

THE SIX DIMENSIONS OF SOCIO-TECHNICAL CHANGE APPROACHES TO INFORMATION SYSTEMS DEVELOPMENT

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ABSTRACT

Socio-technical theory, socio-technical design and socio-technical approaches began emerging in the middle of the 20th century, as an alternative to the mainstream technical approach to information systems development. The basic premise of this exploratory research is to present a socio-technical fit between organizational social and technical subsystems. This socio-technical approach suggests that a fit is achieved by a design process aiming at the joint optimization of the subsystems. The interdependence of the subsystems must be recognized for maximized performance to be achieved. In addition, the subsystems must work in harmony to ensure superior results. The findings suggest that humanistic principles and managerial values are reflected in socio-technical thinking.

INTRODUCTION

Today, in this socio-technical world (Figure 1), understanding an information system will need to include an understanding of the human and organizational aspects that embed and situate how people interact with and through the information systems at hand in the course of their work and workflows (Scacchi 2003). Hence, the most important thing that socio-technical design can contribute is its value system, which tells us that although technology and organizational structures may change, a balance (Doherty, Coombs et al. 2006) of all parts (human and non-human) must be maintained. (Mumford 2006) extends the discussion to future scenarios where he speculates that socio-technical principles might emerge. One scenario is that technology in the workplace will be humanized in a world where consistent organizational and economic changes are the norm.

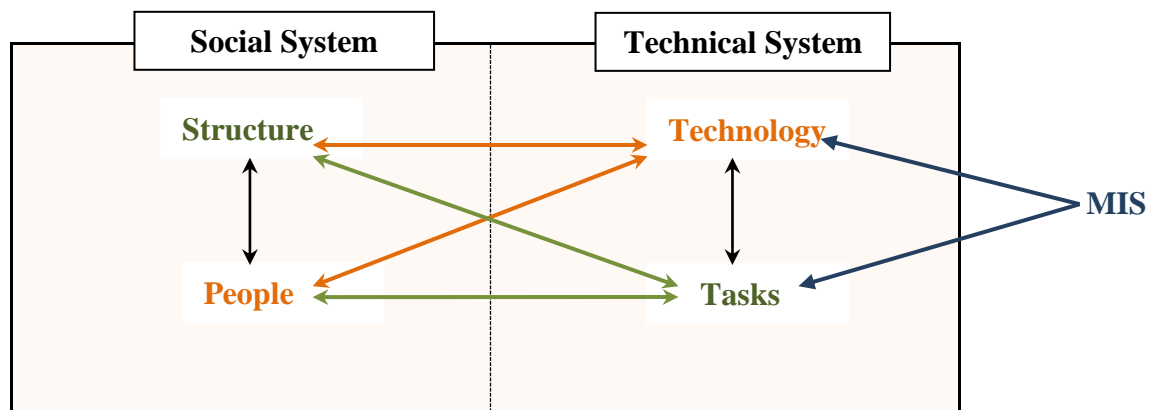


Figure 1. Socio-technical Theory (Robert P. Bostrom and Heinen 1977)

My purpose in this paper is to continue the movement from technical to socio-technical thinking by delivering a coherent collection of information systems research that can provide significant new insights

into how the human and organization aspects of information systems development projects and the resulting change can best be managed. This collection of papers provides a variety of different perspectives and viewpoints as they try to illuminate different aspects of this complex dilemma. The papers range in the conceptual lens that is used, statistical analysis employed and level of analysis conducted, they provide both new tools and new interpretations. Some of the case studies provide new concepts or approaches for analyzing the organizational impacts of information systems projects. Some bring to light development problems, as well as pointing out possible ways of predicting them and dealing with them. These papers do not provide a complete, or even a partial solution, but together they provide sufficient background for those concerned with IT projects to proactively engage in developing better ways of handling the organizational change (impacts) resulting from IT projects.

Technical change is almost always the catalyst for organization change (Doherty and King 2005). If this argument is true, then in a world where consistent organizational and economic changes are the norm, will these changes be a catalyst for technical change? Previously published studies show interesting approaches and what I will call “contextualized” results. One recent study on technochange management (Markus 2004) is an approach where IT is strategically used to drive organizational (change) performance improvements. Effective technochange management requires a different kind of attention to the features of the ‘solution’ and a different change process from those prescribed by either IT project management or organizational change management. Therefore, it is fundamentally different from both IT projects and organizational change programs. Successful technochange is characterized by completeness; it is a fit between the technochange solution and organizational processes, culture, and incentives. Successful technochange involves careful up front design, a balancing act of the technical and social subsystems and an integrated technical and organizational implementation.

Markus and Robey (1988) conducted a study that examined the causal structures found in theories and research about the relationship between information technology and organizational change. They focused on the 3 dimensions of causal structure: 1. causal agency, 2. logical structure, and 3. level of analysis. This study concluded that very few good theories about the role of information technology in organizational change exist, although there is the potential for more. Is this conclusion still valid?

It is possible for this paper to offer many plausible theories, approaches and explanations as to what works and doesn’t work in information systems development projects. I only have mentioned a few (so far) as background for understanding the coherent collection of information systems research that will be presented.

This paper uses numerous dimensions to evaluate the current selection of papers. The 3 dimensions put forth in the Markus and Robey (1988) paper and a few others deemed by this researcher to be important that will also be described. Causal agency (i.e., causal agent and its influence), is the first dimension. This dimension refers to the analyst’s assumptions and the identity of the agent and the direction of the causal influence (Table 1).

Causal Agent		Direction of the causal influence
Technology	(Technological imperative)	External forces cause change
Organizational	(Organizational imperative)	People act purposefully to accomplish intended objectives
Emergent	(Emergent imperative)	Change emerges from the interaction of people and events.

Table 1. Causal Agency (Markus and Robey 1988)

The second dimension is logical structure, which refers to the logical relationships between the causes and the outcomes. This refers to the time span of the theory (variance models versus process models). Third is the level of analysis, which refers to the entities (collectives = macro, individual = micro, or both = mixed) about which the theory poses concepts and relationships.

REVIEW OF SELECTED INFORMATION SYSTEMS DEVELOPMENT STUDIES

I primarily selected a sample of studies since 2005. Although there are many articles discussing the human and organizational aspects of system development, only relatively few report on actual statistical analysis. For my review, I selected a sample of articles that I believe meet the following requirements:

- a clear specification of the type of data;
- the research method is specified;
- Causal agency can be determined;
- Logical structure can be determined;
- Level of analysis can be determined;
- Well presented results that show the organizational impact of IT projects.

RESULTS AND DISCUSSION

The sample of research literature is presented in this paper on how the human and organizational aspects of systems development projects can be successfully managed to result in effective business solutions. This treatise was analyzed and briefly summarized to make additional contextual information available. The summarized articles show a spectrum of recently published viewpoints, and illuminate the six dimensions of socio-technical change approaches to change management in information systems development. Some of the analyzed results are as would be expected. Case studies were the dominant method of research, with qualitative data being collected and analyzed. Causal agency had mixed instances, but interestingly enough, emergent imperative was 50% of the direction of the causal influence. This would suggest that effective business solutions would need to manage the change that results from the interaction of people and events. The logical structure was predominantly process models as would be expected, when doing case studies, which focus on dynamic outcomes, but what is worth noting, is the broad range of theories used as the conceptual lens for understanding the studies. The level of analysis (micro, macro, and mixed) had mixed instances, which would suggest that case studies are flexible in the level of analysis needed. Therefore, it can be decided on a case-by-case basis. The organizational impact supported the observation that emerging in the literature is realization that results are contextualized, therefore they vary from situation to situation.

Below is a brief description of each of the selected studies.

Contextual influences on technology use mediation: a comparative analysis of electronic medical record systems. (Davidson and Chiasson 2005)

Davidson & Chiasson uses two separate healthcare organizations that operate electronic medical record systems to explore and provide insight into technology use mediation (TUM) process (Orlikowski W. J., Yates J. et al. 1995). In addition, TUM is used as a conceptual lens, to examine how software technologies and social practices are mutually shaped during information systems development. The authors concluded that crucial TUM actions occurred during systems development phases as well as during system use, that mediation was vitally important with these specialized IT artifacts, and that system configuration required changes to software infrastructure and code. Organizational size influenced the availability and the

effectiveness of mediation resources; with adequate resources committed to the task, the institutional environment presented substantial, but not insurmountable, challenges to technology use mediation

Information systems development as emergent socio-technical change: a practice approach (Luna-Reyes, Zhang et al. 2005)

This paper explores the dynamics of these social and organizational factors to better understand the causes of success and failure through a longitudinal study in a NY State agency. Based on data from a detailed case analysis of an ISD project, the paper depicts the ISD process as an emergent and dynamic process-oriented view of information systems, characterized by continuous local adaptations. The paper ends with a proposal of a feedback-rich framework, which offers a theoretical explanation of the information systems development process based on a practice view of socio-technical change.

Social ties, knowledge sharing and successful collaboration in globally distributed system development projects (Kotlarsky and Oshri 2005)

This paper studies successful collaboration in globally distributed IS development teams due to the contribution of social ties and knowledge sharing. Data (codified using Atlas.ti software) were drawn from two successful globally distributed system development project teams at SAP and LeCroy. The results suggest that human and organizational aspects, such as rapport and transactive memory, were important for collaborative work in the teams studied within the systems development context.

The ability of information systems development project teams to respond to business and technology changes: a study of flexibility measures (Lee and Xia 2005)

The ISDP team's flexibility in responding to organizational and technical changes has become a critical success factor for system development, but the research literature lacks a consistent definition and validated measures of the construct. Drawing upon the socio-technical and the capability-based perspectives and using a systematic multi-stage approach, the authors identified major business and technology changes and developed measurement scales of ISDP team flexibility along two dimensions: Response Extensiveness and Response Efficiency. The results of the study indicated that while the ISDP teams experienced and responded more extensively to business changes than technology changes, they were much less efficient in dealing with business changes than technology changes.

The social and political construction of technological frames (Lin and Silva 2005)

The authors of this paper explore the dynamic nature of technology frames, in information systems development. In particular, this work argues that the management of information systems' adoption is a social and political process in which stakeholders frame and reframe due to the changing context, their perceptions of an information system. A case study carried out in a European bank illustrates how the Bank's technical team influenced users' technological frames, including those of senior management in order to ensure a smooth implementation process.

The surface of emergence in systems development: agency, institutions, and large-scale information systems (Chae and Poole 2005)

The systems development literature has primarily focused on the system under development, and the role of pre-existing information systems is treated as constraint on development or completely ignored. A case study is used to explore the role of a pre-existing information systems in the development of a new system within a major university system in the U.S. The case study develops the argument that pre-existing information systems are active forces in systems development because of the experiences and learning from

previous systems, which shape developers' approaches to building the new system. The study also develops a theoretical framework that integrates elements of structuration theory and actor-network theory to provide a more fine-grained analysis of how information technologies and institutional features interact in the structuring of organizational information systems.

Towards the development of a social capital approach to evaluating change management interventions. (Hatzakis, Lycett et al. 2005)

The poor relationship, collaboration and communication between business and IT colleagues before, during and after information systems development lead to dissatisfaction with information systems and services. To address these relational issues, relationship management initiatives (RM) have been introduced and in response, this paper proposes a framework, based on social capital theory, for conceptualizing the effects of change management interventions. It uses a case study and questionnaire to explore the strengths and limitations of the approach, and concludes that there is potential merit in using a social capital approach for the evaluation of change management interventions.

A re-conceptualization of the interpretive flexibility of information technologies: redressing the balance between the social and the technical. (Doherty, Coombs et al. 2006)

Interpretive flexibility is the capacity of a specific technology to sustain divergent opinions due to its social construction, but a gap exists in the literature on how a system's technical characteristics might limit its ability to be interpreted flexibly. In this paper, the authors use the results of two in-depth case studies, in order to propose a re-conceptualization of the role of interpretive flexibility by looking at the role of the human agent in shaping the technical artifact, and the artifact's shaping potential. In summary, this model helps explain how the initial interpretations of stakeholders are influenced by the scope and adaptability of the system's functionality, while the stakeholder interpretations will then, in turn, influence how the system's functionality is appropriated and exploited by users.

CONCLUSION

In summary, systems development projects often are treated as technical change processes, rather than social or organizational change processes. While the development of technical systems is an important component of systems development, the achievement of added business value is the principal organizational goal. With this in mind, I provided a coherent literature review and discourse on how the human and organizational aspects of systems development projects can be successfully managed to result in effective business solutions. This treatise was summarized in Table 2. It showed the spectrum of recently published viewpoints, and illuminated six dimensions of socio-technical change approaches to information systems development.

The information systems literature reviewed is clear on three points: a good "fit" and a balance of technical and organization aspects are needed; the primary need is to adequately predict and manage organizational impacts (change); emerging in the literature is realization that results are contextualized, therefore they vary from situation to situation. Consequentially, this paper continues the movement from technical to socio-technical thinking by delivering a coherent collection of information systems research that provide significant new insights into how the human and organization aspects of information systems development projects and the resulting change can best be managed. This collection of papers was only a sample of the different perspectives and viewpoints available in the research literature. Future work would definitely need to expand the range of the papers to more articles in other journal. The inclusion of additional research papers could provide a broader range of conceptual lens (theories) that are used, statistical analysis employed and level of analysis conducted. They could provide new tools and new interpretations, new

concepts or approaches for analyzing the organizational impacts of information systems projects. My conclusion is that these papers do not provide a complete, or even a partial solution, but together they provide sufficient background for my research to continue. In addition, these articles engage those of us concerned with IT projects to proactively develop better ways of handling the organizational change (impacts) resulting from IT projects.

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