructure at global company.

Further I present situated change perspective, which differently from above outlined approaches defines changes as continuous process. This practice-based perspective was established while analysing Customer Service Department of 53 users at Zeta Corporation. In the later section of this paper I will employ this perspective to analyse the establishment of Lotus Notes based information infrastructure for 18,000 users at Statoil. Later I will outline if this perspective can be used to analyse changes associated with large-scale information infrastructures.

Orlikowski (1996) outlines that stability is not the desired state of contemporary organization, because it has to be flexible and adjust itself to ongoing changes – “change is no longer a background activity but a way of organizational life”. Organizational change in this case cannot always be planed or managed, it is seen as continuous process rather than predefined action with exact start and end milestones.

The theoretical basis of situated change perspective lies on Gidden’s (1984) notion of structuring, with the central focus on duality between agents and structures, Weick’s (1993) notion of skilled improvisation, where organizational design is seen from improvisational perspective and Suchman’s (1987) notion of situated action, where every course of action depends on material and social circumstances.

A view of organizational transformation as situated change is grounded in assumptions of actions, not stability. Organizational transformation is seen as an ongoing improvisation enacted by organizational actors trying to make sense of and act coherently in the world. The focus of situated change perspective is on micro-level changes that actors enact over time. Seeing organizational change as situated, it suggests that change may not always be as planned, inevitable, or discontinuous. Rather, it is understood through the ongoing variations, which emerge frequently, even imperceptibly, in the slippages and improvisation of everyday activity. Those variations that are repeated, shared, amplified, and sustained can, over time, produce perceptible and striking organizational change. These assumptions are highlighted in extensive empirical work, where unintended consequences can be characterized as positive (for instance sharing work experiences between graphically distributed offices) or negative (for instance manual development of paper based backup system).
Case

Firstly research method used in Statoil case will be presented. Secondly global oil and gas company Statoil and its activities as well as business strategies will be outlined. Thirdly the process of establishment and continuous alignment of Lotus Notes based information infrastructure will be presented. And fourthly the recent information infrastructure transition to new collaboration platform based on MS SharePoint technologies will be outlined.

In this paper I analyse the establishment of Lotus Notes infrastructure in Statoil. In-depth research conducted by Monteiro and Hepsø outlines the effort to develop flexible Lotus Notes infrastructure in Statoil during the years 1992 – 1998. This research is used as main empirical source.

The research was conducted by using historical reconstruction method. One of the authors worked at Statoil for seven years and other one has been granted Lotus Notes account and have spend over 40 working days at Statoil over the period of five months. 20 semi and unstructured interviews lasting one and a half to two and half hours were conducted with people, involved in Notes introduction, also managers, decision makers, network managers and users. Besides that, participatory observations were conducted by taking part in project meetings, informal discussions and coffee breaks.

Both authors had access to rich set of written historical materials such as reports, memos and strategy documents from various parts of the organization. As well extensive electronic archive (Elark) containing all official Statoil reports, selected contracts, e-mails, memos and project documentation was used.

Statoil is an integrated oil and gas company established by the Norwegian government in 1972 with the Norwegian State as a sole shareholder. In three decades Statoil has grown to global company and represents 25 600 employees with activities in 32 countries (February 2006).

Statoil is operator for 60 per cent of all Norwegian oil and gas production, and its international production is rising steeply. Effective company performance and increase in oil and gas prices led Statoil to the very good financial results in year 2004. The increase in international oil and gas output reached 29%, total revenues came to NOK 306.2 billion and the net income reached NOK 24.9 billion - the best-ever result in Statoil's history.

Successful international expansion and aggressive strategy predicts more challenges and changes: “Globalization and intensified international competition mean that we must become even better at mastering change” (Helge Lund President and CEO. Statoil annual report 2004).

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Statoil constantly puts strong improvement efforts directed towards both results in the near future and more long-term value creation. Strong emphasis is put on more efficient drilling, improved recovery from producing fields, good project execution, applying best practice and integrated operations where specialist teams can cooperate on tasks with simultaneous access to shared information. Collaborative technologies for improving knowledge transfer across geographical and organizational boarders, in this context are seen as important instruments to increase efficiency.

The establishment of corporate wide information infrastructure in Statoil started in early 1990, at the time of post-Gulf war with oil industry recession, falling oil prices and dollar rates. Statoil’s information infrastructure at that time was highly fragmented and diversified. There were in total seven LAN solutions including IBM’s Token ring and implementation of Ethernet by Novell. The only way to communicate corporate wide was with the use of Memo, IBM based e-mail system.

Sequence of reorganizational projects were initiated with the primary aim to cut operational cost. Centralization, standardisation and market orientation of IT services was direct outcome of several projects with the primary aim to solve the problems of fragmented and incompatible IT solutions. Centralization of IT resources led to establishment of central IT department SData and the outcome of standardization was establishment of Lotus Notes office suite.

The decision to establish Lotus Notes based information infrastructure was settled by price only. Lotus based infrastructure was not seen as isolated artefact, but it was packed together with Lotus Notes office tools and PC based wide area network. The establishment of such infrastructure was seen as massive investment and continuous process of alignment.

First the establishment of new e-mail service in Notes took place. Notes mail was presented as Memo with additional feature to attach documents. Co-existance with old e-mail system (Memo) was ensured by establishing gateway between Notes and Memo. These efforts represent socio-technical compromise to ensure smooth transition process during which Memo users were able to communicate with Notes users instead of “jumping” to the new email system.

Establishment of WAN was simultaneous process with the introduction of Notes. The evolution of WAN provided versatile and powerful network functionality and included name directory service allowing logins independent of geographical location, a feature not standardly available in PC based network at the time.

For a long time, Notes was basically equated with e-mail in Statoil. To explore the possibilities of Notes and show that it is more than email, six standard applications were developed: room reservation, meetings, discussions, bulletin boards and frequently asked questions. The purpose of these application was mainly to support administrational work not the core business processes. However the use of these applications never got widespread.
More serious use of non-e-mail applications of Notes started to pick up only around 1996. There were three main Lotus Notes applications with the aim to support business strategy: project management (ESOP), electronic archiving (Elark) and experience transfer (SAREPTA/Delphi).

ESOP aimed at facilitating administration of project documentation such as: meeting summaries, memos, budgets and plans. In addition, some functions aimed to support work flow management, including delegation of work tasks and overview of the status of work tasks. The key problem with ESOP was that it was "one size fits all" application and it was not customizable for different type, duration and size projects. The need for application modifications was outlined by different projects but it took few years to introduce ESOP systematically.

Elark is extensive electronic archive, which contains all official Statoil reports in addition to selected contracts, e-mails, memos and project documentation. Elark was closely aligned with the ISO 9001 quality improvement effort. So it served for management’s needs in relation to documentation requirements for ISO 9001 certification.

The primary aim of DELPHI was to solve strategically important Statoil’s problem – experience transfer. DELPHI provided ability to find various kinds of business documents sorted by different categories. It also had functions for re-routing of documents, a module to support work in organisational networks, that is, a discussion database that made it possible to give comments to these company documents and support an elicitation or experience transfer process. It lacked functionality for experience transfer and had less group-ware functionality. Functionality from both applications melted together in the DELTA-application from 1996, a core business application. The group-ware functionality of DELPHI and DELTA has never been a success, but the information sharing of best practice document has been successful.

Statoil can be seen as example of a highly successful introduction of Lotus Notes. The number of Notes users in Statoil has grown rapidly: 1017 (January 1994), 4104 (January 1995), 8210 (October 1995), 14209 (October 1996), 18300 (October 1997). In 1997 Statoil was among the world’s largest Notes users organizations. But as we can see from above presented research the role of Lotus Notes in Statoil’s IT strategy was never stable it varied from modest to strategic. Lotus Notes repeatedly needed to fend of challengers such as Microsoft, web opponents, SAP. Establishment of Notes infrastructure in Statoil was continuous process of alignment – starting with Lotes Notes office suite, PC based WAN and continuing to development of Lotus based applications and integration with other systems such as SAP.

The very unexpected outcome of centralization projects, and in particular, establishment of Lotus Notes infrastructure, which aimed to support corporate wide users and user groups, was the distribution of numerous local databases supporting various applications used by varying user groups. In short, centralization produced unexpected fragmentation.
Currently Statoil’s information infrastructure is facing another big change. The company puts great effort to implement new corporate wide collaboration platform based on MS SharePoint technologies, which aims to integrate numerous local databases and establish common database, which will improve collaboration, experience transfer and control functions.

Analysis

In this section I employ situated change perspective to examine how it applies to above outlined Statoil case. I will use the following statements from situated change perspective definition:

- Changes cannot always be planned.
- Change is continuous process.
- Organizational change is the result of improvisations enacted by organizational actors and technology is not the main driver for organizational change.

The previous section clearly presents that changes cannot always be planned. It was expected that implementation of Notes will bring fast popularity among users, but it was long and continuous process. SData planned and developed six standard applications to promote new infrastructure among users, but such initiative was not successful, and the use of these applications never got widespread. Another illustrative example, that changes cannot always be planned, can be seen as establishment of flexible Lotus Notes information infrastructure. Statoil aimed to establish corporate wide information infrastructure, but as I recently described unexpected fragmentation was produced. The current Statoil effort to integrate SharePoint technologies can be also seen as not planned change.

The statement arguing that change is continuous process is observable in Statoil case as well. The establishment of Lotus Notes based information infrastructure continuously needed to align new elements “user requirements, new information systems, new technological development or new patterns of use” (Monteiro, Hepsø 2000) and other occurrences. “… it was the pay-off of the continuous process of appropriating or “improvising” the incidents that “drifted” along. In short, it was a continuous process of alignment” (Monteiro, Hepsø 2000).

By examining the last statement, which appears to be the most challenging, saying that organizational change is the result of improvisations enacted by organizational actors not the technology, the dilemma is faced. Changes carried out by the establishment of Lotus Notes based information infrastructure can be viewed as technology driven change that irreversibly influenced the whole organization. At the same time organizational changes are enacted by organizational actors - the situation of project management application (ESOP), where users (initiators), required and achieved application modifications to
support their work processes. In both situations this perspective seems to work. Now I will illustrate the main reasons for that. Firstly, Orlowski analyzes corporation with 1,000 employees, but performs the case study at Customer Service Department with 53 persons. Secondly, the research focuses on implementation of Incident Tracking Support System (ITSS) – application build on existing Lotus Notes infrastructure. And thirdly, no less important, ITSS was designed before implementation.

When establishing large-scale information infrastructure in global organizations such as Statoil, the design step will not produce detail specification, perhaps it will be high-level functionality ‘perspective’ – the opposite than in ITSS case. The development of large-scale information infrastructure according to global company’s produced specification, sounds incredibly big resource consumption. So the most probable action for global organization is to select one or several already developed solutions and through continuous iteration phases adjust it to local and global needs. Considering these issues, the establishment of information infrastructure at Statoil can be characterized as technology driven process, while implementation of ITSS can be characterized as organizational actors with support of technology driven process.

Giving this overview I argue that situated change perspective, which focuses on micro-level changes can only be partially used to analyse the establishment of Lotus Notes based information infrastructure at Statoil. One of the most influential factors to that is the scale. The scale difference can be highlighted in the following way:

- Statoil – establishment of corporate wide infrastructure for over 18,000 users.
- Zeta Corporation – implementation of ITSS application for 53 users.

The scale is a broad term to use it as the main argument, but considering the socio-technical complexity, numerous heterogeneous technologies and installed base inertia underlying under such scale, it becomes apparent that situated change has narrow focus on organizational transformation. Exploring such events where actions are driven by large installed base and supported by numerous technologies, social and technical issues are not just interrelated but also inseparable. For instance considering such events as a)development of gateway between Memo and Notes; or b)current effort to implement SharePoint technologies; it becomes clear that situated change perspective can only explain some part of such transformations.

As mentioned above technology plays modest role in situated change perspective, it can be described as external to organization object, which enables or constrains organizational transformation, without saying anything how social and technological are interrelated and become inseparable. Considering such role of technology, situated change perspective have limited capability to analyse and explain or ‘unpack’ (Monteiro and Hanseth 1995) the socio-technical complexity of large-scale information infrastructure.

Summarizing this section I outline that situated change perspective can only be partially used to analyse changes associated with large-scale information
infrastructures. Considering the case presented in this paper, this perspective could be used to describe relatively similar example in Statoil – development and implementation of project management application (ESOP), which was bottom-up driven event with continuous changes.

Implications

The previous section highlights that large-scale information infrastructures and small-scale information systems have different characteristics and following that I argue that different theoretical perspectives on IT and change should be used to analyse and explain different scale technologies. Further I propose that several theoretical perspectives on IT and change should be used to analyse changes associated with large-scale information infrastructures. More specifically I argue that theoretical perspectives should focus on different levels – micro and macro. Such approach would paint comprehensive picture how information infrastructure is globally integrated and supports local activities.

In the future research I will analyse Statoil effort to perform another large-scale information infrastructure change. I will focus on information infrastructure transition process from Lotus Notes to SharePoint, which aims to increase centralization. This process involves the integration of numerous heterogeneous technologies and deals with socio-technical complexity. Considering these issues, installed base inertia and hardly predictable outcomes of this process, I outline the question for future research: which theoretical perspectives, technologies and methods should be used to integrate large-scale collaborative technologies into large-scale information infrastructure in global organization?

The analysis of theoretical perspectives on IT and change for large-scale information infrastructures will play an important role in this research. Another part of research will analyse what information infrastructure state was produced by accomplishing above mentioned transition process. I will aim to evaluate the assumption proposed by Monteiro, Rolland, Hepsø (2006) that globally integrated systems and technologies aiming at seamless integration tend to re-produce new forms of fragmentation and heterogeneity.

Concluding remarks

The overview of several theoretical perspectives on IT and change with the primary focus on situated change perspective provided some insight how changes should be analysed. Situated change perspective was applied to large-scale information infrastructure and I conclude that this perspective can be used only partially for such scale information infrastructures. Situated change perspective does not encounter socio-technical complexity, heterogeneous technologies and installed base inertia. I propose that several theoretical perspectives on IT and change should be used to analyse changes associated with large-scale information
infrastructures. I also conclude that more research needs to be done in order to conceptualize theoretical perspectives on IT and change for large-scale information infrastructures. Finally I outline further research direction and the main research question: which theoretical perspectives, technologies and methods should be used to integrate corporate-wide information system into large-scale information infrastructure in global organization?
References


