ORGANIZATIONAL CHANGE MANAGEMENT FOR COLLABORATIVE CONSTRUCTION ENVIRONMENTS

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ABSTRACT

Although emerging technologies offer the construction industry many opportunities for computer supported collaboration environments, companies adopting these technologies are failing to get the full benefits from their implementations. The problem lies in how to fully exploit the technologies available and how to make major process and culture changes necessary for this to happen. Recent research has shown that the main reason for the failure of IT systems is the biased focus that favors the technical factors over the soft issues. The human and organizational issues are very important especially for the success of collaborative environments. Each new IT implementation involves changes for the organization and the employees, and is therefore a source of resistance and confusion unless special attention is paid to managing the changes. This paper reviews the theoretical concepts and previous work on organizational change management and maps the current approaches adopted by construction organizations when implementing collaborative environments. The results of an extensive literature review on general reasons for failure in IT implementations are presented. The key areas to focus on during the IT design and implementation are highlighted and explained. The methodologies and frameworks that propose socio-technical design solutions are also presented. The findings of an industry survey on collaborative working and IT implementation in UK construction companies are presented and discussed in relation to the theoretical constructs found in the literature. The paper then concludes with some insights into how construction organizations should manage the implementation of collaborative systems.

KEY WORDS

Collaborative environments, information technology, organizational change

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INTRODUCTION

According to a research project that gathered the information on the experience of 45 leading experts (researchers and consultants) in the UK, 80-90% of IT investments do not meet their performance objectives (Clegg et. al., 1997). The reason for this is found to be rarely technical but related to change, development and implementation, human and organizational factors, and the roles of the management and end-users. The major reason is determined as the lack of attention to the human and organizational aspects of IT adoption.

There is a high collaboration requirement in construction due to its multi-organizational and geographically dispersed nature. There are many collaboration tools and systems currently used and the industry is constantly searching for new, efficient and effective IT-based collaboration methods. Although emerging technologies offer the construction industry many opportunities for computer supported environments, the companies adopting these technologies fail in getting the full benefits from their implementations. The problem in the construction sector is not a lack of technology but more a lack of awareness of how to fully exploit it and how important culture changes are in order to allow this to happen (Betts and Smith, 1999).

Focusing too much on technical issues and ignoring or underestimating the human and organizational factors has been emphasized in other research efforts (Laudon and Laudon, 2000; Kuruppuarachchi et. al, 2002; Mitropoulos and Tatum, 2000; Clegg et. al, 2001). Focusing too much on technical factors will result in technically excellent systems which are incompatible with the organisation's structure, culture and goals (Laudon and Laudon, 2000) since it neglects to consider how the new technology interacts with working practices, work organisation and job design, and work processes (Clegg et. al, 2001).

In the literature survey, it is seen that most of the authors refer to similar or related issues as the reasons for failure. These are grouped into six categories: 1) Poor user requirements capture (Clegg et. al., 1997, Andresen et al, 2000, Aouad,1999, Laudon & Laudon, 2000, Wood-Harper et.al., 1985, Anumba, 1998); 2) Lack of strategic approaches (lack of alignment between the IT strategy and organizational strategy, focusing on short term solutions) (Clegg et. al., 1997, Suwardy, 2003, Andresen et al, 2000, Aouad,1999, Clegg et. al., 2001, Wood-Harper et.al., 1985, Baldwin, 2004; Kuruppuarachchi et. al, 2002); 3) Lack of proper plan/ project management (Clegg et. al., 1997, Suwardy, 2003, Laudon & Laudon, 2000, Wood-Harper et.al., 1985); 4) User resistance to change (Suwardy, 2003, Aouad,1999, Laudon& Laudon, 2000, Anumba, 1998); 5) Lack of user involvement (Clegg et. al., 1997, Aouad,1999, Laudon& Laudon, 2000); 6) Technical characteristics (Suwardy, 2003, Aouad,1999).

The human and organizational issues are very important especially for the success of collaborative environments. Each new IT implementation involves changes for the organization and the employees, and is therefore a source of resistance and confusion unless special attention is paid to managing the changes. This paper presents the initial findings of an ongoing doctoral research project at Loughborough University, which aims to develop a framework for organizational change management for the implementation of collaborative environments in construction. It reviews the related theoretical concepts and previous work on organizational change management and maps the current approaches adopted by

construction organizations whilst implementing collaborative environments. The results of an extensive literature review on general reasons for failure in IT implementations are presented, and the key areas to focus on during IT design and implementation are highlighted and explained. The methodologies and frameworks that propose socio-technical design solutions are also presented. The initial findings of an ongoing industry survey on collaborative working and IT implementation in UK construction companies are presented and discussed in relation to the theoretical constructs found in the literature. The paper then concludes with some insights into how construction organizations should manage the implementation of collaborative systems

KEY AREAS IN IT DESIGN AND IMPLEMENTATION

Based on the findings of the literature review on the failure reasons of IT implementations, five key areas are extracted for further discussion. Three of these focus on the user and are inter-linked: user requirements capture, user resistance to change, and user involvement. The other two are proper planning/project management and strategic IT implementation. Technical characteristics are omitted since the research shows the failure reason is rarely technical, but related to the organizational and people issues.

USER REQUIREMENTS CAPTURE

Since the performance of the system depends on the users as well as the technical characteristics of the system, the needs of the users should be captured carefully. When the requirements of the users are met, they will work better through the system, improving the overall performance.

The role of communication between the users and the designers is very high in the requirements capture process. The differences in the backgrounds, interests and priorities between the users and information technology specialists are referred to as “user-designer communications gap” by Laudon and Laudon (2000). The communication problems between end users and designers mean a high risk of failure and result in technically perfect systems not serving the needs of the end users. When there is a conflict between the designed system and the expected system, the IT tool is usually not adopted.

USER RESISTANCE TO CHANGE

Technological changes with obvious benefits and few discernible negative consequences are often readily accepted in organizations. Changes affecting social relationships take longer to implement (Kast and Rosenzweig, 1974). When a change is to be introduced to an organisation, resistance from the employees is inevitable. Sources of resistance to change are analysed by many sources in literature. The reasons are summarised as: fear of the unknown, lack of information/knowledge/skill, threats to status, fear of failure, lack of perceived benefits, uncertainty regarding the change outcomes, lack of knowledge/skill, internal politics (such as elitism and interdepartmental rivalry) (Ford et. al, 2001; Hoag et. al, 2002; Proctor and Doukakis, 2003).

The reasons behind the resistance should be clearly known in order to take the correct action against it. Training and communication can be used to overcome the resistance if it

results from the lack of information, knowledge or skills. The importance of effective communication and employee empowerment in reducing employee resistance to change is mentioned by many authors in the literature. (Proctor and Doukakis, 2003; Kitchen and Daly, 2002; Holt et. Al, 2000; Rye,1996)

USER INVOLVEMENT

The people who develop and implement new systems and new ways of working tend to behave to the users of the system in a very different way than they behave to their external customers (Clegg and Walsh, 2004). The users are accused of being resistant to change or failing to understand the potential benefits offered by the system. Most of the time, end-users are the last ones to see the new system. In this kind of top-driven approach the system is imposed on users, and any hesitation or unwillingness from them are not appreciated. This hesitation and unwillingness are usually due to the fact that the users are kept away from all decisions at the design stage. A proper user requirements and needs capture is not possible without their involvement and a system not serving the users' needs is likely to be rejected by the users. Since the system is designed or implemented without their involvement, the system will be mainly the developers' system (Clegg et. al., 1997).

User resistance, user involvement and user requirements capture are interrelated, Involving the users is important to capture the users' requirements and the resistance of the employees will decrease.

PROPER PLANNING/ PROJECT MANAGEMENT

Introducing an IT system into an organisation requires careful planning and project management to enable all the other key areas. In order to strategically manage change, the following change levers must be equally available for use (Tichy, 1982): 1)External Interface, 2) Mission, 3) Strategy, 4) Managing organizational mission/strategy processes, 5) Task, 6) Prescribed Networks, 7) Organizational process (Communication, problem solving and decision making), 8) People, 9) Emergent Networks. Maintaining a balance between these levers is the role of project managers.

The project managers should use their human and financial resources to deal with the cultural aspects of the organisations (such as individual or group values, attitudes, role perceptions); operational aspects (such as cognitive information on new practices and services, new working styles, transformations in the job functions); and policy aspects related to the redistribution of power, and redefinition of rewards (Songer et.al, 2001; Laudon and Laudon, 2000; Robertson, 2000).

STRATEGIC IT IMPLEMENTATION

According to Walton (1989), the company's formal organisation and IT must be designed to reflect all components of the strategic vision and it should take account of environmental factors. He also mentions that the organizational design and IT design should be matched and integrated for the development of effective organizations, and builds up the concept known as Walton's strategic triangle representing the relationship between the business strategy, IS/IT strategy and organizational strategy and that a change in one will affect the other two.

Carrillo (2001) found that construction companies are aware of Walton's strategic triangle, and try to make the implementations according to the principles introduced by the triangle but fail in the IS/IT strategy and organizational strategy link.

Companies implement IT in their internal operations for the purpose of improving efficiency within the organisation, but since they do not manage this implementation strategically in accordance with the corporate strategy of the company, the investments fail to deliver the intended outcome. Most of the IT systems purchased in the past have been mainly because of operational requirements, therefore most of these failed due to the lack of focus on the strategic and business requirements and long term goals (Aouad et. al, 1999; Andresen et.al, 2000).

METHODOLOGIES AND FRAMEWORKS FOR SOCIO-TECHNICAL DESIGN

There have been many methodologies proposed in the literature for IS/IT design and implementation. Most of these provide step by step guidelines to achieve their objectives. SSADM is a very disciplined engineering approach developed by the Central Computer and Telecommunications Agency in the 1980s and has been used as a system analysis and design methodology for governmental software developments within the UK since then. SSADM and similar strict waterfall systems are criticized by many researchers due to its differences from today's approach where a description of reality is expressed by ill-defined, tacit, diffuse and embedded knowledge; due to its rare consideration of soft issues and due to its high level of prescription increasing the size and complexity of the project (Middleton and McCollum, 2001; Sauer and Lau, 1997; Rogerson et. al, 2000). On the other hand, there are some socio-technical methodologies that propose technical solutions bearing the soft factors in mind: Soft Systems Methodology (SSM) aims at extracting the soft factors in the system (Checkland, 1981); ETHICS aims at integrating the participation, effective communication and socio-technical design (Mumford; 1981,1996); MULTIVIEW builds on Checkland's and Mumford's work and advocates that information systems development should include the human and organizational aspects (Wood Harper et. al, 1985); MULTIVIEW2, which includes technical design and construction, socio-technical analysis and design, and organizational analysis stages, based on the work of Mittroff and Linstone (1983), followed by information modelling which acts as a bridge between these three stages (Avison and Wood Harper, 2002). Table 1 shows the steps proposed by each methodology. It has been realized that none of these tools or methodologies has been properly used in the construction industry.

ORGANIZATIONAL CHANGE MANAGEMENT

The success of a collaborative environment does not only depend on "what is introduced to the organization" but is also related to "how it is introduced". Each new collaborative environment implementation is a change in the system and change is difficult to accept; thus it should be managed.

According to Contingency Theory, each organization will have a different way of structuring itself and this structure depends on the circumstances, referred as contingencies, such as environment, organizational size, technology and organizational strategy. Each organization has different contingencies, and obtains high performances when the

organizational characteristics fit these contingencies. Organizations try to avoid misfits which mean loss of performance; therefore, they adapt themselves according to the changing contingencies so that effectiveness is maintained. In other words, the will to fit the organizational characteristics to the contingencies result in organizational change.

When a new collaborative environment is introduced to an organization, it results in a change in two contingencies: a new working approach and a new technology. The organization has to adapt its characteristics according to these new contingencies.

Table 1. Stages of the Socio-technical frameworks

Stages	SSADM	SSM	ETHICS	MULTIVIEW
1	Feasibility study	Building the Rich picture	Identifying the user needs and problems, focusing on short and long term efficiency and job satisfaction	Analysis of human activity systems
2	Requirements analysis	Analysis of the rich picture	Setting objectives for efficiency and job satisfaction	Information modelling/ analysis of entities and functions
3	Requirements Specification	Root definitions via CATWOE analysis	Developing design strategies and matching each alternative against these objectives	Analysis and design of socio-technical system
4	Logical System Specification	Building the conceptual models of the systems	Choosing the strategy best meeting the sets of objectives	Human-Computer Interface Design
5	Physical Design	Comparing the models with the real world and revising	Determining the hardware and software and designing the system in details	Technical design
6			Implementing the new system	
7			Evaluation of the new system	

CURRENT APPROACHES IN COLLABORATIVE ENVIRONMENT IMPLEMENTATIONS IN THE UK CONSTRUCTION INDUSTRY

From the literature, it was seen that the main problem in the implementation of collaborative environments is not related to technical issues but people and organizational issues. To map the current IT implementation and collaborative working approaches in construction companies, an industry survey has been carried out. In order to understand the concept deeply, a qualitative research methodology has been followed. The survey was aimed at gathering information on: 1) IT implementation, specifically collaborative environment implementation procedures in construction organizations; 2) Barriers and difficulties observed in the implementation of collaborative environments and collaborative working; 3) Whether collaborative environment implementations undertaken so far are successful; 4)

Thoughts and experiences of industry professionals regarding the transformation of the organization during a new collaborative environment implementation.

The survey was designed as an interview, consisting of both open and close ended questions. The target of the interviews were top level managers in construction organizations who had been involved in the implementation of the collaborative environment implementations, experienced the difficulties and barriers and made decisions to overcome them. A total of 7 interviews have been carried out with top level managers from 3 contracting companies, 2 consultancy companies and 2 companies delivering collaboration solutions to the construction industry.

SURVEY RESULTS AND DISCUSSIONS

Each interview lasted approximately an hour. The interviews were recorded using a digital recorder and were later transcribed and analyzed. The responses to close-ended questions and open ended questions have been analyzed by matrix evaluations and by qualitative coding techniques respectively. The initial findings from the survey are presented and discussed below.

Failure rate of IT systems to provide the full benefits expected

Regarding the general IT implementations, all companies stated that up to 30% of the IT implementation initiatives have failed to provide the full benefits expected. Only one consultancy firm specified a higher failure rate of 50-70%. This consultancy firm also indicated that IT implementations were marginally meeting the expectations of the users.

Success criteria for collaborative IT implementations

When the interviewees were asked about the success criteria for their collaborative IT implementations and how they measure the extent to which implementations satisfy these criteria, it was realized that they mostly do a perceptional analysis of whether they work better than previously and whether they are more efficient or more useful than previously. It was found relatively easy to calculate the tangible benefits in terms of cost savings or time savings via comparisons with cases where paper-based systems were used. On the contrary, measuring the intangible benefits such as the savings in time and cost due to the decrease in rework and request for information (RFI's) due to the use of the system was found difficult by the contracting and consultancy firms. When they need to measure these, they either choose to do a perceptional analysis or measure the construction project instead of the collaborative tool against a number of benchmarks or key performance indicators defined at the very beginning of the project. The technology provider companies stated that specifying a universal cost saving was difficult. The perceptional analysis they do for the success of collaborative environments , and hence their success, focuses on checking whether companies implementing them are satisfied with and whether they plan any future implementations .

Factors affecting the success of the collaborative systems and collaborative working

The interviewers were given 11 factors considered in the literature to affect the success of collaborative systems and were asked to rank how severely the success of their collaborative

system was affected by the presence of these factors using a scale of (0-5), where 5 represents very high severity and 0 represents no severity. According to the average rankings, the five most significant factors were determined. The interviewers were also asked to rank these factors according to their frequency of occurrence. Table 2 shows these factors and their occurrence rankings.

The participants were also given a set of barriers and asked to what extent they agree that these barriers have an adverse affect on effective collaboration. The results are shown in Table 3 with some of the barriers having the same ratings.

Table 2. Top 5 factors affecting the success of collaborative systems and their occurrence rankings (*0=No Severity, 5=High Severity)

Factors affecting the success of collaborative systems	Severity Rank	Severity Rate (0-5)*	Occurrence Rank
Failure to meet the user needs	1	3.86	2
Organization not being ready for change	2	3.71	5
Insufficient/inefficient training of users	3	3.57	1
Employee resistance to change	4	3.43	3
Technical constraints	4	3.43	4

Table 3. Barriers to effective collaboration

Barriers to effective collaborative working	Rank
Lack of clearly defined vision and goals for the collaboration	1
People who do not want to work differently	1
Different organizational cultures	2
Participants using a variety of methods of collaboration	3
A lack of understanding of participants expertise, knowledge and language	3
Staff turnover/continuity of participants	3

When the responses regarding barriers to effective collaboration and factors affecting the success of collaborative systems are investigated, it is seen that the rankings for collaborative working in general and collaborative environments were similar and in compliance?? with each other. All interviewees also referred to these reasons throughout the interview when they were answering the open-ended questions. The initial findings from the industry survey included the five key success areas extracted from the literature.

Change management

Construction organizations were found to use collaboration tools mainly for project collaboration. The most common collaboration technology used was found to be extranet applications provided by different technology suppliers. All of the parties stressed the importance of the tools being used by all parties in the project for the success of the whole project.

When the companies were asked how they implement a new collaborative environment, and how they handle the change occurring in the system, the responses were mainly limited to training. In parallel with the theoretical concepts, it was observed that the companies that

do not involve the users in the requirements capture stage complained more about the user resistance. When the companies were asked about their least successful implementations, employee resistance, inconsistency of the contract terms regarding the collaborative tool to be used, and insufficient training were mentioned as the factors that made those implementations less successful than the others. Cultural problems, trust issue, and unsatisfied user requirements were also mentioned by all of the interviewees as failure reasons.

The interviews showed that the users were involved mainly at the training stage after the system has been implemented. Most companies have started a different method of training to improve the quality. Instead of training a large number of employees in one classroom together, they now train the users at different levels and shift the training process from a theoretical to practical basis. When they start on the job, the trainers stay in the company during the adoption stage and help the users.

The survey findings regarding the failure reasons had some overlaps with the findings from the literature survey, but were not limited to them. The following key points were also stressed by the interviewees for successful collaboration:

- All of the contracting and technology provider companies referred to the importance of contract terms regarding the collaborative environment used for external communication. The contract should be binding for all companies participating in the project to make sure there are consistent procedures for the use of the sytems.
- Enabling trust has been found as another key point for successful collaborative environments. Contracting firms have been observed to have hesitations in sharing their information in external collaboration. They see the transparency of the collaborative environment as a threat to their bargaining position. If the type of information to be shared and the extent of sharing are fixed at the beginning then the hesitations will be less.
- The third point mentioned is the necessity of agreement on the common formats, types and conventions for the information exchange before the collaborative environment is set up, to provide consistency and avoid possible confusions.
- The role of the senior management was considered as another important point in the adoption process. It was found out that there has been a committed “collaboration chief” from top level management in each of the most successful collaborative environments implemented so far. This “chief” has been responsible for the implementation of the environment and getting the users to use the system and should be accessible both for the users and the senior management. If there is an option, the users will choose to continue working in the way they have always been working.

CONCLUSIONS AND FUTURE RESEARCH

This paper has presented the initial findings of an ongoing doctoral research study at Loughborough University which aims at developing a framework for organizational change management in the implementation of collaborative environments in construction. Theoretical concepts and previous work on change management and collaborative

environment implementations in construction have been reviewed and the key areas to focus on during the IT design and implementation highlighted. The methodologies and frameworks that propose socio-technical design solutions were also reviewed. To map the current IT implementation and collaborative working approaches in construction companies, an industry survey has been carried out. The initial findings of this survey and the conclusions drawn are as follows:

- All companies were found to be failing in providing the full benefits expected out of the IT implementations because of the under-estimation (or ignorance) of the people and organisational issues. "Failure to meet the user needs", "Organization not being ready for change", "Insufficient/inefficient training of users", "Employee resistance to change", and "Technical constraints" are found as the top 5 factors affecting the success of the collaborative environment;
- "Lack of clearly defined vision and goals for the collaboration", "People who do not want to work differently", "Different organizational cultures", "Participants using a variety of methods of collaboration", "A lack of understanding of participants' expertise, knowledge and language", and "Staff turnover/continuity of participants" are found as the top barriers for collaborative working;
- The contract terms regarding the collaborative environment to be used should be clear and binding for all parties to make sure there is only one way of doing things;
- The transparency of the collaborative environment should be arranged carefully to prevent any possible hesitation in the parties;
- The common formats, types and conventions for the information exchange should be agreed before the collaborative environment is set up.
- Senior management commitment by means of a "collaboration chief" being accessible for the end-users should be balanced with "waving the stick".

Further research will focus on developing a framework to show the transformation dynamics in collaborative systems implementation in the construction industry. The steps for future research will include: 1) Determine how specific collaboration systems are implemented in the sector through case studies; 2) Develop an improved change management framework based on the results of case studies and theoretical foundations; and 3) Test and evaluate the framework proposed.

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