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Technological frames: influence of group frames (ingluence)

Abstract

This study discusses the selection of the relevant social groups in frames research and looks at frame structure versus frame content to achieve this. To do this an ethnographic study was undertaken at an educational institute and the social groups that used computer systems within the organization were analyzed over a 10-year period. Two main relevant social groups were found within the staff group alone (staff / mediating staff) based on their perceptions of information technology in the organization. The findings suggest that within one social group there are multiple groups. Prior research that takes a social group as being homogenous may actually be doing a disservice to frame studies as there may be multiple social groups within the social group. This extends prior literature through focusing on determining the relevant social groups via frame structure and content over a ten-year period. The contribution is that the relevant social groups need to be more closely investigated as to whom they contain using frame structure and content over time. This is particularly true when we want to draw conclusions about the behavior of relevant social groups in relation to understanding and use of technology and implement interventions to improve organizational outcomes.

Introduction

People's interpretation of technology is critical to understanding their interaction with it. People have to make sense of technology to use it and in this sense-making process they develop particular assumptions, expectations and knowledge of the technology, which then serve to shape subsequent actions toward it. This includes not only the nature and the role of the technology but the specific conditions, applications and consequences of that technology in particular contexts. These assumptions, expectations and knowledge about technology are their technological frames. Given that individuals work in groups, different groups within an organization may have different technological frames. Frames studies introduce the notion of congruence to describe the nature and extent of differences among frames. For this reason people's technological frames influence their actions towards technology; different groups may have incongruent technological frames which could lead to difficultly around technological use and change. The different technological frames imply different ways of knowing and making sense of technology. A study analyzing the use of information technology enables the examination of formation and change of the technological frames within an organization. The research questions addressed by this paper are:

1. What are the technological frames that each of the groups share?
2. How do the frames of particular groups change over time (using frame structure) and how does this affect information systems technologies?

To be able to achieve these research questions we need to be able to ascertain the social groups within the organization. After ascertaining the social groups we can establish their frames and track these changes in frames using frame structure rather than context dependent frame content. Given these frames, we can look at the affect on information systems technologies. With the effect of frames on technologies we can move this toward more generalizable knowledge in the technological frame area. This enables frame studies to be more comparable to facilitate cross-case comparisons and contributions to the technological frame genre. If we ascertain the relevant social groups in our study incorrectly this affects the overall conclusions relating to the effects of these groups on information technology.

1. Theoretical framework

How we construct meaning from information technology is critical to understanding how we use the information technology. Technological frames are frames that show how we construct meaning from technology and technology-related change. Technological frames are lenses through which we filter and then interpret the actions of others and our environment to make sense of our world. Technological frames are derived from social-cognitive theory and were first used in information systems in the seminal article by Orlikowski & Gash (1994). This section covers the history of technological frames from the socio-cognitive area. Why this is important is that, in social psychology frames relate to individuals, yet in the organizational and information technology area frames are used in relation to social groups. We also discuss what phases of the life cycle and the types of areas that

frames have been used previously in the information systems discipline. This leads on to a discussion of the findings of frames studies in the information systems area and the contribution of this study towards understanding a social group's selection of frame content and structure.

1.1. History of technological frames. The technological frame concept widely used is that of Orlikowski and Gash (1994) which has links to the socio-cognitive literature and sense making. Studies of cognition began in the social psychology field and looked at individual decision-making (Walsh, 1995). As an individual makes decisions they draw on their frames which are the mental models (Senge, 1990) and knowledge structures they have accumulated. If a decision had been made previously, past experience can be drawn on as being useful. This is useful in one sense in that it guides a decision, however it is not useful if it constrains a decision to previous solution and excludes facts that don't fit the problem template. These knowledge structures can therefore help a person make complex decisions yet blind them to others (Fiske & Taylor, 1984) so they can both enable and bind a decision maker. These mental templates contain both content and structure, content being what a frame contains and structure being the number of frame items. Social psychology has used experiments on individuals and process tracing methods to identify frames commonly used. Therefore, linking action (what a research subject does) to their knowledge structure (frame) organizational researchers have brought knowledge structures (frames) from the individual level to the group level. Groups of individuals may house knowledge at a group level. This group level function acts just like an individual's knowledge structure (Walsh, 1995). It is a mental template that serves as a cognitive basis for action (Gioia et al., 1989). Some researchers have looked at upper management's collective frame in particular the case of Facit Corporation when their upper management was unable to see the threat from the electronic calculator to their mechanical calculator business until it was far too late (Starbuck and Hedberg, 1977). "A shared cognitive map emerges from a social process marked by negotiation and argument, as well as by a host to unarticulated internal and external triggers for change" (Walsh, 1995, p. 293). People's behavior inhibits their cognitive frame, however through socialization, interaction or negation, individuals develop common and shared frames in each organizational department. Problems may arise from the different cognitive frames of employees who work in different departments.

The socio-cognitive literature on social groups indicates that group members share frames. Orlikowski and Gash (1994) categorized three frame domains from their empirical study on Groupware adoption – nature of technology, technology strategy and technology in use. A technological frame "identif[ies] that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations" (Orlikowski and Gash, 1994, p. 178).

Technological frames has been used in a variety of different phases of the development process – the definitions phase, implementation phase and end use. The first set of frames studies involve the technological frames of stakeholders in requirements definition and how people envisage systems should be such as human resource systems. The next set of technological frames studies look at implementation circumstances such as: requirements definition, implementations (email systems, library systems, Groupware, quay docking systems, finger printing systems, e-Government land registry systems, insurance underwriting system, electronic patient records, geographical information systems), the attributes of an ideal knowledge management system, use of computer-based meeting technology in a global organization, end-user satisfaction, implementation of new systems and ways of working, e-learning project, risk management systems, security certification, benefits alignment, local government, wool industry, fire fighting reporting systems, human resource systems.

The majority of frame studies have identified social groups – though not always, simply stating who the key stakeholders are (Wainright and Brooks, 2010; Mishra and Agarwal, 2009; Hsu 2009; Azad and Faraj, 2008; Sobreperez, 2008; Sneddon, 2008; Conover, 2008; Chang, 2008; Mengesha, 2008; Sandford and Bhattacherjee, 2008; Jensen and Aanested, 2007; Karsten and Laine, 2007; Davis and Hufnagel, 2007; Hsu, 2007; Davidson, 2006, Bjørn et al., 2006; Puri, 2006; Davidson, 2002, Davidson, 1997, Davidson, 1996; Ovaska et al., 2005, Lin and Silva, 2005; Khoo, 2005; McGovern and Hicks, 2004; Khoo, 2004; Iivari and Abrahamsson, 2002; Hsu, 2002; Khoo, 2001; Law and Partridge 2001; Gallivan, 2001; Hsiao, 2000; McLoughlin et al., 2000; Lin and Cornford, 2000; Yoshioka et al. 2000; Barrett, 1999; Shaw et al., 1997; Orlikowski and Gash, 1994; Sahay et al., 1994).

Orlikowksi and Gash (1994) shed some light on what they determine to be shared frames. "Individuals can be said to share a frame if some core cognitive elements (assumptions, knowledge,

and expectations) are similar" (p. 177). Therefore, they recognize individual differences in frames. However through socialization and interaction, through working closely, professional training, organizational and department membership, individuals come to share a frame. The overriding factor is having group members who share assumptions, knowledge and expectations.

Frames are cognitive structures or mental models held by individuals or shared frames held by groups of individuals. How groups have been determined in prior studies is of interest. Table 1 provides a breakdown of past studies, their choices of key stakeholder groups and social groups. There is a split between the relevant social groups discussed in the articles and the relevant stakeholder groups for which the frames are discussed. Orlikowski and Gash (1994) have consultants as one of their social groups and have provided a narration and justification that indicates all consultants from the graduate to the partner share the same work and promotional scheme (charging for their time, and if not achieving promotion then leaving the firm). They have the same exposure to IT and therefore, they have the same assumptions, knowledge and expectations related to IT. The IT group on the other hand do not have to account for their time like the consultants yet have similar technological training and are therefore in the same social group. Davidson discusses social groupings in her 2002 article and provides detail of group membership in her 1996 thesis. The title of her relevant group was 'core team members' originally as she thought it would include members of user groups on a development. However, it ended up being just technical developers, so she could have renamed the group but did not as she felt in the future the core team members may include user group members. Hsu (2009) provided us with a discussion of who she chose and why, and the process by which she looked at the data to analyze this.

Other later studies have not provided detail on group membership. In the case of the Wainwright (2010) study, the researcher was one of the individuals deciding who was going to get the information systems development job, yet did not include themselves as a relevant social group. Whereas Bjørn et al. (2006) provided justification for including the researcher in their relevant social group.

Mengesha (2008) listed the key stakeholders as libraries management, deputy librarians, department and branch heads, project team, cataloguers, staff of the circulation department, ICT development office of the University. However, in the discussion and analysis he used the terms middle management and users, and top management and technologists. In the discussion of strategy and technology-in-use they were discussed as having the same technology strategy in the analysis section however the selection of the relevant social group was not provided. Therefore, in such studies, who is part of the relevant social group and shares similar assumptions, expectations and knowledge with relating to information technology appears to be taken as given. Other studies look at the relevant social groups but seem to scale down their relevant social groups to examine frames (Boulus and Bjorn, 2010) or group several groups together as having group frames (Azad and Faraj, 2008) but do not provide the justification for doing so. Sobreperez's (2008) study had many relevant social groups but the quotes from group members were so dispersed in the discussion it was difficult to see what a group's frame was (Sobreperez, 2008).

The current study looks at a rather homogenous group and finds that the researcher's immersion in the culture of the organization enables relevant social groups to be distinguished and their effects on the interpretive processes in the organization to be examined more closely.

Table 1. Past research on technological frames: selection of relevant social groups

Study	Topic	Relevant social groups mentioned	Relevant social groups used in study	How selected
Boulus and Bjorn (2010)	ERP adaption and use of electronic patient records	Physicians and secretaries Nurses IT dept/IT vendor The archive department Policy makers	Physicians and secretaries	No information given of how relevant social group used; however article concentrated on aspects of technology in use
Wainright and Brooks (2010)	Requirements definition	Purchasing department (Business users) IT department (internal technologists) IT divisional manager, IT project managers, BPR project manager ICT vendor (external vendor) Researcher (academic advisor/consultant)	Purchasing-department (business users) IT department (internal technologists) ICT vendor (external vendor)	Researcher decided

Table 1 (cont.) Past research on technological frames: selection of relevant social groups

Study	Topic	Relevant social groups mentioned	Relevant social groups used in study	How selected
Hsu (2009)	Security certification in a finance house	Interviews with senior executive managers Employees – 4 different departments Internal audit department Researcher – as employee	Management – five members of senior executive management level Certification team – members in IT and internal audit departments with responsibility for implementing the project Other employees – members from other nine departments	"The initial understanding of the implementation process led the researcher to identify three distinct relevant groups in the empirical setting ... in reading the field notes and interview materials several times, the researcher refined the development of the themes and ensured that they were dominant across different interest groups" (p. 143)
Azad and Faraj (2008)	Adoption of e-Government land registry system	Project implementation unit Employees and middle mangers of the land registry Foreign aid donors Advisors Contractors who developed the system	Employees/managers Project units/donor	"During this period, two major competing technology frames emerged and became associated with the key stakeholders groups. One frame was associated with the middle managers and most registry employees, along with certain allies such as influential advisor to the land registry (p. 81)
Sobreperez (2008)	Use of fire fighting reporting system	Office of the Deputy Prime Minister Senior managers Middle managers Data analysis personnel Fire officers County Statistics Office (statisticians, data entry clerks, technicians dealing with data from regional counties)	Fire-fighters involved in an incident Station officers using the information systems Developers Installers and maintainers of information systems Senior staff involved in debriefing Local statisticians involved in recording, compiling and presenting information for the county National staff consolidating, synthesizing, and presenting national information Politicians and policymakers involved in design, funding and managing the national fire service	Researcher decided
Mengesha (2008)	Adoption of electronic library	Libraries management Deputy librarians Department and branch heads Project team Cataloguers Staff of the circulation department ICT development office of the University	Top management and technologists Middle management and users	Stakeholders listed as relevant social group whereas in the analysis and discussion section this is broken down into management, technologist and users
Davidson (1996, 2002)	Requirements gathering in a health care organization	Core team members (technical developers) Systems constituents	Core team members Systems constituents	Substantial discussion and diagrams of who and why are included in a relevant social group
Bjørn et al. (2006)	Groupware adoption at educational institute	Teachers Students Action researcher	Teachers Students Action researcher	"We include the action researcher as a key actor, because this individual's technological frame influenced the groupware adoption process and the technological expansion of the other participants" (p. 134)
Orlikowski and Gash (1994)	Adoption of Groupware system in professional consulting firm	Professional consultants IT staff	Professional consultants IT staff	Discussion as to why they are in each group

Prior studies also look at implications of the congruence/incongruence of the frames adopted. If we are not identifying the relevant social groups adequately, the implications and organizational interventions proposed may not be useful. Prior studies generally identify incongruence and comment on how this impacts the information system being developed/implemented. To move the frame genre forward Davidson (2006) has suggested we need to move away from frame content to frame structure. Frame structure is defined as "categories or domains of knowledge and frame content as the specific knowledge within a domain" (Davidson, 2006, p. 25). Prior research has concentrated on

what each of the frames say – that is, content – whereas how frames change over time and the number items within each frame category are of more interest. This is because the content of a frame is always dependant on the context of the study, whereas the structure is looking at the way a frame changes over time, which facilitates cross-case comparisons. This could move the frame genre beyond stand-alone context-related cases to building cumulative findings.

However, from 2006 many studies have continued to look at content rather than structure. Structure has been concentrated on in this paper. It has been useful to observe the changes in structure of a frame over time, as this helps illuminate the relevant social groups.

2. Research method

A ten-year longitudinal interpretive ethnographic study was conducted of a New Zealand university with approximately 350 staff. The data collection method used ethnography and the data analysis method used grounded theory as a coding technique. The ethnographic methods of data collection involved the use of participant observation, interviews, examination of strategic and regular memoranda, intranet, advertising material, published documents and internal newsletters, as well as the researcher's knowledge of the organization. Complementary data about the organization was obtained from internal archival records to ensure accuracy of the data. Thirty interviews with staff were held every year, querying their computer hardware/software; which item they used on day-to-day basis and for how long; what types of technologies they would like to be using and how did they learned about these technologies; the amount of time did they spent on computer training; what types of faults they had in the computer system and how were they resolved. Five interviews per year were held with mediating staff, along with attendance at IT computer group meetings.

The data was analyzed using grounded theory coding. Grounded theory data analysis was applied to the dataset after first being classified by social group – senior management, staff and IT development group. These social groups were originally determined by the researcher, from the knowledge gained in observing the organization for several years, as to which individuals were part of various social group cultures. An additional social group of interest was found in the staff data and those individuals that

related to that discourse – mediating staff – were put into a new discourse.

The mediating staff were members of the staff discourse that had a relationship with senior management in the sense that senior management listened to what they had to say. This social group having different expectations, assumptions and knowledge related to information technology was analyzed separately, so that the influence of their technological frames on senior management's technological frames could be evaluated. If the individuals comprising mediating staff remained within the staff group this influence would not be able to be evaluated. The data was categorized by year and within each year by social group, and within each social group folders were kept for the named individuals.

As the folders were named with the individual's name within each year, it was relatively easy to form a new folder for a new social group and move the individuals that belonged to this new social group into the new folder. The ethnographic emersion in the organization enabled the researcher to distinguish the new group over time and the data when separated also evidenced this pattern.

Conceptual themes emerged from the interviews for example twenty five codes were originally obtained from these staff interviews. After constant comparison this was reduced to 9 codes. This was then categorized into the domains used by Orlikowski and Gash (1994) with only two out of there frames (technology-in-use and technology-strategy). This left 5 codes in technology-in-use and 4 codes in the technology strategy. Data was also tagged by which system it related to. The coding of several rich documents was re-coded by an experienced grounded theory researcher and discussed with several amendments in coding occurring. Data from other sources were used to corroborate multiple informants and documents.

It was felt that the method of grounded theory used as coding technique only was useful for ensuring that the data spoke for itself and the researcher did not reflect any of their biases on the data. This is highly suitable given the ethnographic angle to the research and the coding being performed while still observing in the organization two days a week at a desk provided by the organization. The grounded theory method was only used for the original coding of the data it was not used to develop a theory from.

A history of the organization, including frame evidence, is presented in the following section.

3. Organization history including frame evidence

With the classification of the social groups, issues could be looked at. The two social groups are examined separately across 10 years, then compared.

The computer literacy of staff using information technology is an important issue within an organization. The continual updating and development of information technology brings challenges for users to update their skill base to utilize the newly available technology. As in any organization there are varying levels of computer literacy. The staff group had problems using computer systems in the organization *"Difficulties with systems interface"* (Staff, 1995). This problem of using the computer system had arisen from the prior use of technology within the business. Therefore, their prior frames affected their current usage.

During the 1980's and early 1990's the staff within the organization had been starved of newly available hardware/software. By the mid 1990's the majority of staff were still using DOS-based word processing when most organizations were using Windows-based word processing. The only way staff could get up-to-date was to attend courses on newer technology and/or purchase their own machine at home with the newer technology. Problems of incompatibility arose when transferring files prepared at home on the newer technology to their work machine and vice versa. Staff had problems using the resources as shown below:

"There are ongoing problems with the network and computing facilities and services. Software needs to be standardized and access by all staff assured. Similarly, adequate hardware" (Staff, 1995). Given the low computer literacy skills, performing technical tasks such as changing the printer you wished to print to, were the skills that the IT staff were training the teaching staff to handle. The high teaching load of staff, however, made it difficult for them to attend computer courses. The 1994 staff questionnaire on restructuring asked the staff group about their most significant problems. In response they mentioned network problems, lack of training and adequate computers: *"Network computer problems"*, *"Paper only communication and no technology training"*, *"Sort out the computer"* and *"The computer networks are pathetic."*

In the mid 1990's a serious shortage of up-to-date hardware, software and robust network facilities were the major focus of the mediating staff group as well. The discussions below come from the IT User Group comprised of members of the IT Group and mediating staff group which discussed IT issues and meet each month. Particularly when issues were supposed to have been resolved yet kept occurring, the IT Group investigated them and presented their findings to the User Group. *"Instability of Network – Crashes occurred during the last period on these file servers. IT group are unable to tell us what is causing them to crash as no error messages or ideas as what could have caused this. The slowness noticed on the fileservers should have been fixed"* (IT User Group meeting minutes, June 10, 1997).

These issues were slowly addressed over the next five years and the amount of comments from staff related to insufficient network capacity and inadequate machines reduced to none in 2001. Machines were replaced every three years with the latest technology. However, the number of lease contracts had to be increased each year to replace machines over three years old with new leased machines.

By 1997 newer machines were being installed with up-to-date Microsoft Office software. Staff still found it difficult to attend IT courses. Many staff embarked on obtaining higher qualifications – in 2001 this was one-third of staff.

The time left for computer training became less as earning higher qualifications became a top priority specified by senior management. Staff continued to use their computers as they had done previously. By 2001, adequate hardware, software and networking issues became of little concern as they were now readily available, although not fully utilized.

3.1. IT support and training of staff. Staff computer users did not feel particularly supported by the IT development staff. *"There is a need for more training and support of IT"* (Staff, 1995). Some staff computer users' skills in accessing folders or attaching a printer to a PC were non-existent; such users relied on IT staff to do this for them. IT staff did not feel it was their job and thought that the staff member needed to be trained better.

They discussed staff IT literacy as the issue to be fixed as shown below, an excerpt from the Mediating staff group attending the IT User Group minutes. *"Further discussion on staff IT literacy. Staff are constantly ringing the helpdesk and because of their lack of skills are monopolizing their time. It is suggested that all staff should have a basic level of competence and should be a part of their employment agreement. An ICDL should be the required minimum level. All staff and students*

should be tested and instructed at induction" (IT User Group minutes, Friday, October 26, 2000).

Excuses were used, such as undertaking higher teaching qualifications and a heavy teaching load. Some staff thought this was not part of their job, or did not have sufficient time: *"Time available to undertake staff development, availability of resources for staff development, work time allowed for studying/training, opportunities to develop interests/research at work"* (Staff, 1997).

On the other side the IT development staff sometimes changed how to access printers or remote logins without notifying users of these changes, and then wondered why there was staff user dissatisfaction with their level of service. An example is given below for a directory change as well as a complete server shutdown, a response elicited from the staff group. *"Changing user directories from 'f' to 'h' – this has a huge ramifications as all our notes instruct students to look in 'f' drive; this is particularly important for '(c)' courses, where all our screen dumps (typically 3 per page) had to be done. ...We should have been informed that this would be happening before the start of 1997".*

Mediating staff told the IT Group of the staff group's dissatisfaction at IT levels of service *"(h) (faculty technician) who 'fields' a huge number of our queries, was not aware of the changeover date for the server". "We were not told what to expect, nor when the changeover would be taking place. '(o)' was switched off without warning, while staff were using it"* (IT User Group meetings February 17, 1997).

Staff wanted warning of changes and service in a timely manner rather than unanticipated changes causing stress. *"IT support needs to be timely - access to technician services is deficient, leads to stress"* (Staff, 1995).

Overall in the period from 1995 to 2001 the composition of technical IT staff changed from students that had just graduated with diplomas to those with industry experience and professional training. A helpdesk system which logged jobs, and a charter showing job priorities (listing differing types of faults), helped to improve staff satisfaction with the level of support provided by the IT group, as shown by the comments made on satisfaction with the helpdesk: *"All round you are very good. You just need more technicians and helpdesk staff", "Allow users "read only" access to the help desk",*

"Technicians talk in technical jargon which I don't understand" (1998 computer satisfaction survey).

A user support/helpdesk manager was hired in June 1997 that assisted in the set up of the helpdesk, coordination of technical staff, attendance at IT User Group meetings and offering training sessions in groups and a one-on-one basis. Staff computer literacy also increased over this time period. These actions received these positive comments: *"The software training is a great idea", "Training is a brilliant and much needed service*" (1998 computer satisfaction survey).

Attendance at IT User Group meetings by the mediating staff group was sometimes low, given that the purpose of the meetings were to enhance the communication between the IT group and the faculty. This may have been due to high staff workload or several disciplines not wishing to attend. Representatives were appointed by each of the academic group leaders. Notices, agendas and minutes were emailed to the academic group leaders if they did not want to attend or appoint a representative (Summary of Minutes, IT User Group minutes, March 4, 1997). The IT Group Helpdesk Manager, Operations Manager and IT Site Technician for the faculty attended the meetings.

Another change to occur at this time was the setup on staff machines of a standardized set of licensed programs that staff could not change. This meant that users could not delete program files which many staff did in the early 1990's (to give themselves more disk space). Data and program files were now held on different partitions on the disk, enabling the software to be up-dated when new software came out, without affecting the users' files.

4. Findings

This section begins with a general description of the frames of each of the groups over the ten-year period and a comparison. Then, more detailed data collected to substantiate findings, is presented.

4.1. Technology strategy. In the mid 1990's staff were mainly concentrating on their basic needs with regard to having adequate hardware and software on their PC's to perform their jobs, such as being able to access the network for printing and basic email facilities. Forward thinking relating to new information systems did not occur for many of the staff, as being able to complete their jobs with inadequate tools was the major concern. Therefore, the technology strategy of staff was sufficient equipment to perform their jobs.

Mediating staff, however, voiced their concerns strongly over the lack of basic equipment and what

systems should have been used. They suggested video-conferencing as a solution to overseas trips. *"Too many staff are going on overseas trips – are there not less expensive ways of achieving the same thing e.g. video-conferencing"* (Mediating staff, 1995). Therefore, the technology strategy of mediating staff appeared to be utilizing the technology to work in new ways more efficiently.

Table 2. Technology strategy frame of relevant social groups

Group	Staff group	Mediating staff group
Technology strategy	IT is the medium used for communication, IT support and resources	Information age, alliances with industry, resources seamlessly distributed, access anytime anywhere

In 1995 staff mentioned various systems that needed to be looked at; however, they did not mention that technology would be useful in solving their problems. The reason for not suggesting that technology would be useful could be that the types and capability of technology that would be able to solve those differing information systems needs was beyond their frames of reference. They may have been able to define their problem areas, but not solutions to their problem. They also mention the concept of information overload and that systems were inflexible and inefficient, but suggested no way of addressing this. By contrast, mediating staff had a broader knowledge of the capabilities of IT to solve problems as well as be applied to situations such as overseas travel. They were IT literate and looked at how to communicate, collaborate and coordinate to the best advantage using information technology.

4.2. Technology-in-use. Due to the lack of technology in the early 1990's many staff were not trained and able to utilize their systems efficiently. Bureaucratic management systems and rules on the use of systems were not helpful. E-mail, voicemail and paper mail added to communication overload. Added to this was the perceived lack of helpfulness of the IT technicians

who did not have sufficient time to offer training to staff. Adhoc changes to network systems and machines by the IT Group, without communication to staff, caused added stress. All these issues combined and caused comments by the staff group related to their technology-in-use which are similar across the years. Staff were trying to get their work done in spite of systems being complicated, lack of training, and network structures changing without warning.

Many of the issues covered in the technology strategy have been mentioned as issues in technology-in-use: the complexity of multiple communication channels, with use of voice, e-mail and paper; the need to give email access to all staff; basic overall systems efficiency and use of database technology to communicate and coordinate issues of enrolment, transfer, results, timetabling and student management; expanding resources relating to on-line and computer access for students. The staff technology-in-use frame changed in 2001 when their focus moved from trying to get adequate hardware/software and networks to the systems and processes and the efficiencies in processing their work.

The content of mediating staff frames appeared to change across the years to reflect current issues challenging the organization in the information technology field. There are large amounts of data evidencing that the mediating staff have tried to communicate issues to senior management, which is noteworthy given this frame consisted of the least number of individuals. In certain years this communication related to the internet, number of machines, network issues, then in other years focused on email, photocopiers, computer maintenance. Overall their content frame was highly changeable given they focused on current crisis e.g. network changes or enrolment for example. It is considered that their frames were not actually changing, but merely addressing the issue of the day.

Table 3. Technology-in-use frame of relevant social groups

Group	Staff group	Mediating staff group
Technology-in-use	Frame to 2001: Systems are inefficient, overloaded with bureaucratic rules and too many communication mediums are used. There is no time to keep up with IT changes or reflect. Internal communications systems do not work. There is a lack of availability, reliability and maintenance of software Frame after 2001: Communications mechanisms and infrastructure in place. The systems are still inefficient and provide information overload	Problems with current system that need to be addressed

4.3. Detailed frames for the staff group. The original data supports the frames that have been created, for example the original categories for technology-in-use for the staff frame communications

mechanisms, infrastructure support needed with remote access, systems efficiency/overload/ bureaucratic rules, too many communications media used, IT literacy policy, central procedures

efficiency/own area efficiency, data projectors, keep up with changes/no time to reflect, unrealizable internal communication systems, technical requests, availability/reliability/maintenance of hardware/ software, poor systems/huge amounts of paper work and lack of equipment, databases, workstations, coordinated systems, communication, training and support for IT, standardization of software, adequate hardware and admin support systems, info system access to information. The table below indicates where there is raw data (*Y*) supporting these categories.

Table 4. Technological frames of staff discourse combined by themes

Year	1995	1996	1997	1999	2000	2001	2002	2003
Staff technology use frame								
Communications mechanisms	Y	Y	Y		Y	Y		Y
Infrastructure support needed with remote access							Y	
Systems efficiency/information overload	Y	Y	Y		Y	Y	Y	
Availability/reliability/maintenance of hardware/software, standardisation	Y	Y	Y	Y	Y			
Training and support for IT , IT literacy policy	Y	Y		Y	Y	Y		
Technology strategy frame								
Medium for communication	Y		Y	Y				
IT support, resources	Y			Y				
Web based resources				Y				
Library resources				Y				

These frames can be broken down even further; for example, availability/reliability/maintenance of hardware/software, standardization in Table 4 breaks down into its frame structure. This shows the structure of the theme reducing. In 1995 and 1997 there were eight comments relating to adequate hardware and software, in 1999 just four, and in 2001 none at all, as staff were satisfied with the hardware and software.

Table 5. Technological frames of staff discourse: adequate hardware/software raw data

1995	1997	1999	2001
♦ problems with the network and computing facilities and services ♦ software needs to be standardised ♦ adequate access to equipment ♦ adequate hardware is needed ♦ more computers needed ♦ adequate computers needed ♦ sufficient hard disk capacity ♦ adequate administration equipment ♦ computer resources e.g. disk space	♦ adequate equipment ♦ machines older than 36 months ♦ computer equipment to do my job ♦ computer equipment ♦ computers are slow ♦ access to email and access to a computer ♦ computers are not sufficient ♦ nowhere near enough IT equipment to go round	♦ poor availability of computer equipment to do your job ♦ poor maintenance ♦ availability and reliability of desktop computer ♦ availability of computer equipment to do your job	

All systems within the organization were examined. Table 6 below shows the types of systems that were discussed in each of the years. Some systems were discussed every year, indicating that the underlying problem was never addressed.

Table 6. Systems in the organization for which the frames were collected

	1995	1997	1999	2001
IT technology in use				
Enrolment	X	X	X	X
Communication – email/voicemail	X	X	X	X
Adequate hardware/software	X	X	X	X
IT support and training	X		X	X
Network	X	X		
Library database access			X	X
Room resource allocation	X	X		
Purchase/finance systems			X	X
General	X			
Human resources				X
IT technology that is being envisaged by staff – nature of technology				
Enrolment/database dev/staff details	X			
Communication – email/voicemail	X	X		

Table 6 (cont.) Systems in the organization for which the frames were collected

	1995	1997	1999	2001
Workflow/video conferencing	X			
Adequate hardware/software		X		
Web based learning	X		X	X
Learning facilities	X			
Systems envisaged as needed but the Information technology component needed but not mentioned				
Enrolment	X			
Communication – e-mail/voicemail	X	X		
Adequate hardware/software				
It support and training				
Network				
Library database access	X	X		
Rooming resource allocation	X			
Purchasing/finance systems	X		X	
General				
Quality control systems	X			
Research application systems	X			
Library database system				
Marketing system	X			
Human resource systems	X			X
Systems generally				
♦ Are non-flexible	X			
♦ Internally focused	X			
♦ Lack co-ordination/ability to know how they work	X			
♦ Systems generally fail to deal with info overload	X	X	X	

5. Discussion

This study has looked at the formation of the staff and mediating staff's technological frames and the context in which they have changed or not over time. From an analysis of the data we can see that the individuals that belong to each of the groups have different assumptions, expectations and knowledge relating to information technology. The staff group wanted to use technology to perform their jobs and that is shown in their technology strategy and their use of the technology. Mediating staff were more interested strategically in what the technology could do. To envisage this mediating staff were technologically literate and envisaged technology solving problems in the organization. They were the ones that attended the IT User Group and mediating the discussion relating to technology on behalf of staff. They also had the ear of senior management and tried to influence technology increases this way. These staff were originally mixed in the staff group and were individually identified through sense making by the researcher in the field, and were removed from the staff group and analyzed separately, as they were a separate social group in the organization. Without this sensitizing time in the field and reflection on what this disparate group did, they may have been mistakenly included in the staff group. Firstly the content of their frames was quite different,

reflecting their assumptions relating to technology. The staff group looked to technology to complete their work with no strategic view other than as a medium of communication, whereas the mediating staff were considering technology as solutions for more than technological problems. The staff frame technology-in-use was consistent in its content, for example the adequate hardware/software theme, and interestingly enough, the strategy and in its use frame. The only thing that changed over time was the structure of the staff frame as the technology got better – you can see this though the content, in that this theme stopped in 2001 as all their basic hardware and software needs were meet. However, if you look at the structure of this frame there was a gradual reduction in the number of items within it.

The mediating staff continued to contribute to the IT development discourse consistently over the period relating to the same issues. Therefore, the IT mediating staff's technological frames stayed the same across the time period.

Conclusion

According to Orlikowski and Gash (1994) the interpretive flexibility of technology allows technology to be open to different interpretations by multiple groups who construct different technological or assumptions, meanings and cognitions to understand the technology. Since

technological frames strongly influence the views held about the function, value and role and hence the choices made regarding technology, information technology enabled change can therefore be understood in terms of shifts in technological frames over time. Orlikowski and Gash (1994) believe that individuals have different interpretations of the same things and thus make sense of things differently. This can certainly be seen with the staff social group who included a separate social group, the mediating staff group, who had different technology strategy and technology-in-use frames. The primary motivation of this study has been to add to the literature on technological frames relating to relevant social groups and frame content and structure. Only through separating the relevant social groups can we see the effect of their frames on the organization. This is particularly necessary if trying to identify the frames of social groups, look for congruence, and implement interventions aimed at overcoming incongruence. To separate social groups we need to rely heavily on the literature relating to what constitutes a group frame – that is, similar expectations, knowledge and assumptions relating to technology – and bring this to the fore when performing frames research. As our findings indicate, different social groups assign different meanings to information technology. If we perform an analysis using frames, we need to ensure, we identify separately each relevant social group.

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