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The Challenges of Introducing Off the Shelf Systems into Complex Work Organizations

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THE CHALLENGES OF INTRODUCING OFF-THE-SHELF SYSTEMS INTO COMPLEX WORK ORGANISATIONS

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Abstract

This paper describes research into problems commonly experienced when implementing an off-the-shelf information system into the complex work-practices of an organisation. Encountering such an occurrence, the authors employed a grounded theory approach to study the case though the collection, analysis and interpretation of a variety of data. The case concerned the troubled introduction, into a large educational institution, of a complex class timetabling system that was already well established in another similar organisations. Unanticipated problems encountered by various stakeholders in the system during and following the implementation of the system are documented and classified into three categories: knowledge issues, system issues, and organisational issues. Aspects of these categories are analysed for this particular case and then generalised to provide lessons for those in any similar situation.

Keywords: Enterprise systems, knowledge transfer, complexity, grounded theory

1 INTRODUCTION

The research described in this paper stems from a growing awareness by the authors that, despite decades of experience of implementing and using IT, many organisations go through such trauma when there are changes to their systems. Studies in the literature (eg Argyis 1990. Beatty& Gordon 1988) and much anecdotal evidence from colleagues of the authors in various mature organisations point to a chronic habit by management, advised by IT staff, to severely underestimate the problems that will be encountered. When a typical case of IT induced organisation trauma began to unfold in our institution it was decided to undertake an indepth grounded theory study of the phenomenon. This approach presupposed no initial framework or theory but allowed categories of issues to emerge from a detailed analysis of comprehensive data collected over a period of time from a variety of stakeholders. The findings of the study are presented here.

When an organisation is looking for a computer system or application to support a significant part of their operation it is not uncommon for them to consider an off-the-shelf package that is already in use in an organisation similar to itself. Those managers and IT staff responsible for a system's acquisition are naturally influenced by any advice they receive on experiences with the intended system from those who have supposedly used it successfully. Such communications between organisations may only occur at relatively high management level so that actual end-users are rarely involved. Issues of system suitability and usability are therefore assumed to be unproblematic in the organisation, as the system has already been used in a comparable real world situation. Even less of a consideration is whether the context of use in the receiving organisations is similar to those where the system is currently being used so that systems transfer can take place with ease.

The case chosen for this research was the introduction of a comprehensive, computer-based timetabling system into a large educational institution. This choice of case study site was made shortly after the initial implementation stage of the project when it was recognised that severe problems were being encountered by several sets of stakeholders. No such problems had been

anticipated by the project managers as this application was already doing well in several other similar institutions. The main aim of the research was to gain some understanding of the situation and identify issues that were making the successful generation of the timetable so difficult with the new system. The adoption of a grounded theory method of data collection and analysis therefore seemed appropriate, where there would be no preconceived hypotheses but rather core categories are allowed to emerge from data. This method could potentially produce original findings and not just verify or reject predetermined propositions.

The paper begins with a brief description of background of the case. This is followed by an explanation of the grounded research method before the data collection and analysis is described. Categories of interest emerging from the data are then introduced and, only at this stage, do we present the relevant literature on these categories. The paper concludes with a discussion of the findings with some generalised implications for organisational managers.

2 BACKGROUND INFORMATION ON THE CASE

The scheduling of the annual timetable of classes in any large educational institution is a complex and time-consuming task. There are a variety of stakeholders with different work agendas and little appreciation of the objectives of one group by another. Apart from the obvious concerns of the timetabling officers and IT support, management want efficient use of resources and smooth running of the teaching program, and academics staff in a variety of disciplines want classes scheduled when and where suits them with flexible options to make changes to their requests at any time. Students also want to know their schedule in plenty of time so that they can make transport arrangement and fit in part-time work, and administrative staff often had to mediate between all these groups. In this institution the number of students is increasing every year while resources are stretched to the limit demanding increasing efficiency in the fit of classes to space and time. Increasingly, class numbers and course offerings need to change after the timetable has been created to match real-time demand. In order to achieve efficiency with the use of resources and produce an effective flexible timetable a sophisticate scheduling system is required.

In the chosen case, a computer-based timetabling application package had been purchased which promised to increase efficiency and transform the use of both physical and human resources by automating much of the effective timetable processes for classes. The vendors claimed that the system was designed to automate all the logistical aspects of the teaching activities of an institution under every conceivable constraint, including the allocation of class space, time and teaching staff. This stated ability of the system led to a decision by senior management to purchase the system in order to revolutionise the running of the teaching program. A senior manager and the registrar were also involved in the decision on the mode of introduction of the new timetabling system into the institution on advice from an external consultant. According to the external consultant, who had assisted with the introduction of this timetabling application elsewhere, the system was successfully implemented in other similar educational institutions.

In the timetabling process before the implementation of the new system, school timetabling officers would send class information on each course in their school in a spreadsheet form to the institution's timetabling officer in July each year for the following year's calendar. The officer would then manually create the timetable using the current year's schedule as a starting point, as the bulk of requests did not change from year to year. This process became more onerous each year as the institution diversified with online student cohorts, multiple-campus arrangements and offshore offerings of a wider range of courses whose range of starting times and duration continued to expand.

The specifications of the new timetabling system indicated that it could both streamline the processes of data entry of upcoming course offerings, handle the increasing diversity of request and automatically generate a timetable, which maximised the use of space and time resources to satisfy all constraints. When it was implemented, the school timetabling officers, or even the teaching staff themselves, would be able to enter data directly into the system on class details, resources needed and any other special needs. The institution's timetabling officer only needed to check the consistency of

the data from the system instead of collecting and entering data. Once all the data had been entered he would run the system, which would then automatically allocate a time slot and space for all classes in an annual comprehensive timetable. The system could also accommodate any subsequent requests for changed allocations, checking for any anomalies that were caused by the change.

At the start of the data collection for the study described below, the processing of the first timetable with the new system was underway but had completely broken down in two respects. Firstly, most of the school timetabling officers had found the data entry function of the system unusable and had not been able to enter their requests for class times and space correctly. So the previous spreadsheet-based process had been reinstated with entry of this data done manual as before, by the central institutional timetabling officer who was an expert user. He was eventually given the services of an extra assistant for this. Secondly, when the timetabling generating function had been run the resulting timetable had so many flaws that it was unworkable. These also had to be rectified manually in a rush of overtime at the last minute as will be described below.

3 RESEARCH METHOD AND DATA COLLECTION

The research was planned as an extensive field study, in which a variety of data would be collected through various methods in an effort to cover the work of all stakeholders with no preconceived research questions or hypotheses. Using a grounded theory approach has been shown to be suitable for this type of research (Glaser and Strauss, 1967; Glaser, 1998; Martin & Turner, 1986). It enables the revelation of details within complex phenomena in an organisation when a substantial new system is implemented. It allows concepts to emerge from the data, which are then organised by the researcher into core categories, which are then investigated further through literature searches and, possibly, additional data collection. This approach was shown to be suitable for information system's research, which characterises the organisation's experiences in terms of process of incremental or radical change, in the award winning paper of Orlikowski (1993).

The research plan was to collect data through interviews, observations, and relevant documentation. This process for collecting data lasted over a year from mid 2002 until end of year 2003, covering the preparation of both the 2003 and the 2004 timetables. Key stakeholders interviewed were identified as the senior manager responsible for the project, the registrar, the external consultant, the institution's timetabling officer, school timetabling officers, IT system support staff, teaching staff, and students. Relevant documentation was collected from the start of the implementation and included system documentation, user training manuals, instructions to staff and a comparative evaluation of resource utilisation before and after the introduction of this new system. Observations were made of school timetabling staff using the system in their offices and through formal usability tests of real surrogate users performing scenarios of typical tasks in a Usability Laboratory.

The researchers conducted the grounded theory analysis by inspecting, summarising, coding and interpreting the data to arrive at the concept categories that emerged as the most significant. An indication of how this was done in shown in Appendix 1. This table is a summary of the initial interviews with School Timetabling Officers with selected Concepts leading to Themes. This is an example of what was done for all data collected, which were then merged into the three categories described in the paper by interpretation of the researchers in light of the literature.

4 DATA COLLECTION

The study was started shortly after the initial implementation stage of the project when it was recognised that severe problems were being encountered by several sets of key stakeholders. As mentioned previously, the research was planned to collect data through vary methods from mid 2002 to end of year 2003 covering the period of preparing the 2003 timetable to the completion of the 2004 timetable. This section of the paper contains a summary of the collected data, including with the views of the school timetabling officers and key individual stakeholders: the registrar, institution's

timetabling officer, the consultant and senior manager responsible for the project. The data collection was conducted in 4 phases as follows:

- Phase 1 (Exploratory phase): Data collection began with a study of relevant documents and initial interviews with the registrar, the institution's timetabling officer and an external consultant.
- Phase 2: Interviews with school timetabling officers and observations of their work.
- Phase 3 (Data Sampling): Interviews with senior management, the institution's timetabling officer, academic teaching staff and students. This phase also included the usability tests.
- Phase 4: Follow up interviews with school timetabling officers.

4.1 **Views of key individual stakeholders**

The senior manager, ultimately responsible for the acquisition and implementation of the new system, was only interviewed after the 2003 timetable was released as it took a long time to get an appointment to see him. This was perhaps in part due to the amount of his time that was taken up dealing with timetabling problems. This interview provided us with the reasons for acquiring the system and a perspective on management issues on the timetabling process, the system implementation, and staffing issues. The manager said that he promoted the purchase of the new system in order to allocate resources more efficiently in fulfilling the teaching role of the university. He noted that there were time when teaching spaces and other resources were heavily used and the campus was crowded while other times, such as early mornings and Friday afternoons, when resources were under-utilised. These were not popular times with academic staff and students and he felt that the new system would compel them to accept classes at these times.

This manager does not have an IT background and held the view that all new systems create problems. He stated that it would probably take some time to implement this system as successfully as in other universities, predicting that it would be running smoothly in about 3–4 years. He acknowledged the problems during the implementation and attributed them to the following:

- Not enough planning was undertaken before the implementation
- Not enough people were available to work on the implementation
- Hardware problems (presumably staff machine which could not support the system)
- Not enough done to prepare people for the change.

He believed that the majority of staff (academics and timetabling officers) understood that there would be benefits from the new system in term of flexibility and efficiency. However, most do not like it the system as they are reluctant to change something they have done for a long time. This is especially true of academic staff and less so of the staff who actually use the system directly. They have a better appreciation of the efficiencies that the system will bring. He menioted the following:

- Efficiencies of organisational processes
- Cultural changes and work practices
- System's capability
- The planning process of implementation
- Communication with staff
- Communication with external parties

The registrar is responsible for providing a supportive environment for the teaching staff and students so that she had a keen interest in the efficient running of the teaching program and therefore played an important role in the implementation of the new timetabling system. The interview with her was mainly about her expectations from this project and to get some information about those in throughout the university responsible for the timetabling process. Her permission was needed to interview these people. The registrar's perspective of the new timetabling computer-based system was that it should be as useful here as it appeared to be in other universities.

The university's timetabling officer has been responsible for the university timetable for about 5 years and is probably the main player in the implementation of the new timetabling system. He was

interviewed several times during the course of the study and was in regular contact when the usability tests were conducted. He had a great deal of experience with the system before it was purchased and had recommended it to management. He was an expert user and knows far more about the system than anyone else in the university. In 2001 he worked with two experienced timetabling officers in small academic units to do a trail run of the data entry process. From this exercise, he judged that the university was ready for full implementation in 2002. Although he had greatly underestimated the difficulties that would be experienced, to his credit, he worked long hours to ensure the timetable was ready, doing most of the data entry himself.

The consultant is also an expert on the system and had assisted other universities with their implementation. It is surprising that he did not foresee the usability problems that occurred as they had surely surfaced in other universities who use the system. The consultant and the university's timetabling officer worked together to plan the actual introduction of the new system and also to solve any problems that occurred during the implementation in 2002. As it became clear that most end-users could not enter data directly into the system they oversaw the development of a workaround module for 2003: a new simplified interface that would allow users to enter any straight-forward requests into a spread sheet in a form that they could subsequently import directly into the main system. They set up a meeting with school's timetabling officers to present them with the screens of this simplified system on Power Point slides and also provided them with simple written guidelines to the steps in the process. This module will be discussed later from the viewpoint of its users.

4.2 Views of stakeholder groups: timetabling officers, teaching staff and students

The most telling data on the issues of interest to this research came from these stakeholder groups. From numerous interviews it was clear that, despite the trial with two of the smaller schools in the institution, there seems to have been little awareness of potential problems by those managing the project when they decide to change completely to the new system in 2002 for the 2003 timetable. To begin general use of the new timetabling system, only a brief introduction was provided to school timetabling officers in one session (of about 30 minutes) by the external consultant and the institution's timetabling officer. The timetabling officers reported to us that no actual hands-on training was provided to them; instead they provided a manual and list of instructions about the system to the officers, most of whom had no idea about the system.

The institution determined a particularly short time frame for the school timetabling officers to input data into the system in this introductory year and had no hope of finishing on time. Most reported that they had attempted to learn to use the system by themselves. There was only one person, the institution's timetabling officer, that they could ask to help them to fix the problems. He was the one expert on using the system in the institution, and had to help more than 20 timetabling officers as well as do his own job. He was not trained to deal with this task and found it was impossible to fix problems for all of them within the timeframe. However it was due to his long hours of manual effort, doing much of the work for the others that the timetable was eventually created.

The problems did not end once the data was entered. There were many drafts of the 2003 timetable produced by the scheduling function of the system causing an adverse reaction from teaching staff and students who were rejected them outright. It was difficult to know which complaints were genuine intractable problems and which were just from people taken out of their comfort zones. Many of the academic staff wheel a great deal of power to which the timetable officer had no comeback. As a result, much of the actual timetabling ended up being done by the old the manual process. The need for the institution's timetabling officer to do most of the data entry and then redo the timetable by hand as he had always done, caused the 2003 timetable to be delayed and some teaching staff could not get the correct information for their subjects in time for the start of session. Many complaints and requests for changes from academic staff were received and school timetabling officers were not able to respond to them promptly. This caused widespread discontent among administrative and teaching staff alike. Curiously there were much fewer complaints from students and, of those approached, it was only a few part-time students that noticed that there was anything different from previous years.

It is probably that the final timetable was much like previous years. Indeed a survey by management showed very little different in resource usage over previous years.

After the 2003 timetable was finalised the development team, consisting of the external consultant and the institution's timetabling officer, formed a user group to gather information from school timetabling officers' on their problems and suggestions. After receiving many comments from the user group, the development team spent unintended time to created the simplified software module (mention in the previous section of the paper) on top of the system to enable the school timetabling officers enter the data easily. This module provides a step-by-step process for entering data. It occurred to us that other institutions using the system must have also encountered this problem but the knowledge was not transferred to our case. Usability tests were conducted at this stage on both this module and the original system. The results shown in Appendix 2 confirm the usability problems with the original system. It was not suitable for use with minimal training and for the sort of casual use (once a year) that most officers would have. The new module, though more usable, also had problems with its restricted capability.

The timetabling process for the 2004 timetable was somewhat better. The school timetabling officers were becoming more familiar with the job, the process, and the system, particularly with the extra data entry module that helped them to enter data more easily. They were provided with more training, and given better written instructions, both in the use of the new module, and also in some functions of the timetabling system itself. However, there were still problems with the new simplified interface module for data entry as the real data is not as straightforward as the step-by-step data entry module indicated. There is such variety in the way different subjects run and the single simplified interface does not allow users to enter specialised information or other requests for less straight-forward classes. Therefore, the timetabling officers had to provide numerous requests in a separate Word document that was emailed through. An example of such a request was the varied reasons for repeat lectures. The system was programmed on the assumption that lectures were repeated because the class was too large for any available room whereas often the repeat lecture catered for different groups of students, such as, part-time working students or to fit in with off-campus classes. This meant that the repeat lectures need to be a special times such as evenings for part-time students.

The main concerns of school timetable officers, who are the main end-users, are that they cannot get their job done on time because of a lack of knowledge and understanding of the new system itself and the whole timetabling process that seems to have changed to meet the constraints of the new system. As mentioned previously our coding of their initial interviews is shown in Appendix 1. The view of most of them is that using the new timetabling system has increased their workload while the old process was already working, well from their perspective. It seems that much of the complexity of the timetabling process may still be best handled by people and indeed are still done by system workarounds. It is generally believed that the system attempts to automate too much of the process that is not as stable and specifiable as the system demands.

5 DATA ANALYSIS: IDENTIFICATION OF CATEGORIES

Following the data collection summarised in the preceding section of the paper, all results were subject to a Grounded Theory process of coding the data, identification of themes and reduction into main categories. At the end of this process there emerged three main categories of concepts that appeared to hinder stakeholders from working effectively in the organisation. These are as follows:

1. Knowledge Issues: inhibitors to knowledge flows and lack of effective communication
2. Systems Issues: system rigidity, highly structured functionality and poor usability
3. Organisational Issues: the complexity of organisational work and uniqueness of each organisational context

Discussion on these categories is now presented based on the findings of the study together with a selection of relevant literature in each category.

5.1 Knowledge Issues

It was noticeable how restricted were the knowledge flows between different stakeholders in the timetabling project and how many of their problems could in our view have been avoided with appropriate knowledge transfer protocols. There seemed little awareness of the need to identify who has relevant knowledge, who needs that knowledge and how it could be effectively transferred. Two aspects of the knowledge transfer issue stood out. One was the lack of communication between institutions about experiences with the system, particular the flow of knowledge from the institution where the system had been used to the institution in our case. The other was the lack of first-hand knowledge of other working environment among various stakeholder groups within the institution.

The field of knowledge management (KM) recognises both the importance and the challenges in dealing with knowledge flows in organisations. Much of the interest in the KM literature has been strongly influenced by the work of Nonaka's (1994) model of knowledge sharing and creation in organisations and is based on the assumption that knowledge has this two-dimensional structure:

- *Explicit knowledge* is codified or codifiable knowledge that can be transmitted in formal, systematic language. It can be captured in records of the past such as libraries, archives and databases and is assessed on a sequential basis. It can be expressed in words and numbers and shared in the form of data, scientific formulate, specifications, manuals and the like. This kind of knowledge can be readily transmitted between individuals formally and systematically.
- *Tacit knowledge* is highly personal and hard to formalise, making it difficult to communicate of share with others. Subjective insights, intuitions and hunches fall into this category of knowledge. It is deeply rooted in and individuals' actions and experience as well as in the ideals, values, or emotions he or she embraces.

It is not unusual to attempt to provide explicit knowledge concerning a new IT system by means of documentation and training. Training promotes the internalisation of knowledge where users can absorb explicit knowledge from the training and expand their tacit knowledge in order to develop new knowledge about the use of a system (Handzic & Hasan, 2003, p.12). However there can be difficulty in managing much of the knowledge related to a system because so much of the way work is done is tacit. More recent aspects of KM theory may be applicable to understanding this category. Snowden (2002) uses complex adaptive systems theory to create a sense-making model of collective knowledge creation. This recognises that most systems in the organisational context have a degree of complex behaviour that cannot be predicted or fully designed and assumptions to the contrary can lead to difficulties in transferring systems from one context to another.

In respect of knowledge transfer between institutions, noticeably missing in our case, Bhatt (2001) observed that it is generally not easy to receive knowledge from other organisations because they have their own unique history and culture. In our case however the specific reason for purchasing this timetabling package was because of its apparent successful use in other institutions. It seems incomprehensible to us that, with all this institutional experience, more was not known about difficulties users would have in with data entry. The obvious channel for communicating this knowledge was the consultant and management, after initial contact with management in the other institutions using the system, left it to him. Although diligent in his task, the consultant had no particular concern for the work of the organisation. His focus was on the capability of the technical aspects of the system and the work needed in making it operational. His world-view was that the system was successfully operational in other institutions and would work the same way here. It was just a question of getting people to enter the data and the system would do the rest.

There is considerable interest now in the concepts of Competitive Learning and Knowledge Exchange Networks (COLKENs) (Angehrn & Loebbecke 2003). In a COLKEN the benefits of knowledge sharing between organisations is balanced against the need to retain knowledge for competitive advantage. In our case managers from different institutions communicated although perhaps unaware of, or reluctant to admit, any problems experienced with the system. There seems also to be communication between institutional timetable officers and some IT people who were members of the

system's user group who extol the immense capability of the system. The knowledge however that was not communicated was at the level of the work of the organisation with school administrators and academic teaching staff.

Within organisations, the facilitation of knowledge sharing is seen by the KM literature to be a source of competitive advantage (see eg. Oliver & Handzic 2001). Most of this literature focuses on the need to overcome the inherent self-interest notion that knowledge is power. What is often not acknowledged is the complementary attribute that allows people, particularly senior managers and experts in various areas, to admit that there are things outside their area of understanding and that they should be willing to receive knowledge from others. This is related to their absorptive capacity (Cohen & Levinthal 1990). One example of this in our case was that management had a lack of knowledge in Information Systems and technology transfer and did not consult expertise in those areas. At a more basic level of knowledge sharing there was a lack of real understanding of the work culture, priorities and traditions among different stakeholder groups or even between staff in different discipline units within the university. While this is understandable, it is also undeniable that more understanding between these groups would have ameliorated many of the problems and so a forum for knowledge exchange could have helped.

5.2 System Issues

From an organisational perspective a good system is one that increases efficiency and effectiveness of their processes and improves business performance. It should be as far as possible compatible with existing systems. From the users' perspective, a good system decreases their workload and increases their ability to do their jobs. Desirable characteristics of a system are ease of use, flexibility, and a close match between the system design and their mental model of the work. Users prefer to use a system that does not complicate their work and provides a user-friendly interface. The inherent complexity of a job is more of a concern for the users. Therefore, they want to have a system that can help them to work more easily on complicate tasks.

The timetabling system in this case is a sophisticated system, which can handle in a large institution a wide range of conditions of class space requirements, semester lengths, class times and size matched to resource availability of space and staff. However it is both rigid, in that the design is fixed and highly structured in the way all these conditions are specified. This makes for an extremely complicated systems interface that requires both an advanced understanding of the timetabling process in the context of the particular organisation and a high level of IT literacy in manipulating the interface. It is questionable whether such as system can be set up so that all stakeholders would use it directly. It was the intention that eventually all teaching staff would enter their class requirements directly, doing away with the need for school timetabling officers. It is evident that the process is inherently too complex for all but a few experienced academics to have the capability to do this.

Information systems have evolved over the years to cover a broad spectrum of types, sizes, complexity and uses in an environment increasing in both complexity and dynamism (Neumann 1997). It is our contention that a process such as this one which is complex and dynamic cannot and should not be fully automated. Just because a system has the capability to address a range of contingencies foreseen by the designer does not mean that the most effective way to use the system is to compel workers to adapt what they do to use as much of its capability as possible. There are limits to the value of integrating all of a company's data, so that some authors have recommended a pragmatic solution. Goodhue et al (1988) advise that data integration should be done for specific business reasons. They talk of long and short-term trade offs, observing that 80% of the benefits from data integration can be brought about for 20% of the effort. The integration of the remaining 20% of the data will require 80% of the effort and is almost certainly not worth it. The more sophisticated decisions are better left to people who have long experience and expertise in the matter.

5.3 Organisational Issues

IT applications such as the timetabling system are designed to automate processes on the assumption that everything about the processes is knowable. The senior manager, the external consultant and perhaps to some extent the registrar, hoped that the implementation would drive change to essentially improve efficiencies through automation. They failed to realise, on the one hand, that the process was inherently too complicated, complex and unstable to be so completely automated, and hence relegated to the realm of operations, and on the other, that the outcome of any such automation would have a profound effect on academic culture, reducing the flexibility and agility of the teaching activities. Rather than professionals, teaching staff would be seen as tradespersons whose work can be automatically controlled and structured.

Similar findings have come from research into the introduction of enterprise systems usually known as Enterprise Resource Planning (ERP) systems into large organisations. Haines and Goodhue (2000) found that most organisations are faced with not having the necessary knowledge and skills to implement an enterprise system successfully and are becoming conscious that managing knowledge is one of the most significant costs of an ERP project. What the creators of ERP strive to do is combine all possible functions that every company requires to do its job and integrate them all together in one software package that can be implemented in any organisation. Company managers invest millions in acquiring ERP systems in the hope of increasing productivity and efficiency, particularly for global operations. However, research (Pan et al 2001) has identified that knowledge integration is a key problem in ERP implementation and that this is a contextual issue that does not happen automatically. The degree of complexity, together with the uniqueness of each organisation confounds the hopes of managers that an ERP will drive organisational change to a more productive, efficient operation.

There is little doubt that organisations must understand how to continually expand their capacity to learn, supported or enabled by information systems (Markus & Benjamin 1997). This presents quite a challenge and Schultze and Boland (*2000*) report low success rates of around 30% for advanced systems, attributable to technologists' lack of understanding of the situated work practices of user communities. They believe that systems designers do not have accepted models for the large invisible and complex nature of work that such systems are expected to support. The management literature suggests that traditional conceptions of work place and community conditions are becoming obsolete (Bishop 1999). Productivity in the industrial age was measured in terms of volume and cost efficiency. In the information era, where information is no longer a 'scarce' commodity, quality and innovation are a priority.

The managers in our case were still looking to IT to improve efficiency and still failed to understand the organisational impact of new systems despite numerous experiences. Changes to job processes brought about by the introduction of a new system are a major issue for both direct and indirect users of the system. There may be an increase in job complexity and apparent loss of control of a job as the system takes over. Many of these issues have been addressed by literature in the field of computer-supported co-operative work (CSCW) (see for example Ehn 1988, Bannon & Bodker 1991) and more recent work on complexity and sense-making (see for example Kurtz & Snowden 2003)

6 CONCLUSION AND FUTURE DIRECTIONS

The case study described here was chosen as a suitable site for a Grounded Theory study when unanticipated difficulties were encountered when a computer-based system was introduced into an organisation to solve a complex scheduling problem. It was assumed that the implementation of the system would proceed smoothly based on supposed successful use of the system in similar organisations. However the context of any particular organisation is invariably unique and differences need to be anticipated when the transferring a sophisticated system between even apparently similar organisations. This study raises issues of the degree to which a system can automate complex decision-making processes and the ability of even experienced staff to quickly adapt to new ways of doing their job as demanded by a new system. A research regime of data collection followed by a grounded

analysis of the data in this case revealed three inter-related categories that summarise the main aspects of the problem: knowledge issues, systems issues and organisational issues. The failure of the flow of knowledge together with the highly structured design of the system and the complex and dynamic nature of organisational work were identified as significant issues in this case. Reference to some of the literature has echoed much of what was found in this case and so the findings may have a much wider application than this single case.

Future research could be undertaken not only on each of these categories but also on the relationships between them from which emerge patterns of use when a workplace adjusts to a new system in the organisation. We were astonished by the lack of understanding by managers of the IS implementation process or even the recognition that they needed expert advise in this area. It could be that organisational managers should be better education in matters of IS research and practice.

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Appendix 1: Example of the Grounded Theory Analysis:

Data	Concept	Initial Theme
Interviews 1-3	- Lack of training and knowledge to use the system - time frame to work out the new system was too short - Need to establish a user group - Lack of compatible with existing systems and automatically update on the web timetable - Expect to have an efficient timetable and decrease the workload. - Management did not provide clearly information about the implementation of the system and did not listen to staff about their concern and did not understand their situation. - The process of producing a timetable has been changed and it changed the way they had done things in their academic units.	-Training requirements not realised -Management did not anticipate learning involved -Lack of communication with staff -System's compatibility issues not foreseen -Anticipated benefits from the system -Lack of communication by management - Changes to organisational work culture
Interviews 4-6	- Disbelief of the consultant who always said about how wonderful the system is. - They have other jobs to do as their responsible besides the timetabling job. - From the observation, there were a lot of interruptions during the interviews. - Some of them were new to the job or even were assigned the job temporary. - Some staff are willing to use the system because it makes the job more interesting and easy. Also they are willing to learn a new thing to increase the job efficiency. - The system is too complicate and it is not user friendly.	-Negative attitude towards key stakeholders -Job description need updating -Staff already overloaded, -Learning the job as well as the system -Positive expectations - Difficulty in using the system
Interviews 7-11	No new themes were identified. However, some data were developed in support of the themes above.	

Appendix 2: Summary of the Usability Tests.

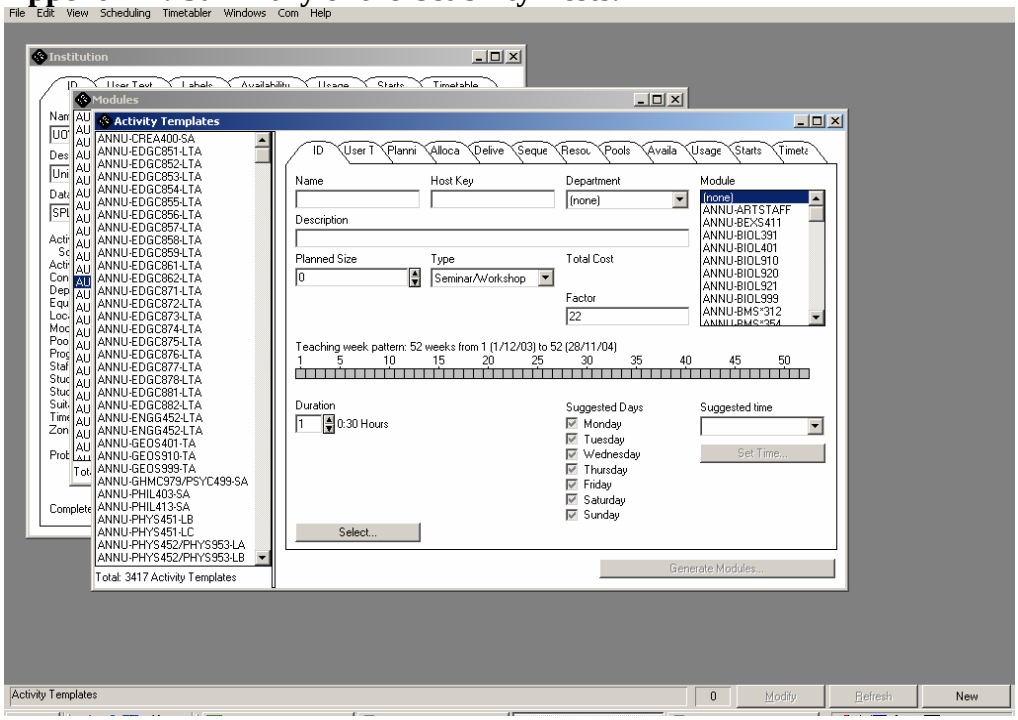

Figure 1. A typical screen of the new timetabling system showing 12 tabs from which to choose and the long pick lists in the drop down boxes. Usability tests confirmed that even experienced timetabling officers were confused and could not find desired functions or successfully complete required tasks.

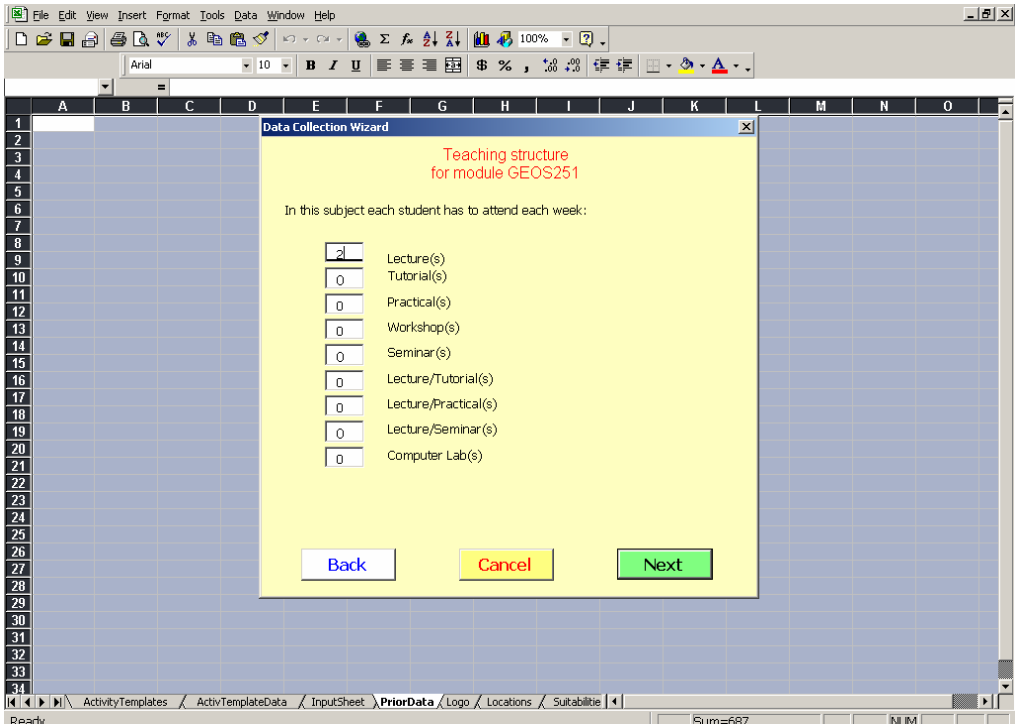

Figure 2: A screen of the simplified software module. Usability testing indicated that users were frustrated that it would not allow them to do anything but enter very routine details of subjects.