

31 FRAMEWORK FOR BARRIERS TO IS-RELATED CHANGE: DEVELOPMENT AND EVALUATION OF A THEORETICAL MODEL

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Abstract

Organizations live in a volatile environment and to survive they have to be able to adjust and change their organizational processes as needed, easily and fast. Information technology is considered to be the major single driving force and also the facilitator of change. Change is not an easy process and very often there are barriers to overcome. If barriers are not identified and addressed, they may hinder change or result in unplanned changes. We develop a framework called BIF (Barriers Identification Framework) for identifying and categorizing barriers to IS-related change. We illustrate the usefulness of the model by using a library information systems change process as an

example. The research project in the library lasted for nine months. The approach was interpretive, with interviews and participative observation as techniques. Several barriers are identified, categorized, and assigned to different phases of the change process. If the framework had been used in the library, at least some of the problems could have been avoided.

Keywords: IS-related change, barriers to change.

Introduction

Increasing competition, globalization, and internationalization is the environment that organizations face and have to overcome to survive. Sustainable organizations respond to such an environment with flexibility and ability for fast change. Handling organizational change has thus become more important than ever before (Markus and Benjamin 1996).

Organizational change processes are not easy to handle since they have an influence on structure, tasks, people, and technology (Leavitt 1964). Furthermore these are interrelated. Information technology has been claimed to be the greatest single driving force (Brandon and Morris 1993), and at the same time a facilitator to change. In this article, we focus on IS-related change.

There are many barriers to change that can hinder the implementation of IS-related change. Recognizing such barriers can help in avoiding or handling problems in change processes. If not addressed, barriers may prevent or hinder change or result in changes which were not planned.

To address practical and complicated problems, a theoretical framework can be very helpful. We did not find any useful framework for identifying barriers to IS-related change, and consequently, we developed a theoretical model, BIF (barriers identification framework), which we present in this article. BIF integrates into a holistic view four types of factors that influence the change process: structural, managerial, user, and technical. We illustrate the use of the model in a library information systems development process. This example shows that problems could be traced to the barriers, and if identified prior to implementation these could possibly have been avoided or handled.

The rest of the paper is organized as follow: In the next section, a theoretical background of IS-related change is discussed. The framework for barriers is presented in the third section. The case study is briefly introduced. The usefulness of the model is presented and discussed. The final section concludes the findings and offers some suggestions for managing IS-related change.

Background

IS-related Change

Change in organizations can be interpreted as a learning process according to several researchers (Argyris and Schön 1978; Huysman, Fisher and Heng 1994; Senge 1990). The success of change depends on an organization's ability to learn new things, to learn by experience, and to learn how to learn. It also largely depends on the degree to which changes in organizations are related to experience (Huysman, Fisher and Heng 1994).

According to Grantham (1993, p. 202) organizational learning occurs when people in an organization collaborate to share their different visions, knowledge, experiences, and skills. Thus, learning at both the individual and organizational level is a basic requirement for successful change (Argyris 1990; Argyris and Schön 1978; Grantham 1993; Senge 1990). Still, such a learning perspective during a change process is often treated as a marginal issue, or an issue of future interest (Huysman, Fisher and Heng 1994), instead of giving it the central position it deserves.

Lewin (1952, 1972) has defined a three step learning curve to guide and manage a change process; unfreezing, changing, refreezing. *Unfreezing* is the process of motivating people and creating readiness for change. At this step, the emphasis is on creating awareness of the need for change, challenging existing beliefs and practices, and on drawing people's attention to the benefits of change. *Changing* is the phase when most learning occurs and when people change their attitudes and behavior. People start searching for new information and learning new skills. New procedures, and changing to new work flows and working relationships which are required to meet the new goals, are adopted at this step. *Refreezing* means consolidating new, tested procedures into organizational norms and work routines.

Barriers to IS-related Change

The subsection above discussed requirements for successful change but many barriers are recognized that hinder successful IS-related change. According to Senge, reasons for failure can be found in the ways organizations are structured, work routines are designed, and how people collaborate. Argyris (1992) states that organizational defenses are one of the most critical barriers for learning and thus for change.

Beatty and Gordon (1988) have analyzed barriers to change and classified them into three categories: structural, human, and technical barriers. Structural barriers arise from structural mechanisms in organization, human barriers refer to workers' skills, perceptions, and biases, while technical barriers have their sources in technology.

Auer (1996) has further divided human barriers into user and managerial barriers. He motivates the division by the absorptive capacity of organizations. Absorptive capacity (Cohen and Levinthal 1990) means an organization's innovative capability which depends on its prior knowledge. "The level of absorptive capacity depends both on potential adopter's ability to recognize (management) the value of new information, and to exploit that information for the organization (users)" (Auer 1995, pp. 42-43). Thus, according to Auer, management and users have different roles in the adoption of information technology, which results in distinct categories for user and managerial barriers. All four categories are interrelated, they depend on and influence each other. Auer (1996) also introduced a fifth category of barriers which originates from incompatibilities between the four previously mentioned categories, but did not present what type of incompatibilities there might be.

Framework for Barriers to IS-related Change

In this section, we present our framework for barriers to IS-related change in organizations. A first attempt to classify such barriers and assign them to phases of change is presented in Hirvo (1997). This work was the starting point for creating our framework.

Lewin's (1952, 1972) theory of change and Beatty and Gordon's division of barriers as modified by Auer (1996) form the two legs of our framework.

Although we do not totally agree with Auer about the different roles and capabilities of managers and users, we find the categorization practical for analyzing barriers to change. We follow the division of barriers into the four categories: structural, managerial, user, and technical. However, we recognize the combination of these barrier categories as even more important and aim at further analyzing the nature of it as well. This leads us to a holistic view which is more relevant for practical use.

We base our framework on Lewin's theory of change, because it is rather straightforward and well-accepted among researchers. However, Orlikowski and Hofman (1997) have presented "an improvisational model for change management." The improvisational model suggests that change is an on-going process which consists of anticipated, emergent, and opportunity-based changes. We agree with Orlikowski and Hofman about the on-going nature of change. We consider change as a *continuous* process, and thus also as a continuous learning process. In continuous change, the phases—unfreezing, changing, and refreezing—may overlap each other. The consequence of this view is that it is not always possible to clearly distinguish the phases from one another; for example, an organization may be in a refreezing and unfreezing phase at the same time.

In the subsections to follow, we describe the structural, user, managerial and technical categories. Then we discuss the barriers which emerge from the combination of the categories. After that we outline the barriers according to Lewin's phases of change. It is worth emphasizing that one barrier may appear in several phases of change.

Structural, Managerial, User, and Technical Factors

Structural Barriers

Kwon and Zmud (1987) have argued that there are both formal and non-formal structural factors that affect the change process. When related to barriers to change, formal barriers are those which directly depend on the formal organizational structure.

Every organization has to have some degree of hierarchy (Ackoff 1974; Ashby 1956; Aulin 1982). However, organizational hierarchy can also lead to inflexibility, resistance to change, and slow reactions. Deep hierarchy indicates vertical communication and centralized decision making. Such organization makes it difficult to see the need for change. Thus changes take place slowly and resistance to change is not uncommon (Regan and O'Connor 1994). Organizations that react quickly are most successful in continuous change (Ackoff 1974). Reaction rate depends on flexibility and openness to new ideas and changes.

The size of an organization often indicates complexity (Kwon and Zmud 1987), which can lead to centralization of decisions and functional specialization. If, for example, the IS unit is treated as a functional subunit of an organization, IS changes are not usually considered in a larger organizational context (Swanson 1994).

Non-formal barriers to change can originate, for instance, from organizational culture and values, a closed atmosphere, and organizational inertia. Organizations that can change their culture in the right way when needed are viable in change (Schein

1985). Likewise, organizational cultures that reveal resistance to change can become major barriers to change (Brandon and Morris 1993).

Organizational inertia means that old habits control organizational activities (Argyris 1990). These activities result in organizational defensive routines, such as anti-learning, overprotecting, and self-sealing. If people act as to protect such defensive routines, they can become barriers to change.

The category of structural barriers thus consists of all those factors which emanate from the organizational structure, culture, and policy.

Managerial Barriers

Schein states that management's role in an organization is twofold: task-oriented and supportive for groups and teams. The task-oriented role includes taking initiatives, sharing information, stating opinions, and drawing conclusions. The supportive role includes maintaining and supporting groups and teams by reinforcing harmony, setting up norms, and controlling internal communication. Taking these tasks together means that managers should have both human and analytical competence (Beer, Eisenstat and Spector 1990; Schein 1985; Zuboff 1988). In the context of change, human competence means motivating for change and learning while analytical competence means leading the change process. For IS-related change, IS management also is part of the required competence.

Top management is the most powerful driving force—or hindrance—to change (Beer, Eisenstat and Spector 1990). Successful change requires commitment by management (*ibid.*). The commitment of managers is important, because they have to achieve the commitment and participation of other people. Achieving the commitment of other people may be difficult because change can be experienced as threatening. To make people feel safe and break organizational defensive routines, managers must show emotional strength (Argyris 1990, 1992).

According to Senge, the discipline of shared mental models promises to be a major breakthrough for enabling change. Creating mental models requires depth of vision by managers. Further, managers have to be able to share their mental models (Isaacs and Senge 1992) to learn from each others' experiences and thus create new knowledge. Their ability to learn can become critical for the whole organization. If managers cannot renew their thinking and mental models, changes are restricted to existing models. Problems in communication and collaboration can also become important barriers to change (Argyris 1990; Auer 1995; Brandon and Morris 1993).

Managers need analytical competence to build both visions and concrete objectives, and to define means to achieve these. The visions have to be propagated to the personnel involved in the change process (Beer, Eisenstat and Spector 1990; Huysman, Fischer and Heng 1994). Planning and directing the learning process and facilitating accumulation of individuals' and groups' learning into organizational learning also belong to managers' responsibilities (Auer 1995; Zuboff 1988). Lack of such skills in general management can become a major barrier to change.

Information management includes planning, organization, and control of information resources (Earl 1989). Managers have to have adequate knowledge of the possibilities, limitations, costs, and methods of IS (Brandon and Morris 1993). Without such

knowledge, managers cannot identify the role of IS in the organization and decide when to start a change process and how to control it. Creating a proper information systems strategy is necessary for both successful change and efficient use (Auer and Ruohonen 1997). Efficient use of IS can be facilitated by supporting continuous learning (Auer and Reponen 1997). Thus, in continuous change, the need for constant training and development of skills and knowledge has to be emphasized.

User Barriers

Martinko, Henry and Zmud (1996) suggest both internal and external factors as explanations for individual resistance or acceptance of IT. Internal factors can be negative prior experiences with IT, innate conservatism, lack of felt need, fears, and attitudes and prejudices. External factors include coworkers and supervisors, technology, and management. In this paper, the last two factors are discussed among technical and managerial barriers, respectively. Collaboration requires well-functioning communication among coworkers. Communication, especially verbal, is social interaction with a central role in learning. Thus, difficulties in communication and collaboration can hinder creating shared understanding and visions (Senge 1990).

To successfully handle the change process and thus the learning process, the change process has to be understood. People have to be able to transfer the learning process into practice. Probably, the most efficient way to do this is by learning by doing (Argyris 1990; Kolb 1984; Senge 1990). Also, individual learning modes should to be recognized. Imagination, playing with mental models, is necessary in learning. Lack of imagination and creativity can cause barriers to change (Senge 1990). Argyris (1990) also calls for individual motivation, lack of which leads to unwillingness to develop one's skills and to learn, a decreased learning mood, and finally prevents an individual from learning.

Difficulties in conceptualizing the change may cause fear of failure, loss of power and control. People actually often resist more the social change process which follows the technical change than the technical change itself (Regan and O'Connor 1994).

When the reality does not meet user's needs and expectations, job satisfaction decreases. Actual usage of IS can be lower than aimed, and IS-related change unsuccessful.

Technical Barriers

Technical barriers are studied in the context of technology, human needs, and organizational tasks. The viewpoint is practical; to make IS fit into their aimed roles in organizational processes, it is necessary to understand the organizational tasks. Too often IS offer only few opportunities to do really useful things. Previously, many tasks have been performed more effectively without a computer-based information system (CBIS) (Landauer 1995).

A successful adoption of new technology usually requires compatibility with existing norms, prior experience, and user needs. Compatibility is a requirement for users to consider IS as accessible. Accessibility here implies that IS are easy to learn and

use, and are controllable by users (Martinko, Henry and Zmud 1996). There is also another aspect of compatibility, namely, compatibility with other CBISs. However, incompatible CBISs are not uncommon and often cause serious problems in the deployment of IS in organizations (Landauer 1995).

Probably the most common technical barriers to successful IS-related change are problems in the usability of a CBIS. If an IS is hard to understand and difficult to use, for example, because it is too complex, resistance to change might develop. The reason for usability problems can be deficiencies in users' skills and knowledge (Kwon and Zmud 1987) or in organizational capabilities (Auer and Ruohonen 1997).

Usability is one aspect of the quality of IS. Another important aspect is functionality. If a new IS proves not to function properly, its usage is not likely to be frozen into routine work. Unreliability is one aspect that shows the lack of quality, according to Landauer (1995).

Furthermore, the quality of the system specifies the quality of data which the system contains. Data quality depends on the design and production processes which generate the data (Wand and Wang 1996). Frequently mentioned dimensions of data quality are accuracy, completeness, consistency, reliability, and timeliness. However, data quality is relative to the actual usage of data. Poor data quality has an influence on the efficiency of the whole organization (ibid.). Therefore, problems in data quality have to be recognized, or otherwise these can hinder successful IS-related change.

Combination of Factors

After describing the four "basic" categories of factors that can cause barriers to IS-related change, we will discuss the combination of these factors. We argue that successful integration of these factors is a necessary prerequisite for successful IS-related change. Thus, the combination category is the most important factor of all.

The relationships of factors are not linear or causal in nature, but systemic (Grant-ham 1993). An example of this is that the reason-cause relationships are not always clear. It is often difficult to tell whether workers change their working habits due to new IS, or whether the IS is renewed because of changes in work. Further, managers define organizational structures with their activities and behavior, but organizational structures also define the mode of managing (Beer, Eisenstat and Spector 1990). The consequences of taking the systemic view are many.

First, *lack of systems thinking* can cause barriers to IS-related change. Senge argues that systems thinking is the way to see the whole pattern of change. Systems thinking "simplifies life by helping us see the deeper patterns lying behind the events and details" (Senge 1990, p. 73). Instead of concentrating on isolated parts of the organization or system, it helps to change, or at least see, the whole pattern effectively. Systems thinking has become more important due to increased complexity; it helps to see the structures that lie under the complexity.

When discussing systems thinking, it is important to understand the meaning of feedback processes. Senge defines feedback as reciprocal flows of influence, i.e., every influence is both a cause and an effect. According to Senge, feedback processes can be balancing, and balancing occurs when organizations aim at certain goals. These balancing processes try to maintain the status quo, although all if the participants would

like to change the situation. When this happens, Senge suggests that rather than “pushing harder” toward the goal, efforts should be concentrated on the causes of resistance. When considering IS-related change with a defined goal, the systemic nature of the factors has to be understood, otherwise factors respond to change efforts with balancing processes. By examining the balancing processes, it is possible to identify the causes for resistance and unchanging.

When facing change, organizations have to be able to respond to new challenges while maintaining stability at the same time. The relationships of the factors in different categories should be stable, but not static (Mumford 1983). IS-related change has an effect on each of the categories. In order to maintain stability in the whole system, change in one category usually requires adjustments in others. If the *relationships between the factors are static*, organizations cannot be active in the change process.

The *interrelations and interdependencies between factors should be defined* and understood. Defining interdependencies is difficult, but if an organization cannot see the specific effects of change, it cannot see the overall effects of change either. This may be because symptoms cannot be distinguished from causes, or indirect effects have not been taken into account (Brandon and Morris 1993).

Another important aspect is *timing of the categories*. The change process becomes more complicated if different categories are not in the same phase. For example, if technology related factors are already changing, but users are still in the unfreezing phase, the consequence can be trying to speed it all up, which in its turn can cause resistance to change. Another example considers timing between managers and users. Users’ learning is the responsibility of and should be led by managers. This is not possible if managers are in an earlier phase of change than users. Indeed, managers should preferably be somewhat ahead of the users to be able to plan for the future. Thus, to avoid timing problems, all factors and plans for their respective changes must be taken into account.

Barriers and Lewin’s Phases of Change

After categorizing the factors, we are now ready to distribute them to the phase of change they best fit. Some factors belong into several phases while others are more or less explicit. Table 1 summarizes the categorization of the factors. Each factor is allocated into the phase where it is most influential. This is the phase in which the factor is most critical and where it is possible to influence the effects. If not addressed, this is the phase where serious problems can be observed with consequences in the later phases as well. The motivation for choice of phase is explained in the respective column in the table.

The barrier category, which consists of the combination of structural, managerial, user, and technical factors, was stated as being the most important category. Generally, it can be said that a combination effect can occur in any phase of change, and based on many different combinations of factors. Consequently, combinations of factors should be taken into account regardless of the phase of change. Also, communication and collaboration related issues affect every phase of change. Further, these communication related barriers may arise from managerial or user categories. There can be problems in communication among both managers and users themselves, and between managers and users. Emotional aspects of managerial factors, such as management’s own commitment

to the change process and efforts to build commitment and participation by other people, tend to have an influence on all of the phases of change, but are emphasized in earlier phases. In our framework, technical factors are closely related to the usefulness of the information system. The new IS should be expected to be better than the prior one and when implemented it should be experienced as useful. At least in the unfreezing and refreezing phases, managers' information management and information systems strategy skills are critical and lack of such skills can become a major cause for barriers to IS-related change.

To Summarize the Framework

Figure 1 summarizes the whole BIF model. The four basic categories are embedded in the combination category. The phases of change progressing in parallel are represented by the overlapping arrows.

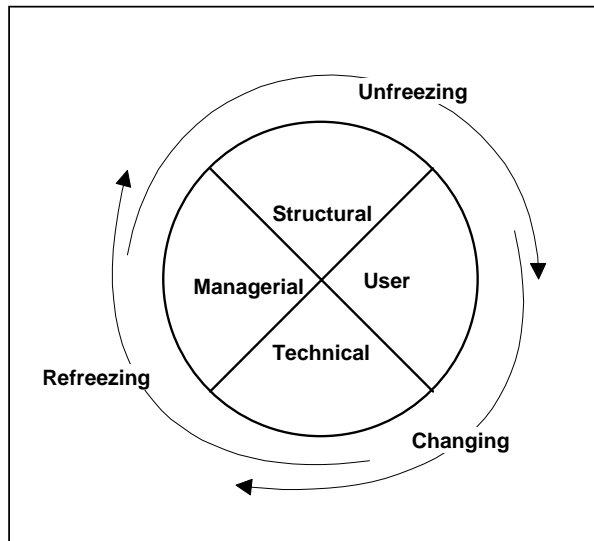


Figure 1. The BIF Model

Some barriers are rather specific for certain categories while others can affect different categories. As Table 1, shows structural factors mostly influence the earlier phases of change, while managerial factors are important both in the unfreezing and refreezing phases. User factors and technical factors seem to be rather evenly distributed over all phases.

The model is based on literature studies and empirical experience from organizations but it has never been tested before. The very first attempt to test the relevance of the model will be done in the case study to follow. We

do expect that there will be changes and new distributions and, certainly, we do not claim that the model would be validated after this case study either. Still, there should be some more structure for further development of the model.

Case Study

A case study conducted at a scientific library organization is used to illustrate the framework. The library employs 118 workers. Information about the library's collections is stored in the library system, a shared database for workers and customers. The library system is a well-known product in use in several countries in Europe and in the USA. In our case organization, it has been used for several years. Modifications and changes to the original system have been made in an evolutionary manner by the vendor.

Table 1. Distribution of Factors to Phases of Change

	Unfreezing	Changing	Refreezing
Structural Factors			
Resistance to change from organizational culture and values; closed atmosphere; organizational inertia	Difficulties in motivating people and preparing for learning		
Inflexibility; slow reactions; complexity	Hard to see the need for change	Changes take place slowly	
Managerial Factors			
Inadequate emotional strength and depth of vision; problems in sharing mental models and abilities to learn	Inability to create new mental models and to learn from others' experiences		
Constant training and development of skills; improper information systems strategy			No support for continuous learning
Deficiencies in information management skills; improper information systems strategy	Problems in identifying role of IS in organization and resource planning		IS resources not properly controlled
Management's commitment insufficient; difficulties in achieving other peoples commitment; inadequate communication and collaboration; deficiencies in general management skills	Management doesn't act as a driving force for change; organizational defensive routines occur	Change not managed	New routines not established

Table 1. Distribution of Factors to Phases of Change (continued)

	Unfreezing	Changing	Refreezing
User Factors			
Negative prior experiences; innate conservatism; lack of felt need; fears; attitudes and prejudices	Resistance to change		
Difficulties in understanding and conceptualizing change; individual learning modes not addressed; lack of imagination, creativity, and motivation		Learning process not transferred into practice	
Reality does not meet needs and expectations			Job satisfaction decreases
Inadequate communication and collaboration	Shared understanding not created	Knowledge not shared	No shared understanding and values
Technical Factors			
Incompatibility with existing norms, prior experience, and user needs	Inaccessibility		
Problems in accessibility, usability, and compatibility with other CBISs		Problems in learning and using; uncontrollable; information not available	
Deficiencies in functionality and quality of data			Inefficiency of organization
Not really useful	Not expected to be better than prior	Not found useful	Not experienced as really useful

The library system was studied in a work-oriented research project (Jalonen et al. 1997). The project concentrated on the use of the system in real context. In total, the project group spent about nine months in the organization. Data was gathered by observations, questionnaires, and interviews. Also, documents were investigated and the system was used by researchers. A questionnaire was sent to all workers in the library and the return rate was, amazingly, 100%. Interviews were conducted with 15 workers, representing managerial and user levels. Another questionnaire addressed to library's customers was returned by 200 customers.

The library's main functions are acquisition and service. Basically, the acquisition process consists of making a proposal, ordering, controlling the delivery, cataloging, and transferring the publication to the proper collection. The service process consists of searching, making a request, obtaining, checking out, and returning a publication.

The library is now organized with a headquarters and six rather independent subunits. Previously, the subunits and the headquarters were totally independent libraries, and they did not have any CBIS in use. When changing to the current library information system, IT was the driving force for change.

After the present library system was introduced, the need for workers in service tasks increased dramatically and has to be addressed somehow. Probably, a major reorganization of activities will be carried out within a year or two. After four or five years, a new CBIS will replace the current one.

The library system is now at the refreezing stage, which is the main area of concentration in this article. However, the system was introduced fairly recently, so some knowledge of the change phase is available. Further, the planned new system, which offers a concrete example of the view of continuous change, allows us to take a look at the next unfreezing phase as well.

Using the Model in the Case Organization

We use the BIF model to analyze the library case. The model gives us a structured way to analyze the huge amount of data, which is rather unstructured. It is especially useful in our case organization since this library, as well as the entire library field, is under constant change. For example, the need for new services (electronic publications, etc.) is an extremely important issue.

The categorization seemed to work in the case company; factors belonging to each category were rather easy to identify. The responses to questionnaires and interviews, the and observations made in the library, support the distribution of factors into the phases of change shown above. Table 2 summarizes the findings from the case study. In accordance with the theoretical model, the factors are categorized and distributed to the phases of change according to their relevance for the case company.

In the next subsection, we analyze the four factor categories in more detail and the following subsection discuss the combination of the factors.

Identification of Basic Factors

Several *structural* factors were identified. The working environment in the library is quite inflexible. Organizational inertia occurs. Still, after several years, old working habits and old culture control many activities in the library. The atmosphere in the library is not the best possible, although workers are quite satisfied with their own units.

The consequence of the introduction of the library system is that some processes in the library have become partly centralized. Every group, quite naturally, wants to retain their own habits and ways of working, and this causes resistance for change—and integration. Some tasks are still performed using several different tools, manual and computerized, with repetition of tasks as a consequence. Also, old work processes are left intact; for example, loans are made with receipts in some units because there is a lack of workers on-call, and, consequently, the information in the library system is not always correct. Work processes are not well-known among temporary workers, which leads to improper performance in service tasks, e.g., loans that are not always entered into the library database. Further, in some units activities are extremely fragmented. All of this causes loss of responsibility for the data quality in the database.

In studying *managerial* issues, we have to take into account the managers of sub-units of the library, managers of the whole library, and also managers of the “community of scientific libraries in Finland.” Many decisions concerning IS-related issues are indeed made collectively for all of the scientific libraries.

Emergence of organizational defensive routines implies that managers have not succeeded in changing existing cultural assumptions. Different working habits, repetition of work tasks, and dissatisfaction with the results of other people’s work indicate a lack of shared vision of organizational tasks. A part of the job of managers would have been to create such a vision and propagate it to others. Some managers have worked for openness and for better communication and collaboration. However, due to negative prior experiences, workers feel that they do not have real possibilities to participate and they are not highly committed to future changes.

To make major improvements in the current library system is hardly possible; the vision should be a new system. A successful unfreezing process requires proper information systems strategy. There might have been a lack of strategy when choosing the current system. Also, problems in training are reported and indicate the same. When changing to the current CBIS, training was not properly timed and there has been no follow-up.

A further problem, which can be considered part of managerial responsibilities, is that customers are not able to utilize the library system well enough. They lack needed skills and customer manuals are not all satisfactory.

Users of the library system consist of the customers and the workers of the library. Our research has revealed, that among the workers, negative attitudes arise partly from innate conservatism and partly from negative prior experiences with technological change. Reorganization and changed roles make workers feel loss of their old manual tasks, working habits, and competence. They also feel that they do not have any real possibilities to participate in organizational decision making as much as they would like.

Our analysis shows that there is more arguing between worker groups in the library than is typical in other Finnish workplaces (Kolu 1992). This indicates problems in communication and collaboration between user groups. These problems appear in making agreements of work practices in shared work processes and dissatisfaction with some colleagues’ work. Difficulties are also observed in workers’ relations with managers, but not as marked as between the groups.

Table 2. Distribution of Factors to Relevant Phases of Change in Case Company

	Unfreezing	Refreezing
Structural Factors		
Resistance to change from organizational culture and values; closed atmosphere; organizational inertia	Old working habits and culture control activities; atmosphere closed between organizational units	
Inflexibility; slow reactions; complexity	Several different working habits	
Managerial Factors		
Inadequate emotional strength and depth of vision; problems in sharing mental models and abilities to learn	Old cultural assumptions not changed	
Constant training and development of skills; improper information systems strategy		Timing not correct; more training needed; no follow-up
Deficiencies in information management skills; improper information systems strategy	Negative prior experiences require proper IS strategy	Current CBIS not well chosen; problems in training; customers' usage inefficient
Management's commitment insufficient; difficulties in achieving other peoples commitment; inadequate communication and collaboration; deficiencies in general management skills	Workers not committed to change; problems in communication between managers and workers; lack of shared vision	Inefficient implementation of cooperative processes

Table 2. Distribution of Factors to Relevant Phases of Change in Case Company (continued)

	Unfreezing	Refreezing
User Factors		
Negative prior experiences; innate conservatism; lack of felt need; fears; attitudes and prejudices	Suspiciousness to new CBIS; no real possibilities to affect	
Reality does not meet needs and expectations		CBIS not satisfactory
Inadequate communication and collaboration	Arguing between worker groups	No agreement of work practices in shared work processes; job dissatisfaction
Technical Factors		
Problems in accessibility, usability, and compatibility with other CBISs		Interface ambiguous and complex; CBISs not well integrated
Deficiencies in functionality and quality of data		Functions improper or nonexistent; presentation of information obscure and timeliness not adequate
Not really useful	Lack of trust to current vendor	Tasks performed manually

Partly *technical* factors are obvious, visible, and easy to identify. Quality of the system is clearly low. Hardware is inefficient, which causes inflexible and repetitive opening and closing of windows. Also, interruptions in communication networks too often force workers to wait or interrupt their current tasks. Operation of software is not reliable and consistent. Problems appear in checking in loans, e.g., loan refusals disappear when returning any book, whether the book was the reason for refusal or not. Deficiencies in the software are found, e.g., all functions are not proper for the national needs, parts of the system do not work at all, and some functions just are not available. Internal logic of the system is inadequate for performing some ordinary library tasks with the consequence that some information has to be entered more than once. Accessibility and usability of the system are not adequate. The user interface is ambiguous and complex.

Quality of data is not high either. Presentation of the information is hard to understand. Searches are difficult to perform due to the indexing system. Timeliness of information suffers from improper integration of the acquisition system and the library system. The consequence of the aforementioned problems is that users do not always regard the library system useful for performing their tasks.

Combined Barriers

In our case organization, aspects related to *systems thinking* have not been taken into account adequately. Tasks are instead “designed” and performed as being rather isolated. The consequence is overlapping tasks, job dissatisfaction, and lack of information. Such problems indicate that a holistic view was not taken when designing the library’s processes (Jalonen, Kirveennummi and Torvinen 1998). Acquisition and service processes have not been considered as having system characteristics, neither separately nor together, where every task affects several others, but seen as consisting of rather independent tasks.

The technical part is only one aspect, and it might have been difficult to influence the choice very much because the system was jointly selected by the community of the scientific libraries. However, all the other aspects—user, managerial, and organizational factors—are within the decision limits of the library itself.

It is sometimes difficult to define the *interrelationships* between technology and structure. In our case, it was quite easy. The CBIS was the reason for change and structural changes were the consequence. However, changes were purely formal, while non-formal issues were not taken into account. Therefore, the organization actually was not completely ready for change when it occurred.

Relationships between the factors are unbalanced and static. As mentioned, the library system was the cause for change but the other aspects, the work processes, did not change accordingly. User-oriented issues which enable the ultimate performance of changed work processes were ignored. Users were not committed to change and reacted with resistance. In many cases, old work processes are still in use, despite the new formal organization structure. This indicates that these relationships among others are static and not in balance.

Now, when the library is getting ready for moving workers to service tasks to address the need of new services, structural changes are planned but future technological changes are still not decided upon.

One of the reasons for problems in using the library system efficiently is the *timing* of training arranged years ago. According to users, training was given all too early. Thus, the users were actually ahead of the technology implementation and had time to forget what they learned. Wrong timing combined with lack of constant training now hinders the refreezing. Further, the organization is now preparing for unfreezing while the users have not yet learned the old system.

Some problems with timing also may exist between managerial and user related factors. Managers are trying to unfreeze the organization for the next change, but as discussed above resistance exists in the organization. It is critical for the success of change that managers are able to “pull the users to the same train” with themselves. Therefore, this case company should pay special attention to timing of factors for a successful change process the next time.

Discussion and Conclusions

Analysis of the library system using the BIF model revealed many barriers to IS-related change. Yet, it is worth noticing that the library system actually has improved cooperation of the community of scientific libraries, cooperation of subunits of the library, and library services generally very much. We, however, were searching for possible barriers to IS-related change, and found plenty of them.

A large amount of factors could probably have been identified with the help of the BIF model and possibly avoided or handled before implementation. Problems were found in every barrier category. Especially systems thinking related aspects in the combination of factors seemed to be missing. Lack of systems thinking caused problems both for workers and customers in the form of overlapping tasks, job dissatisfaction, and lack of information.

It seems that factors which originate in unfreezing have an effect during the whole cycle of change. These factors are often structural, user, or managerial barriers. Later phases bring along more factors in these categories, and technical factors also raise their head.

Barriers which exist at the refreezing phase of the library system were identified. For example, adjustments in organizational policies, reorganization of work processes, and training could improve the situation in the library. However, technical problems may be quite hard to overcome without a new system. Now, when the library is preparing for unfreezing, it could use the model to identify barriers and avoid or diminish the consequences of the factors which originate from emotional issues. Better motivation for change is essential, but other structural aspects, such as inflexibility or functional specialization, should be handled as well. Managers should try to enhance their own skills in planning both IS-related and other aspects of change, and with their own excitement try get users involved.

The BIF model helps to identify the factors which can cause barriers to change and discover the importance of the combination of factors. However, factors may be quite hard to relate to Lewin's steps of change. Some factors are obviously related to a specific

phase, but many factors seem to have an effect in several phases. Furthermore, the phases of change often seem to overlap each other. This makes the use of the model more difficult. However, factors in unfreezing often have effects in later phases. Thus, if a factor can be identified and handled when preparing for change, it is less likely to hinder change later.

In this paper, we developed a conceptual framework, BIF, and used the BIF model in analyzing a library case. The model enables considering possible barriers to change from different organizational perspectives at a desired phase of change. Using the model makes it possible to analyze existing systems and to find typical problems of the company in concern; and thus to prepare the organization for a change project. Therefore, the model enhances systems development. The BIF model can be used, to map risks at any step of the change project whether the project is IS-related or not. Lewin (1952) provides arguments for the usefulness of such models as BIF when stating that it is better to diminish opposite forces in change than to add forces in the desired direction.

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