

# THE ROLE OF TECHNOLOGICAL FRAMES OF STAKEHOLDERS' IN IS DEVELOPMENT: A Case Study from Ethiopia

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**Abstract.** This study explores the technological frames of key stakeholder groups around the development of open source integrated library system at Addis Ababa University Library System and how it shaped both the process and the implementation's outcome. The result reveals that middle managers and users perceived OSS from the perspective of expertise requirement for customization, configuration and future enhancements, and the availability of full functions and relied more on proprietary software because of their knowledge and experience. The top management and technologists relied on OSS as a viable solution both for their library and the nation and gave priority to core functions. Perception differences at initiation stage continued through the deployment process and deteriorated the relationship between the two groups and affected the outcome.

## 1 INTRODUCTION

Technological change in organizations is often accompanied by a redefinition of organization routines, culture, structure, skill, knowledge, etc (Boudreau and

Robey 1999; Orlikowski 1996; Robey and Boudreau 1999; Tsoukas and Chia 2002; Weick and Quinn 1999). Organization members should also change their understanding if their action is to change substantively (Lin and Silva 2005). The technological frame of reference (TFR) held by key groups that can be constituted from the social, political, organizational, cultural, historical, educational, technological, etc factors either hamper or promote the development and use of ISs in organizations (Orlikowski and Gash 1994).

If key groups in organizations have similar TFR, the design, development and use of ISs in organizations can be smoothed and challenged otherwise (Orlikowski and Gash, 1994). Hence, understanding how organization members make sense of ITs and how their interpretation influence their action related to IT is crucial to the development and use of technology. Such an understanding helps to improve both the theory and practice of IS design, development and use in organizations (Davidson 2006).

However, merely noting that different groups think differently about technologies and that differences can cause problems is not enough (Davidson and Pai 2004). Moreover, the assumption that incongruence is necessarily detrimental has not been critically examined (Davidson and Pai 2004). In line with these calls, this case study explores the technological frames of key stakeholder groups around the development and use of open source integrated library system (OSILS) at Addis Ababa University Library System (AAULS). The study investigates how the key stakeholder groups' knowledge, assumptions, and expectations of the IS and its development process in the library system has shaped the development process and its outcome.

Computerization of the Library system has began in 1988 and tried all modes of acquisition from an off-the-shelf package purchase through in-house development to customization of OSS. The last attempt was to customize OSS. OSS, as technology, has been supported by many as a viable means to bridge the digital divide and bring developing countries to the possibility of developers as opposed

to consumers. OSS has its own characteristics and value which can shape the interpretations of key stakeholder groups' differently than proprietary software systems. Some organizations can consider the reputability of vendors as a factor for the success or failure of implementation projects. There is a tendency to give less value to OSS because of its availability of free of charge.

Furthermore, the public sector in developing countries is particularly known for lack of resources and other complexities, which is the case in this study. Considering the implementation context and the open source nature of the software, the study tries to seek answer to the following research questions: How and why the technology is understood and acted on by the key groups? What is the role of the openness of the software in shaping the sense making? How these interpretations shaped the development and use of the OSILS and the planned organization change? How these interpretations are shaped? What are the unanticipated outcomes? It also examines the extent to which the frame incongruence influences the implementation and use of the information system and whether such frame incongruence has a detrimental effect on IS development and use.

The remaining part of this research report is organized as follows. The next section discusses the concept "technological frame" as originally put forward by Orlikowski and Gash (1994), its subsequent applications in the IS domain, and why and how this analytical lens is applied in this research. Section three presents the research methods followed by presentation of the case. The analysis and discussion are presented in section five and, finally, concluding remarks are presented in section six.

## **2 THEORETICAL FRAMEWORK**

This case study draws upon the notion of a socio-cognitive analytical lens called technological frames of reference as put forward by Orlikowski and Gash (1992,

1994) for examining how stakeholders' interpretations influence their actions related to IT development and use in organizations. This section elaborates on what technological frame is as it is originally explained by (Orlikowski and Gash 1994) and its root; how it has been applied in IS research; and why and how it is applied in this research.

Researchers have for sometime been interested in how individuals cognitively process information and how their information processing affects behavior, decision, and performance. There is an assertion that people act on the basis of their interpretation of the world (Lin and Silva 2005; Orlikowski and Gash 1994). Underlying this interest is the premise that reality is socially constructed through human beings interpretations of experience and action and their social negotiation (Davidson 2002; Orlikowski and Baroudi 2002; Walsham 1993).

Assumptions, knowledge, and expectations of individuals or groups that can be expressed symbolically through language, visual images, metaphors, and stories are called frames (Orlikowski and Gash 1994). Frames are flexible in structure and content, typically operate in the background, shape individuals' interpretations of organizational phenomena and implicitly guide them to make sense of and take action in organization accordingly (Davidson 2006; Davidson 1997; Davidson 2002; Lin and Silva 2005; Orlikowski and Gash 1994). The frames of reference held by individuals can be instilled into others through a variety of mechanisms including trainings, membership in groups or departments, working closely with others, and through over time social interaction and negotiation (Orlikowski and Gash 1994).

Nowadays, IT constitutes the core of organizations (Doherty and King 2005), and its adoption and use have been influenced by the frames of reference held by organizational members (Markus 1983; Orlikowski and Gash 1994). Some researchers (Markus 1983; Orlikowski and Gash 1994) attribute the social problems related to implementation of ISs to the frames of reference held by

stakeholders in the system development, deployment and use environment. Therefore, Orlikowski and Gash (1994) argue that

understanding peoples' interpretation of technology is critical to understanding their interaction with it. To interact with technology, people have to make sense of it; and in this sense-making process, they develop particular assumptions, expectations, and knowledge of that technology, which then serve to shape subsequent actions toward it. While these interpretations become taken-for-granted and are rarely brought to the surface and reflected on, they nevertheless remain significant in influencing how actors in organizations think about and act toward technology. (p. 175)

The examination of these taken-for-granted notions will help gain much insight into how technologies are developed, used, and changed in organizations. As a vehicle for examining the interpretations people develop around technology, Orlikowski and Gash (1994) outlined the core tenets of an analytical approach centered on the concept of technological frames (TF). The approach draws concepts from social cognitive research, sociological literature and social construction of technology.

Orlikowski and Gash (1994) define TF as

.... that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of the technology itself, but the specific conditions, applications, and consequences of that technology in particular contexts. (p. 178)

According to the approach, technology is a social artifact (Bijker 1995; Hanseth and Monteiro 1997; Monteiro 2000; Orlikowski 1992; Pinch and Bijker 1984) the design and use of which is influenced by the knowledge, expectation and assumptions of individuals about the purpose, context, importance, and role of the technology. The material form and function of technologies embody their sponsors' and developers' objectives, values, interests, and knowledge of that technology (Orlikowski and Gash 1994). The choice made by sponsors' and developers' determines, for example, the process of work, the division of labor, autonomy of employees, and the decentralization or centralization of units and decisions. How different stakeholder groups make sense of these choices embedded in technologies and shape their actions?

Time plays an important role in shaping the individuals' interpretations of technology and its role in organizations. Early interpretations can have the chance to be assimilated into the work practice and built into organizational routines which can be difficult to change them later on (Tyre and Orlikowski 1994).

A variety of social groups, whose actions significantly influence the process and outcome of technological change, take part in the social world of computing (Kling and Gerson 1987) cited in (Orlikowski and Gash 1994). In this social world, managers, system developers, and users are default actors. By virtue of individuals' membership to particular groups and the different roles and relationships they have with technology, they tend to share the group's technological frame (Orlikowski and Gash 1994). A group's interpretation of technology which is based on interaction is shaped and constrained by a group's purpose, context, power, knowledge base, and the artifact itself and such group frames are unlikely to be shared across the different stakeholder groups.

The social construction of technology (SCOT) identifies groups which share the same set of meaning attached to a specific artifact as relevant social group (Klein and Kleinman 2002). According to SCOT, in order to identify relevant social groups the researcher is supposed to initially interview actors, have a preliminary list of relevant groups, and keeps on identifying the rest until all relevant groups are identified. This approach which is also called the snowball method is criticized for lack of completeness which can in turn leads to distortion of information. For example, Klein and Kleinman (2002) argue that Pinch and Bijker explanation about the development of bicycles exhibited inclusion of several social groups over time. Their initial explanation centers on the contrasting visions of two groups of potential bicycle consumers. However, the recent analysis gives attention to manufacturers, parliament, advertising and gender mores. Exclusion of some relevant social groups from participation and their absence which might be significant can go unnoticed, further to lack of reason for exclusion (Klein and Kleinman 2002).

The technological frame adopted by Orlikowski and Gash (1994) does not identify groups in terms of the frames of individuals concerning technology in general; rather it is centered on the role and relationships of individuals with technology. A group of members can use a technology, manage it, or be responsible for the adoption/adaptation and hence, user, manager, and technologist groups. The approach assumes individuals in their respective groups to share a similar interpretation of technology primarily due to their interaction with the technology.

Technological frame congruence (Orlikowski and Gash 1994) across groups, which is the “alignment of frames on key elements or categories” (p.180), for example, on expectations around the role of technology in business processes, the nature of technological use, or the type and frequency of support and maintenance, facilitates the development, implementation and use of technology in organization. While incongruence, implying “important differences in expectations, assumptions, or knowledge about some key aspects of technology” (p.180), organizations are likely to experience difficulties and conflicts around the development, implementation, and use of technologies.

The research by Orlikowski and Gash (1994) into the frames of reference held by designers, users, and managers about the Notes technology and how it has shaped the outcome in a large, distributed organization derived three frame domains such as the nature of technology, technology strategy, and technology in use from the empirical data. The nature of technology refers to people’s images of the technology and their understanding of its capabilities and functionality. Technology strategy refers to people’s view of why their organization acquired and implemented the technology. It includes their understanding of the motivation or vision behind the adoption decision and its likely value to the organization. Technology in use refers to people’s understanding of how the technology will be used on a day-to-day basis and the likely or actual conditions and consequences associated with such use.

Their study indicates the existence of frame incongruence between technologists and users in all the three domains having negative implication on future use and change of Notes even if the implementation is completed at the time of the study. Since this work, the approach has been widely used by several researchers both within and out of the IS community (Davidson 2006; Davidson and Pai 2004; Puri 2006) (for a comprehensive literature review, see Davidson and Pai 2004 and Davidson 2006).

In the IS domain, the technological frames of reference has been applied by different researchers in various frame categories and with a variety of content in different technology and organizational settings (Davidson 2006). The review of TFR studies by Davidson (2006) identifies its application in five generic frame categories – such as frames related to the attributes/features of IT, potential organizational applications of IT, incorporating IT into work practices, and developing IT applications in organizations. There are also frame contents which do not fall in either of these categories.

In this research the technological frame was used as an analytical lens to understand the knowledge, assumptions and expectations of the key groups in the library system and its effect on the implementation process.

### **3 RESEARCH METHODS**

The research employed an interpretative case study (Walsham 1993; Walsham 2002) qualitative research approach (Creswell 2003; Eisenhardt 1989; Klein and Myers 1999; Silverman 1998; Silverman 2005; Yin 2003) to collect and analyze data. Detailed data collection was conducted through semi-structured interviews, review of materials (including minutes, reports and memos), and observations at the research site. The researcher was member of the Library for about eight years and was closely following the automation project. He served as project manager from August 2000 to October 2004, which helped him know more about

background of the project. Furthermore, he run the system both at the staff and end users desks.

The field work for this research was carried out at two different periods - from February to April 2007 and from November to February 2008. During this time the researcher conducted 26 interviews, their duration varying from 1 to 2 hours. Most of the interviews (fifteen of them) were tape recorded, and a detailed note was taken for the rest of the interviews.

The Library has two categories of staff – academic and nonacademic. The academic staff is responsible for professional activities while the nonacademic is responsible for daily routine activities and constitutes the largest number of manpower in the Library System. The professional staff plays major role concerning decisions that involve change and take part in such initiatives.

Before conducting the interview, the researcher identified the key stakeholder groups in the development process. The preliminary investigation identified the library's management including the deputy librarians, department and branch heads, the project team, cataloguers, and staff of the circulation department to be the sole actors. Historically the project was associated to ICTDO (ICT Development Office) of the University which was responsible for overall ICT related activities at the University level. The role of the ICTDO was almost negligible after the library took ownership of the project, and, hence, ICTDO was excluded from further investigation.

More than 98% of the professional staff has studied computer science as a minor field of study and about 40% of them have M.Sc. in Information Science from the same university. More than 90% of the interviewees have served the Library for more than 18 years. The following table shows those that are interviewed by the researcher.

**Table I: Distribution of respondents across the project teams**

Project Teams	Managers		Technologists		Users		Total
	AS <sup>1</sup>	NAS	AS	NAS	AS	NAS	
Project Management	1						1
Deployment	1		2				3
Training	3				1		4
Recon	4	1			3	8	16
Non team members	1		1				2
Total	11		3		12		26

The interview was guided by initial questions drawn upon the seven core dimensions of technological frames (Orlikowski and Gash 1992) which then followed by questions arising from the interaction. Phenomenological hermeneutics mode of analysis was used to analyze the collected data (Boland 2002; Eisenhardt 1989). The data was read iteratively until the researcher came up with meaningful categories.

## **4 CASE PRESENTATION**

This research was carried out at Addis Ababa University Library System (AAULS) where an OSILS (open source integrated library system) called Koha has been in development since 2004. The public academic Library, which is composed of more than 19 libraries<sup>2</sup>, is the major public information resource center in the country, particularly, for research and academic purposes. It serves AAU, the oldest and the largest higher learning institution in Ethiopia and other external individuals and organization users.

In the Library system, the technical activities such as acquisition of library materials and cataloging, and the management are done centrally at the main

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<sup>1</sup> AS stands for academic staff while NAS stands for non academic staff.

<sup>2</sup> Originally the library had 7 branches and one main library. But through time, some public colleges and institutes which were operating separately started to be annexed to AAU. The annexation followed by annexing the libraries with AAU Library system. As of today 10 other such libraries are annexed to AAU Library system.

library called John F. Kennedy memorial library. The Librarian is responsible for overall operation of the library system with the help of two Assistant Librarians each responsible for technical and public services. The technical services include acquisition and cataloging while the public services include circulation, reference, departments and branch libraries.

The University, particularly the Library system has exerted efforts computerize the Library system with the aim of improving end user services and alleviate some of the drawbacks of the manual system by automating tasks and helping to easily produce accurate and timely information in the required format. The initiatives led to the establishment of a computer center in 1988 at the main library with the sole responsibility of carrying out activities related to the use of IT. After going through several modes of acquisition overtime – purchasing off-the-shelf package, in-house development and adaptation of OSS - , the library finally decided to customize OSILS called Koha in 2004.

For the purpose of this paper, the project's lifetime was divided into three phases – phase one from 1988 to May 2002, phase two from June 2002 to September 2004, and phase three from October 2004 to February 2008 and onwards. The main concern of this research is on the last phase of the process, the implementation of Koha. However, it is important to highlight the root of the last attempt (Klein and Myers 1999) which might have shaped the knowledge, assumptions and expectations of the key groups in the Library system.

### **Phase 1: Pre-2002**

The AAU Library system was step-by-step introducing computer-based services such as literature search, Internet, card catalog production using computers, and developed in-house databases, trained the staff and conducted studies as to how to automate the library system and justified purchasing off-the-shelf package to be the viable way of acquisition. It has also documented the functioning of the

manual system and requirements for the new system and approached various funding sources even if it failed.

### **Phase 2: The Floating Decision (June 2002 to September 2004)**

The step by step realization of computerizing the library system has got great momentum when the University started a campus-wide computer network called AAUNet. During this time the mode of acquisition was switched from off-the-shelf package purchase to in-house development in June 2002. The decision was accompanied by the possibility of employing qualified developers both within and outside of the University in addition to those in the Library.

Change of the university administration that was supporting the process in January 2003 simultaneously changed the mode of acquisition from in-house development to purchasing off-the-shelf package. This created an opportunity for one of the local companies who had provided software to the University to approach the new university administration. The idea was to collaboratively do a gap analysis between what is offered by their software and what the library requires and implement accordingly. The process did not go further as it violates the finance law of the country. The bad relationship between the ICT director and the University's president worsened the situation, and the decision was not fairly accepted by the University administration.

While preparation for purchase was going on, another group of people came with software initially developed to catalogue museum materials. The close relationship of one of the group members with the University administration facilitated the process to go in but finally failed.

The last attempt was a planned international collaboration between one University in the USA (a professor and his students), an NGO (co-established by the professor) and the AAU Library and ICTDO of AAU. The ICTDO has come into being in January 2003 with the primary responsibility of carrying out computer

networking and administration, conducting research and running ICT projects in collaboration with faculties and institutes of the University, among others.

The plan of this international collaboration was to customize open source integrated library system (OSILS) called OpenBiblio. The project discontinued without bearing the desired result however, indicated the possibility of customizing OSS.

### **Phase 3: Implementation of Koha (Oct. 2004 to Feb. 2008 [and onwards])**

This last phase of the automation process is the concern of this research. Based on previous experiences, the library initiated this project primarily to search for and pick the best OSILS and examine the viability of customization. A project team composed of people from the Library, the Department of Information Science and the ICTDO was organized to discover OSILS, compare them from technical and functional perspectives, and recommend the best solution. The team identified OpenBiblio and Koha, and suggested Koha for further consideration.

Following the recommendation, the team identified the gap between Koha and requirements of the AAULS in terms of functions and technicalities, and submitted visual models for missing functions. Next, the Library in collaboration with ICTDO decided to customize and pilot Koha. As a joint project, the library took the responsibility of populating the database and evaluating functions of the system in real-time, while ICTDO was responsible for financial and technical supports. The plan was to make the Library's catalog available online to users by October 2005.

After the pilot phase, the partnership of ICTDO was dropped and full-fledged implementation continued under the responsibility of the Library system. To proceed with the implementation, deployment, retrospective conversion (Recon), and training teams were established and a project manager was appointed from the Library. The deployment team was responsible for customization and configuration of Koha, the Recon team converts the paper-based card catalog into

electronic format (populates the database with bibliographic data), and the training team was responsible for training staff and end users.

All materials acquired through purchase, gift, and exchange for all of the branches/departments of the library system have been cataloged by the cataloging department. The bibliographic details of books and serials acquired since the establishment of the Library in 1950 need to be entered into the system with the exception of weeded out materials. There were about 500,000 volumes of monographs and about 20,000 bound and unbound journals which potentially needed to be converted into electronic format (Addis Ababa University Library System 2005). Based on the magnitude of the task and the time pressure, in addition to mobilizing the professional staff, the project hired data entry personnel to run the conversion 24/7 for three months.

Finally, the system went operational on AAUNet – cataloging staff have been entering bibliographic details of materials, and end users have been searching for and locating items using various search mechanisms. The circulation function was under implementation and additional features were planned to be incorporated. How and why the technological frames of key stakeholder groups shaped the development process and its outcome? How previous attempts shaped the technological frames of key stakeholder groups? What implication this has to the theory and practice of IS? The following section presents the analysis.

## **5 ANALYSIS AND DISCUSSION**

After the data collection, the researcher carefully analyzed the recorded interviews and field notes one after the other, and sorted out core points where the interviewees give much focus concerning the development of Koha. Issues around initiation of the project, customization and features of the software, the retrospective conversion process, and the relationship among key stakeholder groups – management, technologists and users – have gained much emphasis

among others. For the sake of this discussion, these issues are summarized into three frame domains such as – choice of OSS, features of the technology, and the process of retrospective conversion (work transformation) and they are elaborated below along with the views of key stakeholder groups.

The library's management is composed of the University Librarian, Deputy Librarian and branch and department heads who were involved in decision making processes both at branch/department and overall library system levels. A close analysis of the collected data reveals that members of the management excluding the deputy librarian, who was also manager of the project, and the University Librarian, have similar perceptions concerning the newly introduced technology. The analysis also shows that the central management and technologists, on the one hand, and middle level managers (departments and branch heads) and users on the other hand, have similar technological frames with slight differences. The next section discusses the technological frames of these groups based on the above stated three frame domains.

## **5.1 TECHNOLOGY CHOICE**

Technology choice refers to the key stakeholder groups' knowledge, meaning, expectations, and assumptions about the selection, piloting, and subsequent implementation of OSS in the library system.

### **5.1.1 Technological Frames of Middle Managers and Users**

The actions of middle managers were influenced by an assumed expertise requirement to customize OSS and their knowledge of previous automation attempts. Almost all of the middle managers were direct participants of previous attempts that did not achieve the desired objectives. Besides lack of experienced personnel in the required number, previous experiences reveal that staff can leave a project and the University at any time despite a project's schedule. Therefore,

this group presumes in-house development of OSS to be repeating the previous failure scenario in a different fashion.

Shaped by the above knowledge, expectation and assumptions, the middle managers were against the development of Koha in the Library system. Besides, the managers raise the following points.

You can not trust untested system than the tested and proved ones. This is not something that you can go and pick up from the market without detailed knowledge of the system's practical operations. .... The amount of money allocated for customization was sufficient to buy a third generation, well tested and operational integrated library system.

We do not have the technical capability needed to configure the system let alone customize, upgrade and maintain it in the future. Moreover, it is customary for the vendor to conduct the retrospective conversion, which is an additional advantage. We have got similar opinion from our friends abroad.

In our previous attempts we even contacted users of the chosen system to verify its suitability to an academic library and learn more about the strengths and weaknesses of the system.

This group assumes software system to be piloted before it is implemented fully. Even if there was room for it in the project plan, according to this group, the pilot phase was nominal which did not show any result. They assume it to be the manifestation of the previous poor decision that failed to take into account the expertise of members involved in the deployment. Some of the managers state the following.

It was kept quiet in order to cover up the mistakes of the decision adopted to customize OSS. Had had reported, we would have learned a lot from our experiences. Rather, what we noticed was forcing the implementation to proceed.

We have noticed two scenarios during the pilot phase. It showed the project management knowledge and experiences of the project managers and the need to protect the decision adopted to customize OSS.

The position held by this group was also partly motivated by the decision-making culture of the library. Most decisions concerning the library system were made in meetings after an open deliberation. This group expected the same regarding decisions pertaining to Koha. But it did not happen. The situation aggravated when the project manager was promoted to a deputy librarian position. Managers reflect the following:

We have raised the issue of Koha in a meeting. We deliberated on it in detail. The project manager was not able to convince the rest members even with the support of the Librarian. He went out of the meeting. What we discussed was also erased from the minutes.

Through other means the project manager and the University Librarian are close to the University administration. That is why ... unexperienced, junior staff, unqualified by training and still a student was promoted to the deputy librarian position while senior, better-trained, and experienced staff was readily available.

Generally, this group which is composed of people with better knowledge and experience in Library and Information Science, has interpreted OSS in terms of expertise requirement for customization and configuration, and lack of information on the practical operation of an OSS. They insisted on piloting the new system based on their knowledge of system implementation and unreliability of software systems. Besides, shaped by previous attempts, this group expects a third party to handle the process of customization and configuration. The experience of this group on collective decision making has affected the implementation of Koha as it was not up to their experiences and expectations. As a result, the participation of this group in the overall implementation process was low and the relationship with the top management and the project manager was also deteriorated.

### **5.1.2 Technological Frames of Top Management and Technologists**

According to this group, Koha has the basic functions that any library system can have such as Cataloging, WebOPAC and Circulation and proceeding with implementation was worthwhile. Taking the previous attempts into consideration, customization of OSS locally was novice. Some of the group members state the following:

The idea of OSS customization locally was not considered previously. Using the opportunity we can develop local capacity which serves not only AAU but also the nation at a nominal cost. ... we also have the chance to introduce features peculiar to Ethiopia such as the Amharic script, indexing and searching local materials etc. .... We are on the verge of establishing Koha community in Ethiopia.

Our review of the literature indicates that most libraries implementating proprietary systems were migrating to OSS. These libraries diverted the license fee they used to pay to further enhance Koha.

The top management and technologists, assume that the only viable way to automate the library system was through OSS. As a result, the group continued selling the idea to the University administration. Upon accepting the idea and winning the support of the University administration, the group agreed to pilot the system. The pilot phase was challenging, as stated by some of the group members.

The pilot team did not discharge its responsibilities as expected because of the fact that the team was composed of people who were opposing the implementation of Koha. Those team members who recommended the purchase of off-the-shelf package than customizing Koha manifested their discontent differently at different times. This time the manifestation was not to deliver the expected product.

The pilot phase was crucial for us to learn a lot about the implementation process altogether. We came to understand our mistakes and strengths, and the strength and weakness of the software and the team members. For example, we made unnecessary downloads taking a very long time which had profound effect on disk space and database management system. Scalability, performance, and functional bugs were identified during this time. .... The pilot phase was rather educational.

When the pilot phase was complete, the system was demonstrated to the library staff, some end users and was linked with the library's web page. The project consumed only 25% of the allocated money which was considered to be a success – achieving goal with as much less money as possible.

The decision not to have documentation and discussion on the result of the pilot phase was associated to their understanding of just convincing the central University administration, who is responsible for allocating resources was sufficient. According to this group instead of wasting time on documentation and reporting, the time was essential to proceed with the full scale implementation. The group members state the following concerning the lesson learnt and the action taken as a result.

Despite, the training given to the ICTDO staff and all other benefits, they considered the project work as extra and rather than offering service they would like to dictate....

Secondly, the university administration was not happy with the performance of the ICTDO and considers the office to be service center rather than source of fund and/or project partner.

It was not possible to avoid the participation of those who were against the implementation of Koha in the process for various reasons but there was a need to place them where their role was less likely to affect the implementation process and its outcome.

During this time, the money allocated for the purpose must be consumed within two months, starting from November 1 to December 31, 2005. This again has

divided the library staff in to two groups, one supporting the idea of going ahead with taking the money and doing whatever was possible and the other group that was against it. Members of this group state the following concerning this issue

.... Yes, we were given only two months to finish the implementation and consume the money. Of course, the two months period was not sufficient to finish the task at hand. However, I know that there was a grace period which was one year. So, taking the money and the associated responsibility was right...

Those who were against the idea had core positions including the assistant librarian, computer center head and department head positions. The solution, according to the manager, was to place them in a team where their likely influence in the implementation process and its outcome was relatively low. The project manager states the following concerning the overall implementation:

The project proved the indispensability of no one. Those who believe were indispensable in the activities of the library, are no more thinking of that any more. The image of the library was improved as a result of the project; the University management was convinced that the Library has the capability to run projects that worth huge amount of money.

We had decision-making related problems due to power of the project manager who is also deputy librarian. The project manager takes care of the day to day operation of the project and reports to himself and takes corrective measures by himself. The situation has created inconvenience.

The perception of this group centered around the (none) existence of core library functions in Koha with a view to include additional features and functions in the future, the possibility of bypassing financial limitation through OSS customization and long term capacity development. As a result, the action of this group targeted at winning the support of the source of fund – the University administration – and quickly deploying the system. Hence, it gave less emphasis to documentation and reporting and convincing middle managers partly due to the position held by the project manager in the Library system. The collective decision making culture was also challenged. Those who opposed the idea were regarded to be threats to the implementation and denied active participation.

## **5.2 FEATURE OF TECHNOLOGY**

Technology feature includes knowledge, expectations, and assumptions that individuals have about the capability of the chosen software, level of customization, involvement in the customization, satisfaction, and technical and maintenance supports.

### **5.2.1 Technological Frames of Middle Managers and Users**

Features of technology including the functions and technical aspects play an important role to make-sense of the technology and interact with it. The features and functions of Koha were interpreted in terms of the knowledge and experiences of the technical people, the response for bugs and its timing, and participation in customization.

This group expected Koha to accommodate all the functions of the manual cataloging activities and to have an easy navigation tools. According to this group

The technology does not facilitate collaboration which is desirable in our activities. The Library does not buy equal number of books for all faculties and each of us is cataloging the books for one faculty. If I finish my work, I am not able to support my colleague using the system.

So far, we have been doing both the manual and electronic activities side by side. We were forced to use our old system for the sake of producing card catalogs. We also produce accession lists each month and the new system was not helping us in this respect. Our continued requests for inclusion of features that were important to our activities and solutions for errors identified during operation did not get favourable answers.

Along with this, the group raises training and participation issues as follows.

No one has consulted us regarding the feature of the new technology. We were not consulted what to be included and what not. ... we were not well trained to comprehend the features of the system and to run it as we expected..... However, we learned much through prolonged interaction with the system which made the process difficult.

In addition, based on the experiences of the group concerning error reporting and solution provision, they state the following.

... we were individually approaching the deployment team members for solutions when we encounter problems. .... Due, in part, to the negative reaction that we were getting from some of the team members and the delayed solution, if solved at all, we abandoned reporting problems directly to them but through our coordinator.

I used to report problems but when my requests backfire on me, I stopped reporting. I some time tell to my boss but mostly I kept quiet. ... The error reporting process destroyed the smooth relationship between us and those who are responsible for debugging.

I think the technical people did not have the required knowledge and skill to give favourable response to our requests. We have learned that the same system has been working smoothly in other libraries. ... If there is any need for help, our library should do it. Still there are unresolved problems concerning managing serial publications.... we even made a meeting concerning the implementation process in general. What we reflected on was to continue working with the technology despite its drawbacks. Because, ultimately our expectation was to have a modern library.

As stated, the group presumes that the technology lacks the required features, and their continued demand for a solution did not bear fruits rather damaged their relationship with technologists. This group had information about the smooth running of the same system in another library. As a result they started questioning the knowledge and skill of the technologists and stopped reacting to problems but continue using the system. The reasons included their assumption of not getting solutions and not to further deteriorate the already damaged relationships. They perceive that due to lack of participation some of their requirements are not met and the system is not up to their expectations. What is interesting, however, is that all of them are eager to modernize the library despite the challenges.

### **5.2.2 Technological Frames of Top Management and Technologists**

Guided by the standardized nature of the work of libraries, the assumptions behind the development of Koha, and review of the literature, this group justified the sufficiency of Koha. Some of the group members state the following:

Most functions of libraries are standard and similar and Koha was developed on this basis.

Most of the required functionalities and bugs were already solved. Of course, there are still unresolved problems. But, in general, lack of proper training to the users made them feel uncomfortable to run it. We the developers even did not get proper training. Some times what they report as a problem or as missing was not a problem or was already available.

There are also bugs that are discovered lately. When we are working with Circulation module we have found operational errors on the Cataloging module. We are now building the capacity of our staff to serve not only the University but also the country.

The technologists did not include all of the required functions as the plan was incremental. According to this group some of the functions that are required at the moment such as producing card catalogs will become obsolete after a short period of time so there was no need for including them.

The technologists' assumption to incrementally develop the system through time led them to concentrate only on core functions. Despite the current importance, they failed to incorporate some functions because they no more are required for fully automated system. Due to lack of prior knowledge of the technologies of Koha and due to insufficient training, and the need to develop capacity through time, this group admits the existence of some technical problems on the system.

### **5.3 WORKING WITH TECHNOLOGY**

Transforming the card catalog into electronic format was one of the major tasks of the computerization besides deploying the system. Regardless of previous studies that point out various ways of conversion, the project adopted manually populating the database based on the shelf list information. The frame domain, working with technology, refers to the perceptions of key stakeholder groups concerning the process of transformation of manual work into its electronic version, i.e., the process and issues around populating the database system.

#### **5.3.1 Technological Frames of Middle Managers and Users**

According to this group, transforming the manual card catalog into electronic version lacked the necessary preparation in terms of training, technical expertise, benefit package, preparation and smooth working relationship with the other group – technologists and the top management.

The training was not sufficient to make them able to operate the system and the data entry personnel hired for the purpose did not have the required skill and

qualification to do cataloging on top of lack of knowledge of the new system. The group members reflect:

It was just like a blind leading the blind when it comes to operating the system and assisting the data entry personnel. Of course, we successfully supervised them regarding the work but, it was difficult to answer even simple technical question. This was because of lack of operational knowledge of the system.

The two days training program for the data entry personnel was not sufficient. All of them were students and due to class commitments no single individual attended all of the training sessions. .... We had to tell everything about the task they are supposed to do.

These people were there just to get money. They didn't bother about work and its future consequences. ... They were in a difficult situation to understand fields properly. Furthermore, they did not have the interest to discharge their responsibilities; they were there just to be paid.

According to this group, no pre-conversion preparation was done as to what should be entered into the system. The shelf list does not reflect the actual collection of the library. More than 10 years were elapsed since the last inventory, as a result the library does not exactly know the size of its collection and whether a material is available or not. Despite these drawbacks, the database was populated with information taken from the shelf list without even including information concerning missing items/copies which was readily available in the shelf list cards. At the time of usage, existence of a book's data in the system does not guarantee its physical existence in the library. This, according to the catalogers, violates what is demanded from the profession of librarianship.

Based on information from the shelf list, the catalogers and data entry clerks downloaded the electronic record from a database in the USA and stored it in a temporary database which was then entered into Koha. Due to infrastructure, bandwidth and system (Koha) related technical problems, the process was very slow and cumbersome. Some of the group members state the following:

The retrospective conversion was problematic due to technical and profession related reasons. From the technical perspective, the system was not properly configured so that it runs smoothly... For example, configuration related problem disrupted the work for a month.

Due to the new technology, we were forced to conduct the usual cataloging without physically looking at the books. Because of the order from the project manager, the ethics of the profession was violated. .... The library hired data entry clerks because of the top management's lack of interest on our benefit.

Our initial attempt to report problems and express concerns were not seen favorably. Rather it was considered as an attempt to resist the implementation and disrupt the process. The answer that we were getting was rather discouraging. We were forced to proceed with implementation despite problems.

The actions of users and middle managers, in relation to the development of Koha, were associated to their knowledge of their profession and the outcomes that might happen as a result of (not) obeying it. The group tended towards obeying orders from the project manager rather than the profession. Furthermore, this considered hiring additional staffs that do not have knowledge of either the new system or the cataloging practice to be manifestation of lack of interest of the top management on their benefits.

### **5.3.2 Technological Frames of Top Management and Technologists**

The actions of this stakeholder group were associated to the short time period required to consume the allocated money and finish the project. According to this group the training was not sufficient to cataloguers to make them able to understand the detail operations of Koha. Members from this group state the following:

The training offered to cataloguesrs was not sufficient .... and still I believe they need training. Some times they bring questions the answer of which is already available in the system .... Currently we are facing problems while working with the circulator module due to errors made during the retrospective conversion. Very important field for the circulation module but not mandatory in the cataloging module was left blank while populating the database.. ... We are now telling the catalogues to fill that blank field for all records so that the circulation module runs properly.

There was also an understanding that if the catalogers are exposed to the system they can learn the rest by themselves because of their education and experiences. The pre-conversion preparation was escaped due to the same reason. Some group members state the following:

Pre conversion preparation was very important but given the time required to complete the project focusing on these matters was a waste of time. ... the issue was not about getting the best system and deploy it following the best practice. Rather it was to deploy the system and convert the card catalog within a short period of time and refine it through time.

We know that our procedure has problems but that was right and acceptable given the time pressure. If we do the conversion after inventory of the Library collection it was impossible to achieve what we have achieved now. The inventory by itself takes a lot of time.

This group presumes that prior knowledge and experience of the catalogers are sufficient to understand operations of the new system if they are offered a brief training. They also assumed that doing the conversion rightly takes a lot of time. However, they believe that once the system is deployed and work starts every other thing will follow as the capacity and interest develops through time.

## **6 CONCLUDING REMARKS**

Technological frame of reference held by key organization groups can afford or hamper the development of IS in organizations. In this research the analytical lens, technological frame, was employed to explore the knowledge, assumptions, and expectations of key stakeholder groups at AAULS and its effect on the implementation process and its outcome.

The OSS technology was understood by users and middle managers from the perspective of expertise requirement to customize, configure, and enhance the system in the future. Such an understanding was rooted in the previous failed attempts where almost all group members were active participants. The non-existence of supporting companies in accompanying activities on top of configuration and enhancement, and lack of transparent decision-making process were among the points raised by this group. As a result of these differences the action of this group was geared towards avoiding implementation of the new system.

The top management and technologists on the other hand regarded OSS to be the only viable means of automating the library system and other libraries in the country as far as core library functions are present. They perceived the new system from its strategic importance not only to the University but also to the nation at large through local capacity development and using AAU as a show

case. This group presumes that minimizing the role of those library members that oppose the implementation to be the solution for minimizing the difficulty in the implementation process and its outcome. However, the analysis shows that the proposed solution works only if the size of opposition members is small.

These differing interpretations of the new system and the implementation process have challenged the development of Koha at AAULS, knowledgeable and experienced people denied active participation, the sense of collective decision-making was damaged, and staff mobilization has become difficult. As can be seen from the discussion, frame incongruence brings difficulty to the implementation process dictating project managers to take corrective actions which in turn might have negative implications. However, in the AAULS case, due to the inherent motivation of the staff to change the image of their library and due to the change of decision-making style from participatory to non participatory the implementation was not halted but challenged.

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